Fachhochschule
Dortmund
University of Applied Sciences and Arts

IDiAL Institute for the Digital Transformation
of Application and Living Domains

Dortmund International Research Conference 2022




CONFERENCE PROCEEDINGS – 1-2 JULY 2022

- Education, Workplace & Employability
- Sustainability
- Digital Transformation
- Engineering & Informatics
- Innovation & Entrepreneurship
- Project Management

Dortmund International Research Conference 2022

The thirteenth Dortmund International Research Conference (Dortmund IRC) successfully took place on 1 – 2 July 2022 at Fachhochschule Dortmund - University of Applied Sciences and Arts. The Dortmund IRC is a platform and forum for international and interdisciplinary research networking. This year, the Dortmund IRC took place in an experimental hybrid format. In the first year after coronavirus pandemic, Fachhochschule Dortmund welcomed around 130 participants from 18 countries in person or online, starting with the welcome address from the Vice Rector for Digital Transformation – Andrea Kienle, and the organising team.

A part of the big Dortmund International Research Conference 2022 organising team

During the conference, 40 papers were delivered in the form of oral presentations, videos and posters on the topics: Project Management, Education, Workplace & Employability, Sustainability, Digital Transformation, Engineering & Informatics, and Innovation & Entrepreneurship. This gave the participants an opportunity to take a closer look at the research areas and to obtain the latest results.

Additionally, there were several workshops, panel discussion, and other interactive elements. For instance, the keynote speech on "VR - Playground or Serious Business for the Industry?" delivered by Michael Reiner, professor and senior researcher at the partner university, IMC University of Applied Sciences Krems, or the TechTalk on "Digital Transformation: A Journey", – a new format that was presented during the Dortmund IRC for the first time. This format represents a mix of a podium discussions and interaction with the audience to discuss various topics related to technology-based concepts. This year's TechTalk was sponsored by Erasmus+ KA2 Knowledge Alliance Project ProDiT "Projects for Digital Transformation", and explored Digital Transformation projects and the way how companies perceive them. Among the invited guests were representatives of industry: Siemens (Belgium), Smart Mechatronics (Germany), and consulting companies: UNITY AG (Germany) and mpool consulting (Germany). Further workshops on "3D Printing and Laser Cutting" organised by SQuArE, "Mobile Robotics" by the Institute for the Digital Transformation of Application & Living Domains (IDiAL), and "Creative

Researching and Reporting of Climate Change Projects" gave the participants an opportunity to not only discuss theoretical issues, but also to get to see the actual work in progress.

During the social events in the evenings, the participants had an opportunity to discuss the latest updates from the partner universities and projects, to establish new contacts, and to spend a great time in a relaxed atmosphere.

This conference has its own spirit and power since it was founded by our honoured and very much missed teacher and friend Prof. Dr. Dr. h.c. mult. Peter A. Reusch in 2010.

The organising team was happy to receive positive feedback from the participants, and to introduce a new quality standard for future conferences.

A special thank you goes to the Dortmund International Research Conference 2022 organising team: Ekaterina Mikhaylova, Ekaterina Hermann, Jasmin Hemmer, Nargiza Mikhridinova, Anna Badasian, and the whole EuroPIM team, the student support team, and all the active and supportive members of the team & IRC family.

The organising team would like to take this opportunity to thank all supporters for making this year's Dortmund International Research Conference 2022 a special experience!

After the Dortmund International Research Conference, the Dortmund International Summer School took place on-site again on 4 – 8 July 2022, organised by the EuroPIM Consortium in cooperation with Fachhochschule Dortmund - University of Applied Sciences and Arts, and other international partners in Dortmund; with a total of around 80 participants from Germany, Spain, Norway, Belgium, Lithuania, Ukraine, Azerbaijan, Kazakhstan, and Palestinian Territories.

The Summer School is designed to be international and interdisciplinary, and aims at being a starting point for conversation between academic reflection and practical application perspectives and thus contributing to an international dialogue between different countries. The Summer School offers an opportunity to explore these questions in depth with international researchers from different fields and in different settings. The event, which is attended by researchers and students at doctoral, Master's and Bachelor' levels, offers both the opportunity for open discussion of current research questions and further training based on the latest relevant scientific findings.

The teaching organisation of the different thematic streams included lectures as well as independent assignments, exercises and research. Participants could also bring specific challenges from their teaching or university to work on during the Dortmund International Summer School.

The following streams were offered this year:

- Automotive Systems (Carsten Wiecher)
- Advanced Perspectives on Data Science (ViMaCs) (Stephan Recker, Anna Badasian)
- PhD Summer School (Bassam Hussein, Nargiza Mikhridinova)
- Scaled Agile Framework (SAFe) (Klaus Stephan, Syeda Anjum)
- Software Engineering Project (Philip Wizenty, Florian Rademacher, Eric Krüger)
- Sustainability and Quality in Project Management (Carolina Cruz Villazon)

- Train-the-Trainer event (Neringa Dubauskiene, Carsten Wolff, Nargiza Mikhridinova, Nicola Vollmar, Bertha Joseph Ngereja, Anna Badasian)

In 2022 the conference had different sessions as highlighted above and various conference elements. Presented papers were organized into the following sessions, covered on two days:

Friday, July 1st:

Session on **Education, Workplace & Employability 1** (Bertha Joseph Ngereja)

- If We Were the Rulers of The World. Part IV: Who Can Initiate the Project of: Protecting the World Against Us (Dr.Werner Wetekamp)
- Knowledge Discovery Process Applied to Building Competence Profiles Description (Leonardo Sastoque Pinilla, Nargiza Mikhridinova, Bertha Joseph Ngereja, Nerea Toledo Gandarias, Carsten Wolff)
- The Role of the Cross-Universities-Business (Cub) Platform in the Issue of Employment of University Graduates (Christian Reimann, Olena Verenych, Polina Repka)
- The Effect of Company Characteristics on Industry 4.0 Implementation: An Empirical Investigation (Malika Aitzhanova, Dinara Dikhanbayeva, Ali Turkyilmaz)
- Sustainability of European Projects in Higher Education Institutions: An Inside View (Gulnara Zakirova, Rahat Bekboyeva)

Session on **Project Management & Sustainability** (Jan Christoph Albrecht)

- Knowledge Management for Distributed Agile Teams (Kevin Garcia Oviedo, Janko Govedarica, Claudia Alawi, Marek Polak, Alexandra Goraichuk)
- The Sustainable Development Strategic Life Cycle (Sergey Buhsuyev, Natalia Bushuyeva, Victoria Bushuieva, Denis Bushuiev)
- Project Management Maturity Model as the Direction for Improvement: Case Study for International Privat Small Architecture Business (Olena Verenych, Anatolii Osadchyi)
- Conceptualizing of Sustainable-Oriented Construction Project Management Methodology (Tetiana Fesenko)
- Smart City Projects in the Paradigm of Circular Economy Development (Maryna Kutsenko)

Keynote Speech **"VR – Playground or Serious Business for The Industry"** (Michael Reiner)

Collage of the IRC Experience (Ekaterina Mikhaylova)

- Application of the Acatech Industry 4.0 Maturity Index and Six Sigma Methods to Improve Production Processes with a Use Case Driven Approach (Felix Ebberg, Daniel Strozyk, Henrik Ulitzka)
- EduBots as Academic Advisers: A Speculative Social Science Fiction Thought Experiment (Jan Petrus Bosman, Wim van Petegem, Tinne de Laet, Nompilo Tshuma)

Techtalk "Digital Transformation: A Journey" (Nargiza Mikhridinova, Carsten Wolff, Anna Badasian)

Workshop **"3D Printing and Laser Cutting"** (Andrej Bolgert)

Workshop **"Mobile Robotics"** (Aaron Xavier)

Workshop **"Creative Researching and Reporting of Climate Change Projects"** (Beverly Pasian)

Saturday, July 2nd:

Session on **Digital Transformation 1** (Galyna Tabunshchyk)

- Artificial Intelligence and the Threat to Replace Human (Khushe Motemanikenari)
- Artificial Intelligence in the Field of Health Care: Advancements, Challenges and Risk (Shahida Banu Shaik Abdul Khader)
- Storage and Databases on Cloud (Rodrigo Castro Godinez)
- Smarter Things – A Quick Overview of Artificial Intelligence in the Internet of Things (Marek Polak)

Session on **Education, Workplace & Employability 2** (Olena Verenych)

- COVID 19 and Work 4.0 - Emerging Changes and the Future Competencies: A Literature Review (Md Nafis Istiak, Shahida Banu Shaik Abdul Khader, Sara Azmin, Alketa Alia, Jurgen Shaba, Dzmitry Hryshyn)
- Teaching the Kazakh Language is the Basis of Learning the Turkic Languages (Akmarzhan Akyzhanova, Saniya Kabdrgalinova)
- Competence Profile Development for Digital Transformation (Afrida Islam)
- Digital Transformation in Education Amid of COVID-19 (Atik Hasan)

Session on **Digital Transformation 2** (Christian Reimann)

- Software-Intensive Solutions on Digital Business Perspectives (Khalid Md Ashik)
- The Current State of IoT Security: Vulnerabilities, Attacks, and Protection Strategies (Janko Govedarica)
- Impact-Oriented Controlling at the Police of North Rhine-Westphalia (Corinna Köbler)
- Conceptual Model of Intelligent Information System for Urban Social and Economic Security (Khrystyna Lipianina-Honcharenko, Carsten Wolff, Anatoliy Sachenko)

Video and Poster Session (Bassam Hussein, Syeda Komal Anjum)

- The Efficacy of Printed Modular Learning Mobility Approach in Grade 10 English Subject at Buhisan National School, Davao City, Philippines (Marco Angelo Vasquez, Susan Zamora)
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We say thank you to all authors for the contribution to the Dortmund International Research Conference 2022. The contributions are important – as well as the discussions – for the evolution of the community and the growing power to meet the requirements of the future.

Greetings from the flow of strong projects!

Christian Reimann, Carsten Wolff & Team

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IF WE WERE THE RULERS OF THE WORLD. PART IV: WHO CAN INITIATE THE PROJECT OF: PROTECTING THE WORLD AGAINST US

Dr. Werner Wetekamp
Dortmund University of Applied Sciences and Arts
Dortmund, Germany
werner.wetekamp@fh-dortmund.de, Professor

Abstract: *We care about science, our career, the development of our children, the garden behind our house and erect walls through our world or break them down. But we ignore that we destroy our world in these decades. "The world was empty before – now it is full" stats the Club of Rome because the overpopulation leads to the problem that we have to use all fertile land to live on or to produce food for us. The space we don't use we misuse as waste dump. Part IV (of IV) of this line of articles deals with the most important part namely how this project really can start and who can and should initiate it in which way. We will speak about who might start it and which steps should be taken.*

Part I deals with the reasons to start a project to protect the world. Part II of this line of articles deals with the areas we have to care about on global level. Part III shows the leading rules how to manage such a project to save the world.

Keywords: protection of the world, environmental protection, climate change, overpopulation

1. Introduction

If we were the rulers of the world...

I claim that the issue being addressed here is entirely the most important one. It is about the greatest thing that we as people can influence: the world and its protection and salvation. The world is far more important than we as individuals, as an animal species, a country, a scientific subject, an invention, a biography or as a beautiful story. This is the most important issue because it is about saving the only planet we have: the Earth. We have to deal with how to save it and who can save it, so that those generations that come after us can still inhabit an Earth worth living on.

The present world is divided among people for its resources, land, legal areas, and even those who have played the role of 'opponents' in this round of world rulers, are also people who are committed to environmental protection or biodiversity. We have long since conquered the animals as possible competitors for the control of the earth.

Who could dispute our leadership role? Hardly anybody would question that neither a deity nor an extra-terrestrial being, if such existed, could have the influence that man currently has in our world. No matter where you look, the influence of man is clearly visible. Man undoubtedly dominates the world, and more or less comprehensively.

The purpose for writing about this is precisely the following point: we must understand that we hold the world in our hands - and therefore have the sole and immeasurably great responsibility for our actions in the world and must cease to exploit it. So, what should be done? As always, when problems are to be solved, this means that we must sharpen our eyesight, analyze, plan and implement plans.

2. What is Already Done? Or "We Ease Our Bad Conscience by Doing a Little"

There are already many such plans; politicians discuss them and others are implementing initiatives of various kinds. But it cannot be done with mere fig leaf measures or those which are only partial or are regionally limited.

Energy saving already plays an important role in Germany, whether it's in the private sector when choosing a light source, or with road traffic. Of course, it's good to use energy sparingly, although the effects of such measures are hardly noticeable. However, the exaltation energy savers have can be enormous. At the end of each legislative period, policy-makers also always reach their energy-saving targets.

In fact, this means that the demand for correct, fully-effective measures remains on a too low level, just as their implementation does. The energy supply would last only a little longer because of energy-saving, while the energy reserves will melt away to nothing in e.g. 504 years instead of e.g. 500, just as it is happening with the ice at the poles. Energy saving is certainly a laudable idea, but unfortunately leads to the opposite of the desired outcome. Energy saving simply prevents a real, effective and sustainable energy turnaround from being put into effect.

A student at the University of Applied Sciences, Dortmund, has written about these points in his thesis and notes that there is an interest in taking steps of energy saving and also in actual steps being taken. But they are only minimal steps really, which above all soothe and prevent real concern or further reflection on the needed facts in question. This student brings up Leon Festinger's cognitive dissonance theory in order to explain that with simultaneous awareness of the problem as such, there is an effort toward self-pacification. According to this theory, different directions/ desires/ behaviours/ problems/ decisions (so-called cognitions) are attempted to find a solution for concrete action. These relationships between different alternatives can be dissonances or consonances. Consonances are positive conditional cognitions (e.g., I want to get fresh air and have to go shopping anyway). Dissonances are negative cognitions which influence one another, such as "I want to eat chips" (delicious) or "I would rather not" (I'll become fat). The more significant the cognitions are, the higher the dissonance.

One can observe that man tries to gain a balance in such trade-offs, for example, by referring to the rich nutrient content of beer (positive cognition is added), or to the fact that the renouncement of beer leads to fewer friends (subtraction of dissonant cognitions) or that consumption of beer does not directly lead to an increase in weight, but rather one may even help protect the rainforest by this action like it is mentioned in a German beer marketing campaign (substitution of dissonant for consonant cognitions).

This theory applied to energy saving means that the attitude of the human being is roughly conceivable as: "On the one hand I need energy (heating, car, electricity ...), but on the other hand, I destroy the environment. If I need a car now and own it, but it turns off automatically at the traffic lights, then I am, despite everything, a good citizen and an energy saver. When I use energy saving lamps in addition, I have done everything I need to, especially when I see that my country produces a lot of renewable energy. Here everything is clean. This is supported by politics and the economy. Summarizing this in one sentence: the practice of energy saving hinders the search for a better energy supply. It acts as a positive cognition and leads us to continue emitting CO2 year after year. The change in energy resources is just one example of our problems. In my part II of 4 parts I describe 14 other areas of global relevance.

3. Who Can Bring about the Turnaround?

The interest of **dictators** is directed towards their own well-being, power and its retention. Looking at the importance of dealing with global problems is not to be expected of them.

Scientists have long been working on concepts of sustainability, species protection, energy saving, population growth projections, or tidal power plants. The main problem, however, is that the individual ideas have not yet begun to initiate the turnaround. With their knowledge and concepts, scientists are asked when the goals that have been set will be achieved, to give up on fossil fuels in 20 years' time for example. There is no scientific concept for saving the world from destruction by its inhabitants. It is my conviction that the solution should be looked for in the areas of contract design, organization, project management and change management. From my point of view, these are areas dealing with business administration. We need to approach the preservation of the earth with a corporate restructuring. This of course, will not happen without, for example, political scientists, lawyers, psychologists, and all those who can make their own specific contribution. Here I am trying to do my part as a former leader of companies and at present as professor.

Citizens with the right to vote in a country are the basis of power in democratic states. Therefore, it would be necessary to convince all of them that sustainability is necessary for the survival of the earth - so they choose the "right" parties, and could thereby launch the project in the right direction. Unfortunately, this does not work as the majority of voters obviously does not have such foresight. In some states, it is about pure survival. Who can reproach these voters if the noble objective of the world's salvation does not play such a great role? But even in highly developed democracies without specific needs, a large section of the population is immune to politics and another section is only interested in its own affairs. Those who are committed to the protection of the earth, for example the Green Party in Germany, are likely to be chosen only by marginal groups. They are now more adapted to the world of politics, dressed in suits and ties, after their early more revolutionary methods. This is not a reproach to the Green Party itself, but rather to their voters, who in my view do not encourage the right direction to be followed and will let this party disappear from the scene if it does not adapt and change. In brief: democracy and its voters do not seem suitable for the radical change required in the world, even if democracy is otherwise the only valid concept when it comes to governing a state. Although we have more and more democratic states in the world it seems not to help saving the world.

Individuals could bring about change. Dan Brown's book "Inferno" describes overpopulation as the central problem of mankind. The rich and intelligent villain of the book wants to diminish mankind using a global plague epidemic. The good guys fight to prevent that. Ultimately, the strange turn of events is that they cannot stop the evil event from happening, although this does not cause the plague, rather a lasting and proportionate sterility into humanity. The good guys then accept it gladly because it counteracts the problem of overpopulation forever. The book is full of interesting research and ideas on the subject, but nevertheless it remains unrealistic. One thing is clear though: only through the commitment of people will it be possible to save the world. Individuals look to the future, and individuals will at some time bring about the change - hopefully not before the level of suffering has become too high.

The leaders of the governments of the world are powerful and strong. In fact, only in this group I see an initial spark of action that might be effective. However, the current organization of the world into countries and governments is no longer appropriate for the world as a whole. The countries and their heads of government still can manage around 80% of the country's problems on their own, but this national view does not help to defend a country against enemies or fight environmental pollution. We will return to this subject later. For now, we must deal with the facts we have: governments lead some 200 countries. Nobody expects a solution to global problems

from the government of a poor country, shaken by crises. A single region will of course not manage it either and especially not a single leader. Because if a persistent pursuit of sustainable targets is achieved in a country, this country alone will immediately be out of all markets for a variety of reasons (increased energy and environmental costs, lack of comprehension for the need to decelerate population growth, etc.). The collective can, by definition, only be the world as a whole, so it is indispensable to know that all the heads of governments are on board.

4. Two Possible Concrete Ways as a Trigger

4.1 Reliable Current Leaders of Nations

That the leaders of governments cannot immediately change the world in one stroke is probably clear to everyone; there must be stages. For me, the initiative can only begin with one or a few more heads of governments of the most developed and largest states in the world. I imagine that Merkel, Macron or Putin, or anyone who has a powerful voice would be able to begin internal coordination with other government heads. The initiative of individual state leaders in liaison with one another could develop such a great movement if all would only contribute to it. I can see it happening as easily as it sounds. These leaders would meet and bring along a few million Euro. With this money, consultants/ institutes/ universities/ political or environmental organizations are commissioned to develop concepts. This would be very hard work to do for some government employees, for a few weeks or months, and a few days of conference would be carried out by the heads of government using a recognized team of moderators. Done. One year later, they would meet again and the results of the consultants/ Universities or environmental organizations would be presented. In the meantime, each of the heads of government involved would make some phone calls to other heads of government and try to persuade them to put together a larger, ultimately world-wide framework.

I met Consultants often in my professional career. They appear to be mildly arrogant when viewed at a distance, but up close they are consistently oriented towards their own individual goals and those of the company, and to comprehensively solving every problem, at least theoretically. I trust politicians to communicate and do PR, but to develop new solutions toward the end of creating a new world organization is a job for experts, in other words large consulting firms or universities. And because there may be a lot of meaningful ways to go about this and the topic is so important, the five biggest consultant firms / universities / environmental organizations should be called together and given the same task: to design a viable concept to protect the world consistently from now on.

The change from destroying the world to protect it is not a question of science or money or missing concepts: it is a problem of organizing the world and managing the change. Powerful government heads need to do it! Initiative, conception, expansion - right up to implementation. We can use think tanks to find the concrete way to manage it. They key to success is to manage it. Because we have no management of the world we will not be successful. So we have to start with dedicated top-politicians then followed by organizational concepts.

So the point here is not the "how", this can be worked out. Perhaps it would be advisable to have several consultants compete with each other as is usual with other tenders? The important thing here is that the world ruler correctly identifies the matter at hand, does not pursue any hidden or selfish intentions, and commissions this new world power together.

4.2 Social Media, Internet

Social media around the world are getting more and more important. The young generation lives in this world – the older generation tries to use or first understand it. This infrastructure of internet might be a helpful tool to gather speed and power. It might be helpful to accumulate individual

will to a worldwide wave to change the world to a better one. Greta Thunberg is a symbol for this. She uses the new tools like twitter and Facebook to convince the young generation. This chapter is not about changing the things country by country but to change the world generation after generation. We don't know the development of internet. Will we have another form of democracy in a few years? Will we have political decisions via app? Will we have reporting about all political promises in www? Will this lead to a turnaround of our treatment of the world? It is a long and not predictable way but it might be the only possible way.

If we look to the past, nobody could predict 30 years ago how internet would change the world. There are definitely a lot of possible solutions to achieve the target that social media changes the world. So I try to dream up some ideas only to show the possible range. Especially in this chapter about social media and internet nobody can predict how it might work. Imagine Greta Thunberg has a lot of followers on her account. Imagine she creates an own internet platform to gather power and everybody in every country can subscribe with passport number and name and address to this platform of Greta. Maybe millions of young and old people subscribe to this "official power list". Now Greta could use the power according to the existing law in every country, like in Switzerland where they allow voting topic by topic or like in Germany where the voters can raise a so-called "Volksbegehren" (petition for a referendum).

A second option would be to launch a new "Greta-Party" to every country and change the world in this way within the existing rules.

Maybe the whole structure of the decision taking will change from general elections and parliaments to a voting case-by-case within our voting-app in our country.

In this system the young generation takes over the responsibility for our and their future. They use their tools of the young generation understanding it and using the power not in the background of formation of opinion but really to change the systems and take decisions.

5. Possible Organizational Concepts to Save the World

In this chapter I want to show possible concepts about the way, how the organization should be changed to manage the world in a sustainable way. It has to be considered that organizations tend to reach for organizational structure in different intensity. A state or an army as a strong will to find structure and rules. On the other hand a group of less seriousness tends to have fewer rules like a group of friends or neighbors in a certain street – or nations among each other (!). The world needs rules because the world will be destroyed without – we don't like rules because they reduce our luxury or our freedom. The following list will afterwards be described in detail:

a) A World Government
b) Property rights theory and external effects
c) Certification of countries
d) Changes in the consistence of decision takers
e) Extending the European Union
f) Public Private Partnership

There might be a lot more concepts to change the organization of the world in order to be sustainable. This choice already shows 6 options to the needed direction. After every position I will describe one example of conflict between human being as individuals and the world as the only we have. I chose the target to reduce the share of land in the world used intensively by human being. We use land for agriculture, living on it, traveling or leisure. The opposite is what the world needs to protect animals, plants and also help us to compensate for example our CO2 pollution. So we need to give more land to nature (what means no influence and usage of land by us). In my

example I assume 80% of a country is used by human being and the target is to reduce this to 50% in 50 years.

a) A World Government

As already described, important world matters are to be solved at world level. The USA or NATO have more or less taken this role when it comes to the defense of states. They always have some reason for taking action if conflicts break out. However, there is a vacuum with regard to one-world power, which the existing great powers only fill partially. There is nothing official, nothing that works regularly and clearly. There is no delimitation of the world-level tasks and no real organization which could solve the important issues of the world. The UN could do it, but it is boycotted, kept small, or left dried out by missing membership contributions. Moreover, their job is more "human-oriented" than "world-oriented". Creating a functioning world power - whether from the UN or something new - can only work through the commitment of the great states, i.e. the G7 countries. To this end, the heads of countries would have to coalesce until a result is achieved. Which issues should be addressed at world level? My suggestions can be read in my chapters. Who is to lead this institution? Will there be a kind of supervisory board consisting of the most important heads of states? Are the rules laid down in principle to be legally binding? How must our constitutions be adapted? Do we allow majority resolutions in this supervisory board? Votes according to the share of population, GDP, UN-contributions for example? How will the individual states be broken down according to their competencies in their particular areas of the world, and will they accept a higher level of authority?

It is of course extremely difficult to convince a confederation of states and ultimately, each individual that a minister of the environment is now working at world level and is no longer national, or that an attacking army is now controlled at world level and is no longer national. There must be intelligent solutions, such as the unification and merging of all armies, and yet, in an emergency every head of government could still use her/his part "faster" or in an unauthorized manner. If the ruler acts against binding laws, the penalties for that must also be determined. And these penalties must be established in advance and made clear- not simply at the time of the dispute.

Even though I may risk being too dictatorial here, long-term exclusion of states must not be allowed. How could 90% of the states be sworn to reduce population growth if a state does not care about it and joyfully continues to grow? How can one exclude an ignorant state from concern for climate change over the long term? Therefore, sanction mechanisms must also be integrated here. Of course, these should not be of a military nature. But perhaps these countries can be isolated, 100% rejection of entry, 100% boycott of products or by not selling products to them. Train, road, and flight connections would be closed. Freeloaders, egoists and the ignorant should also be treated in the same way. The most important state leaders must agree. The ideas and the initiative form the beginning of each project. We already have enough ideas; the weakness is the consistent concentration of the leaders on the important things. They are fundamentally far less selfish and narrow-sighted than they were 100 or 200 years ago. I hope that the far-sightedness of state leaders is already sufficient to achieve success here.

The initiative of some great leaders must be the initial impetus; consultants are then tasked to generate an optimal solution for a world organization. This new organization then develops the resolutions for the individual issues to be solved at world level, and monitors them through project control over the coming years, and uses sanctions when forced to do so.

Land-Example: The world government decides for all participating nations that nations have to reduce their land dedicated to human being down to 50%. The world government cuts every nation into two pieces north and south with 50% each and defines the northern part to be nature

reserve. But they allow to the national governments to change the decision of the world government. If they manage to change this easy plan within 2 years, the new plan will be in place. If not the north/south plan has to be fulfilled. This plan has to be fulfilled in 50 years. The nations identify their level of nature reserve and have to define a way how to prevent themselves from the north/south-System. They could draw a map with the future natural reserve. The world government could add a rule that the borderline between human land and nature land must be drawn in one momentum without interrupting the line (to achieve real areas for animals and plants not only belts around cities). This internal border line should not be longer than the borders of the nation itself because if yes they might cheat and draw belts around cities with one move. There must be special rules for every special country like Denmark and Greenland or countries on islands or with 95% of deserts. Beaches and other important biotopes must at least be 33% within the nature reserve. Jungle-states can keep more than 50% for nature and sell their percentage to other states like Monaco with 100% civilization. Who as inhabitant has to move out will be compensated – in the beginning on a high level and at the end on the level of "0". Owners of land have to pay 50 years 1 % of their land value to the state – this amount of 50% is the maximum compensation in year one to those who have to leave. The evaluation is based on state documented values (for example the tax base for real estate taxes – individual expertise have to be avoided). Infrastructure has to be cut at the borders after 50 years.

This way uses the intelligence of a world government (hopefully they are). Countries who do not participate have to be punished in a very strong way but no military actions.

b) Property Rights Theory and External Effects

The core of this theory describes a way to use resources by allocating property rights. According to the allocation of rights the organization of the use of resources will work. During my studies I understood the theory very well with the example of two neighbors and one likes to hear loud music. If he has the right to hear music the other neighbor either has to accept the music or has to offer money to his neighbor in order to achieve silence. The other possible solution is to give the right of silence to both. Now the first neighbor has to reduce the noise or to negotiate a price with the second to be able to follow his hobby of loud music.

The theory of external effects goes to the same direction. The baseline of this approach starts with the fact that some individuals/organizations use unregulated goods like free air or water without compensation of their use and thereby causing damages to others. Like CO2 pollution at no charge leads to climate change and this damage of the world is carried by all of us without compensation.

The combination of both theories "external effects" and "property right" opens a wide range of possibilities. We can organize a situation for our world in a sustainable way by giving property rights and afterwards we can regulate the consumption in a market with products and prices. This has the advantage of using a cheap system, this system is already working and proved by reality in EU, it can be used to steer the volumes of the product or a reduction and it leads to market regulation via prices so allocates the product to the most efficient place. Example for products can be land for natural reserves, C02-certificates or pollution in different areas.

We all know the example of CO2-certificates, where EU installed in 2005 a certificate-system in which certificates can be sold and bought according to the needs of the participants in this market. So EU found property rights and gave it to the participating nations for the product of CO2 pollution and caused by a limitation (year by year) the price is increasing and the pollution is decreasing.

We need to invent a world system of a) products and markets; b) we have to give the rights of this product to participants (nations) and c) have to implement a price-, volume-, and market system to steer what we want to steer.

Land-Example: The current level in this country is on 80% for used land by human being. All users get certificates for using the land – this amount covers 80% of the land and they have to pay a fee "X" for using land to the owner of the right (the state). If someone wants to build a new street or house and needs land which belonges to nature (no certificates connected to these 20%) you have to convince others to give up the use of their land by paying a market price "Y" to them.

The payment of the fee "X" can be used in the second stage by the state to reduce the percentage of 80% for example every year by 1 %. The owner of land within the 80% gets a payment from the state to reduce their use of the land and give it back to nature.

This way uses a market system, leads to a compensation for giving up land and a price for using land – finally it allows reaching targets in the given percentage of land use.

c) Certification of Countries

Certification is defined as keeping certain rules or requirements and to prove towards an authorized organization to fulfill it regularly. This allows showing – after receiving the certificate – that you are complying with a certain level of the requirements. My concept based on certification would look like this: there are on the one hand levels of global permissions – for example in international traveling or trading. And there are levels of certifications for sustainability. A world organization defines the concrete rules of the certification and the connected permissions. If a country fulfills certain levels of sustainability (for example CO2-free or fully CO2-compensated flying with airplanes) then as a consequence the inhabitants of this country are allowed to do certain things (like traveling cross border with airplanes). We can observe this system in EU where you have to fulfill a certain level of democracy, keep human rights and show financial stability to become member of the EU with the advantages this Community offers. Those states excluded for example cannot travel to certificated states nor have trade with them. The success of this system is related to the number of countries who start and the consistence to follow these rules without exception. If only a few states take part traveling with the mentioned sustainable airplanes the others will continue to act against sustainability and those who participate will have disadvantages. If a huge amount of especially important countries take part there will be a high pressure for others to be certificated as well not to be excluded from global activities.

Land-Example: There will be a definition of the level of percentage of the used land in a nation by nature and human being – in our case 50/50. There must be an authorized organization to prove this in a frame of accreditation and the organization hands over a certificate to the successful nation. The achieved and needed level has to be checked regularly. In relation to the achieved certificate a fitting restriction should be in place. For example: the inhabitants of a nation not fulfilling the percentage of land for nature are not allowed to travel to other countries for having holidays (in the other countries nature). Tourists of successful certified countries are allowed to travel everywhere.

d) Changes in the Consistence of Decision Takers

Here it is not the point at issue which topics need to be solved (aggression and environmental policies for example). In part II of IV I propose to change them from being national responsibilities and to solve them instead at world level. This chapter is about future democracies, which will naturally continue to exist nationally, and their enrichment of a broader point of view

which encompasses animals and plants. This follows the idea of developing democracies as we can observe it for more than 150 years: at first men were fighting for and forming the parliaments – after it women entered too after their fight for their rights. No we have all groups of people in it like handicapped people homosexual people because they want to strengthen their voices and fought for their rights. Plants and animals die out if they are under pressure and cannot raise their voices so we have to give them voices in our parliaments if we want to care about their rights. Since it is clear that some policy areas for animals and plants are not interesting (the amount of VAT or the introduction of the car toll), I would not change the parliaments further. This would also have the advantage of easier introduction (since there would be little change). Instead, I would introduce a veto-right for world-related politics. This voice of plants and animals would test laws in terms of species protection, population growth, environmental protection, etc. and identify hazards. The politicians with their legislation-draft would have the opportunity to discuss and negotiate these dangers in advance with the institution. If this is not successful, the institution would then have a right of veto, which would continue until the law is world-compliant. The institution would be managed by a central world organization and thus retains its sovereignty over national governments. A court of justice for disputes should also be introduced at world level. The country is thus managed in the form of a matrix - a purely national component and a centrally controlled world component.

Land-Example: In this case the crucial point is whether it will be successful to implement the voices of animals and plants to our governments. If we accept that not only human being should rule the world but also other inhabitants the biggest step is already done. Although we know that plants and animals cannot vote we need to create institutions guided by human being to represent the voices of animals and plants. After the successful introduction of voices of animals and plants we will be successful in implementing a 50% nature rate for land to all nations.

e) Extending the European Union

This chapter will be short because of one reason: European Union does not work well and has no real concept for sustainability – The Union cares too much about details and has no real competence to push new rules to the participating countries. But why to add the chapter? Because the European Union is a working organization, where nations give up rights to a higher level and why not to extend the EU in Europe to a worldwide level? EU is attractive for many nations and starting with 6 countries in 1951, now they cover 27 nations without GB. If one day we want to solve global problems we can start with a new organization or we could use an existing one with already more than 10% of nations of the world included. And the administration works alredy! In this case I also don't want to continue the Land-Example: As described above the achievement (50% of land has to be in nature's hand) has to be described and according to this permission should be defined (inhabitants of countries with this certificate are allowed to travel abroad for holiday). Important is in this case to agree with several important countries to fulfill this requirement in order to be not the only country with fulfillment and then be isolated. The certificate should be given to passports and the list of certified countries to entry points to countries.

f) Public Private Partnership (PPP)

During the last decades the private sector tried to extend their number of clients by inviting the public sector as client by fulfilling public tasks "all inclusive". In this concept the private sector shows excellence in special topics (waste management, facility management, road building and management, energy management) and it could be shown that cost control and time management increase substantially. I can imagine, that private companies will offer to the public sector new products to fulfill public tasks of sustainability and achieve a profitable fee for these global tasks

like protecting rivers against pollution and caring about the forests and their salvation. Advantages might be

- the fulfillment of global tasks by global companies across all borders
- the motivation for private sector to earn money with these products
- the better knowledge about the body of knowledge in implementation and tougher project management skills in the private sector.

This concept is known for high transaction costs and all problems related to principal agent theory. This concept has like all the others a high level of "no way - we can't imagine", but the political pressure will grow and I predict that we will have the first developed PPP by a global private company as an offer for governments than a successful conference and agreement of nations to protect the world.

Land-Example: a global player like Siemens or google could offer a product to the states who want to be sustainable in future. Here we speak about 50% land to nature but we could also think about waste management or clean rivers in which the private sector has already a high level of competence. The land example might work like this that the service level will be defined for the participating nations and a fee will be agreed – beside this control mechanism of the public sector, bonuses or maluses included to the fees, key performance indicator to define the service level and most important: competences of the private investor. The concrete concept can be the already mentioned price system for users of land which will be organized by a private market platform according the theory of external effects. This global private player could use the advantage to work for several nations and could allocate the use of land via a global solution and arbitrage-fees could compensate possible help and compensation of used land between the countries.

6. Closing

For centuries, the world has been under the full force of human influence in all its aspects and in all regions. Too high a population density, pollution, extinction of species and climate change are just some of the factors that have a negative impact on the world. At this point, these considerations or a thousand other potential initiatives could be an impulse for the governments of the world to reorganize themselves. Starting from the top, the world's top leaders would have to focus on the important issues and – based on democracy - change the organization of the world. Issues such as energy policy, military policy, population growth, information policy, sanctions policy, depopulation policy and cleanliness must all be raised to a democratic world level. At the same time, animal and plant institutions should be established in individual nations which can impinge on politics with veto rights if the above-mentioned global policy areas are not fulfilled. It is quite clear today that the course of the giant tanker of the world must be changed over the next 50 years and put on a new course in order to finally reap the benefits of success.

Appeal

If YOU see this topic the same way I do, try to arrange a meeting with the most important politicians you know or with Greta Thunberg - and let's start. The important thing about this article is not the list of ideas. None of this is unknown or new material. But perhaps the arguments presented here could lead to a domino effect. Perhaps (and that would be the author's goal) something will finally happen. Perhaps these ideas will be liked by someone who trains young people and they start talking about it. Perhaps someone who works for a newspaper hears and writes about it. Perhaps someone has a connection to somebody who is politically active, someone

who speaks about really important issues at party conferences, not just about the personal carousel, coalitions and political trifles. Let us begin the discussion of the important issues; it is only then that our generation can begin to relax. We take too little care of the earth, we destroy, we colonize, and we pollute without consideration for future generations, all without a guilty conscience. It is not enough to save energy or have only one child yourself. We must go to the world leaders and appeal to their consciences. Who can manage to attract Angela Merkel's attention? She is strong and successful, and I firmly believe that she has a good heart. I also believe this about the former president of the USA, Barack Obama. This is a good man. One can complain about everyone who does something. But these are no despots, crazy or unintelligent people. I am currently writing these lines from Ufa in the Urals. The people I speak with here are enthusiastic about Putin. I can imagine well that Putin would also join in, even if the wealth of his country depends very much on resource deliveries. A song by Sting says: "Believe me when I say to you - I hope the Russians love their children too". It is not about complaining to these people about the extinction of species and world energy problems. Experts know these things better than anyone else does. It is about moving them to do something. To call each other, to arrange an appointment for the important things in the world, to bring in money, to be able to engage consultants, and then to explain the concepts developed in a year.

Let us vote, create new groups, write and discuss, inform the students around the world, use the internet and Google, request the Pope to ask all the singers in the world to write a song about these problems instead of another ten songs about love, stimulate the billionaires to start something incredibly important with the power of money. Ask scientists whether they can concentrate on the world once again in addition to the detailed research on the aorta or the correct legal contract design. Sit down and focus your mind on the world. Talk to neighbors who may be older and do not understand things as they are intended and who may feel uncomfortable. Artists and writers could deal with the subject and teachers could talk with their pupils and teach them these ideas if they have not thought of them themselves. Everyone can do something. I wrote and told my students from all countries about it. Unfortunately, I do not know Angela Merkel. Maybe you do? Then talk to her or acquaintances of acquaintances of hers. The world can only be saved with actions. Let us do something, whatever we each can do. We are talking about no more and no less than the future of our only world. Whoever understands this, please begin now.

KNOWLEDGE DISCOVERY PROCESS APPLIED TO BUILDING COMPETENCE PROFILES DESCRIPTION

Leonardo Sastoque Pinilla [1*], Nargiza Mikhridinova [2,3], Bertha Joseph Ngereja [4], Nerea Toledo Gandarias [5], Carsten Wolff [2]

[1] University of the Basque Country (UPV/EHU) – CFAA, [2] Dortmund University of Applied Sciences and Arts (FH Dortmund)/IDiAL, [3] Katholieke Universiteit Leuven (KU Leuven), [4] Norwegian University of Science and Technology (NTNU), [5] University of the Basque Country (UPV/EHU)

[1 5] Bilbao, Spain, [2] Dortmund, Germany, [3] Leuven, Belgium, [4] Trondheim, Norway

[1] 0000-0002-7290-854X

Abstract: *Data acquisition and data analytics approaches play a crucial role in research on data-driven project management. Although terms data mining and knowledge discovery are used interchangeably, authors will consider data mining as a step of the knowledge discovery process. The aim of this paper is to deliver a concept for the analysis of competence profile descriptions and further extraction of competences in frames of knowledge discovery process. First, using data mining and Natural Language Processing (NLP) tools, the competences (described explicitly and implicitly in the description of the project manager professional profiles) will be extracted, and then analyzed and validated as competences. The developed approach will be tested with real data, and results of this test will help to deliver the research outlook highlighted in the conclusion.*

Keywords: knowledge discovery, competence, data mining, project management

1. Introduction

The main objective of a project manager's work during a project is to fulfil the proposed scope while meeting several requirements in relation to time, cost and quality. The competences necessary to carry out projects have been extensively discussed in the literature. For each of the phases of the project, project managers should have a set of competences that will enable them to perform the role. This set of competences, which each organization determines according to its field of expertise, is increasingly sought after in the labor market. However, when looking inside the organization, it is necessary to know, determine and define the competences that each project manager has. This information is important to be able to make a correct assignment to the project, to know what the capacities and limitations organization experiences when facing a new project, or to train the staff in the lacking competences.

2. Literature Research

2.1 Competence Definitions

The competence concept is a diverse research area with different frameworks and approaches towards its definition. [1] define competences as "context-specific cognitive dispositions that are acquired and needed to successfully cope with certain situations or tasks in specific domains". This definition underlines the complexity of the concept as it incorporates context, cognitive aspects and task domains. Competences – especially in project management – are formulated as complex profiles which are based on competence models (formulated as the conceptual model of "competence" and standardized in competence catalogues, e.g. IPMA ICB [2]).

2.2 Competence Categories

In their review personnel scheduling [3], authors introduce three skills categories: user-definable, hierarchical workforce and specific skills. [9] point out that competences should be organized in reasonable categories, which are recommended to be derived from specific job profiles and current requirements. To address a specific nature of managing digital transformation projects,

[4] provide a summary of 9 competence categories: methodological, professional, social, self-competence or personal, knowledge-based, communicational, managerial, scientific and academic, and innovative. [5] focus purely on project managers' competences and come up with the summary of 4 competence categories: behavioral, technical or specific, management and contextual. [6] in the review of project management competence considers also project manager skill areas, which cover human, conceptual and organizational, and technical skills.

2.3 Formal Descriptions of Competences

Competences are much more complex than single-valued skills or even skill vectors/matrices and, therefore, a major research topic in project management. Still, most research is based on textual, informal descriptions of competence profiles. [7] highlight how assessing the gap between individual and project's competences will help to identify the training needs of a project's team members. In order to accurately evaluate this gap, a formalism should be applied. [8] have noted in their discussion of individual and group competences that although group competences are thought to be the sum of individual competences this definition "does not reflect the efficiencies gained or lost from such an aggregation". This is confirmed by [9], who stress the complex nature of operators (e.g., the "-" and "+" operators) applied to competence profile calculation.

Various quantitative and algebraic approaches towards competence management in general [7], [8], [10], [11] and within project and human resources management domains [9], [12]–[14] have been introduced. [9] highlight the advantageous role of competence quantification for competence management. [7] propose using competence analytics and statistical assessment in a web-based platform. The authors apply a weighting system for three levels of competences which then ranks employees for certain jobs. [10] continue down this line of research and employ set theory to represent attributes related to the competence management methodology.

2.4 Competence Elements and Ontologies

Discussing about competence management frameworks, [15] considers competency to be a part of competence concept, and under competency authors mean "knowledge, skills or attitude". [16] in their model of competence consider next elements of the employee competence: potential, skills and knowledge. [17] in their perceptions of project management competences identify next components of competence model: knowledge, skills, core personality characteristics, and demonstrable performance.

[18] investigates how to automatically generate semantic user profiles based on competence description, and particularly focuses on vocabularies for competence modeling; authors consider different competence ontologies, e.g.: competence statement, competence, skill, knowledge entity and resource. [19] use data mining techniques to support creation of competence ontologies, and highlight the drawbacks of the developed approach like manual filtering of the list of competences "to exclude terms that could not be considered as competences".

Obtaining knowledge from the text is not an easy task. The automatic extraction of competences from a profile description requires an analysis that goes beyond identifying a series of keywords. It requires formalising the relationship between the description of a person's profile and the components of their competences in a semantically rich format.

Natural Language Processing (NLP) is a multidisciplinary field that demands humanistic, statistical, mathematical and computer science knowledge. It aims to use computers to process language, which, being ambiguous and dynamic, can be classified as natural. Machine language, on the other hand, is classified as formal because it is unambiguous and universally accepted. Recent developments in NLP have made it possible to handle the ambiguity, imprecision, and

lack of data inherent in natural language in increasingly better ways. The tasks it develops can be approached in two ways, machine learning (ML)-based or rule- or statistics-based. Text processing with an ML-based approach is one that uses such algorithms, whereas for a rule-based approach, these rules are coded manually. The latest advances in artificial intelligence-based NLP techniques such as word2vec [20], TF-IDF [21], Long Short-Term Memory [22], paragraph2vec [23], or Convolutional Neural Networks can generate superior results in various NLP tasks. Given its versatility, its use has expanded over the last few years, allowing the development of tools that helps a data-driven project management approach.

3. Proposed Framework

In the previous research the next data analytics model was proposed (Fig. 1), where project and team dimensions were considered. Based on the hypothesis given in [24], data acquisition techniques contribute to gather information on competences profiles data, and data analytics approach contributes to a quantified competence profile of a project team member. Summing up, such design of a competence management framework should facilitate calculating a competence gap or compiling a team competence profile.

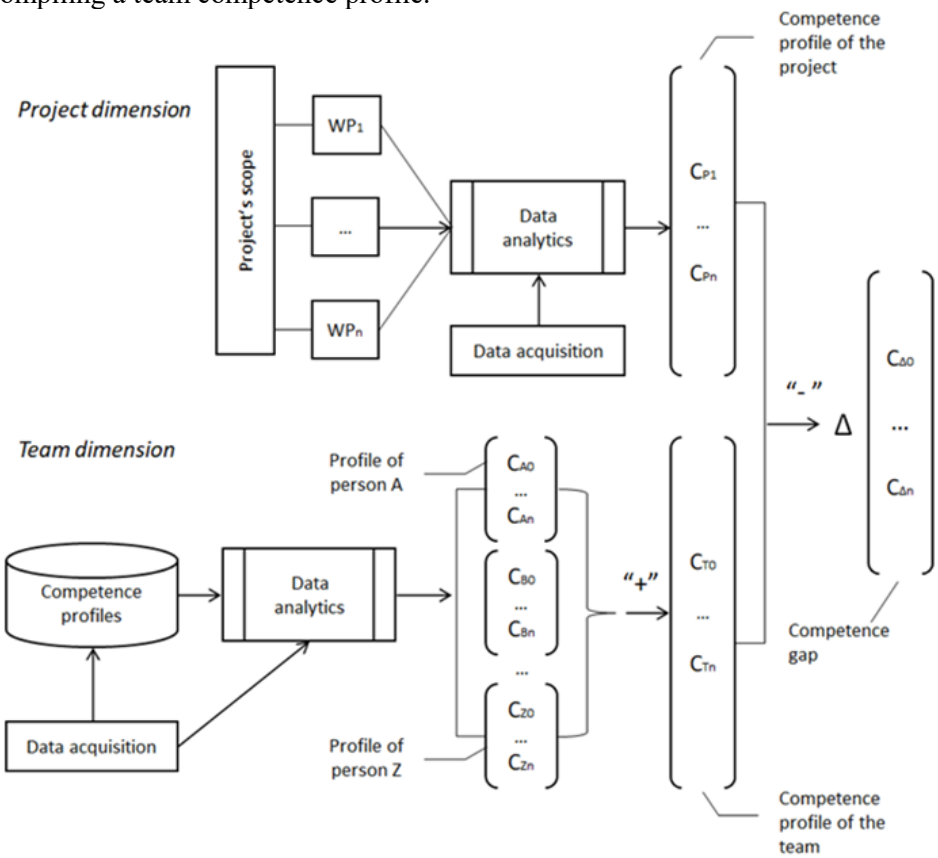

Fig. 1. Optimization process for project staffing based on data analytics [24]

In this paper the next hypothesis is considered:

- based on the description of a person's professional profile it is possible to identify their implicit competences (which are not explicitly mentioned in the text) and those which are explicitly stated in the profile.

A a person's professional profile assumes interrelation of academic background, professional experience, areas of expertise, and other elements (Fig. 2). For example, a person who has an experience in carrying out a project, has a specific education in the subject, and in addition has a

necessary expertise to carry out a task, and by doing the projects, the person is changing a certain level the competence necessary to carry out this particular task. In this way, from each aspect of information, details of their competences can be obtained and subsequently a semantic profile of a person can be created. The approach can be summarized as follows:

$$Competence = Expertise + Education + Experience \quad (1),$$

where "+" is a more complex operator than a simple plus/aggregation operator which needs to be investigated.

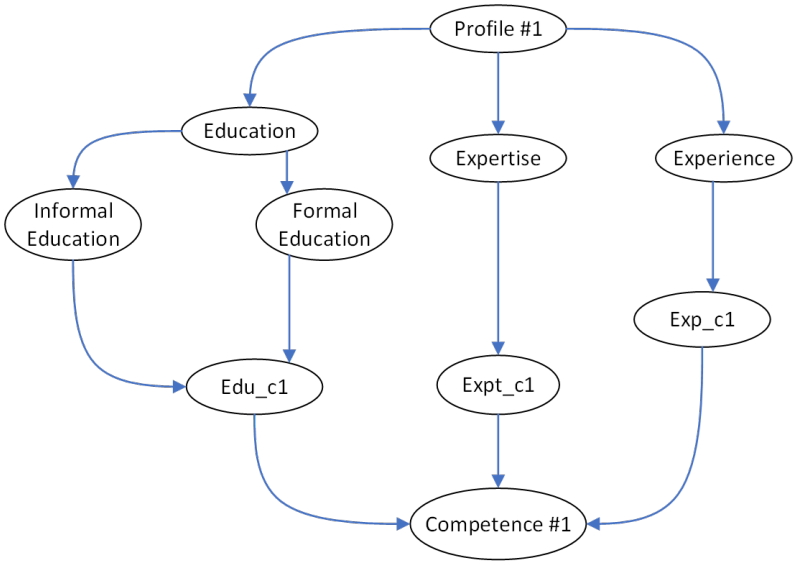

Fig. 2. Overview of the competence extraction

4. Automatic Detection of Competences

To identify the competences, this paper defines each of the competence components of the profile, expertise, education, and experience, with the aim of formulating each of the competences that the person possesses (Fig. 3).

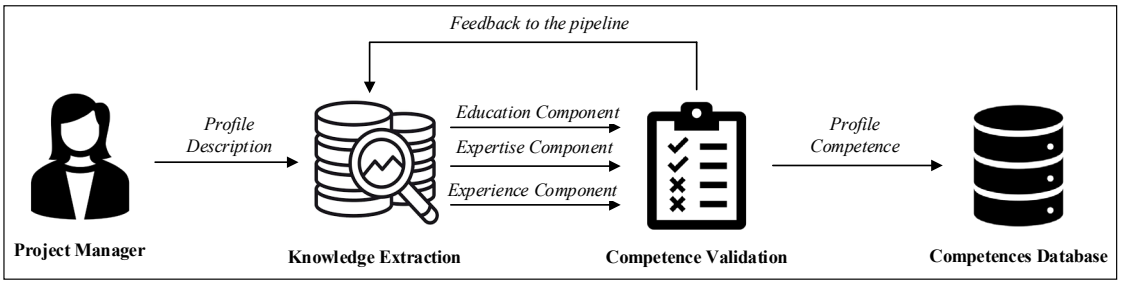

Fig. 3. Overview of the competence extraction

Using NLP libraries, the workflow described in Fig. 4 has been developed for the extraction of the competences from the analyzed professional profiles. To achieve it, first the file format is converted to a plain text format, to make it easier to handle. In this way, any specific format contained in the file is removed from the document, thus initiating the first phase of the text pre-processing. As a first step, the document is segmented into sentences to be able to create independent lists with each of these sentences and make easier the next step, which consists of dividing the text of the segmented sentence into tokens (smaller, and linguistically meaningful segments). Each of the tokens is then labelled with a part-of-speech label, e.g., "verb" or "noun".

Subsequently, to eliminate the different orthographic forms of the tokens, each of the tokens is lemmatized, so that all inflected forms of verbs (distinct tenses) and nouns (words are converted from plural to singular) are changed to their canonical form. Once this form is achieved, the lemmatized words are re-joined to form the original sentences to extract the noun chunks (Noun chunks are flat phrases that have a noun as their head plus the words describing the noun, e.g., "the world's largest tech fund") from them.

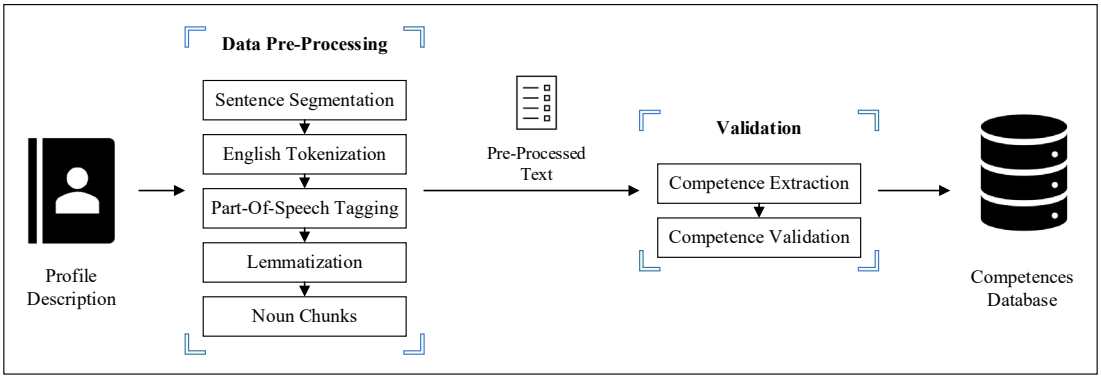

Fig. 4. Competence extraction workflow

Afterwards, the pre-processed text goes to the validation phase where keywords of each component of the professional profile are extracted from each of the noun chunks to be validated as competences. To do so, the competence must have a component in each of the three elements analyzed.

5. Implementation

A text mining pipeline (Table I) was developed and implemented based on spaCy [25] framework, to be able to analyze each of the professional profile's description to automatically extract the competence components. Using the designed pipeline, the professional profiles of 20 project managers currently working in a project management consultancy firm have been analyzed.

TABLE I. Processing Sequence

Phase	Item	Processing resources	Type
Pre-Processing	Read and prepare the file	glob	glob
	Text type definition	spaCy	spaCy nlp
	Sentence segmentation	spaCy	spaCy Sentence Segmentator
	English Tokenization	spaCy	spaCy English Tokenizer
	Part-Of-Speech Tagging	spaCy	spaCy Part-Of-Speech tagging
	Lemmatization	spaCy	spaCy Lemmatizer
	Noun Chunks	spaCy	spaCy Noun Chunks
Competence Validation	Competence Extraction	Pandas	Pandas Dataframe
	Competence Validation	spaCy	spaCy Rule-Based Matching

Glob and Spacy libraries were used to preprocess the full text of each of the professional profiles, segment them into sentences and further process each of the sentences with spaCy's Part-Of-Speech (POS) tagger, so that each of the words are tagged with a POS tag, such as verb, noun, pronouns, etc., and lemmatized to their canonical form (root). Subsequently, the authors use the complement of noun chunks, one of their linguistic features, to detect noun phrases from the text,

which helps us to extract the topics of competence from each of the items of information they have.

Once the previous step is completed, each component of a competence was compared whether the same component was present in each of the items. If a person has all three components, according to our hypothesis, this person possesses the competence.

After analyzing the professional profiles of the 20 professionals, 315 competence components between education, experience, and expertise components were obtained. For example, for the information of a project in which four of these people participated, a total of 108 competence components were identified (Table II).

TABLE II. Competence Components

Competence components found	**P1**	**P2**	**P3**	**P4**	**Total**
Education	3	3	4	5	15
Expertise	4	7	11	11	33
Experience	18	7	17	18	60
				Total:	108

For the validation of the competence, the following results were obtained for P1 (Fig. 5).

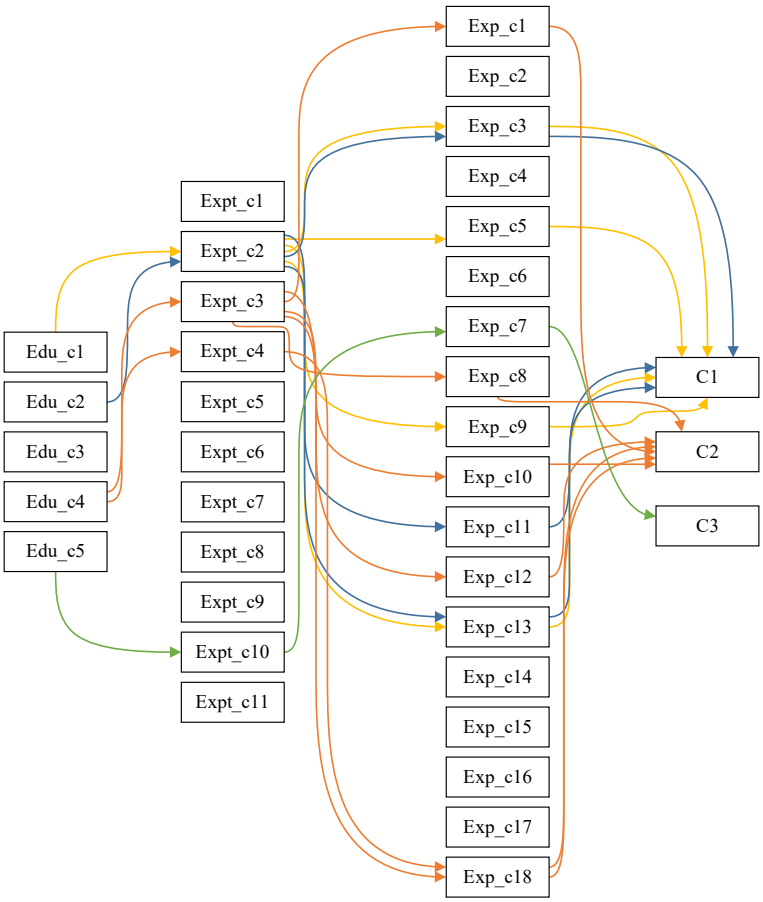

Fig. 5. Competence validation concept

For P1, three competences (C1, C2, C3) could be validated. For Competence C1, as an example, this person has an education component #2 (Edu_c2) + an expertise component #2 (Expt_c2) + an experience component #3 (Exp_c3). This means that from the information available in their profile, one is able to find data related to Competence C1 in each of the components analyzed.

6. Discussion and Limitations of the Study

After testing this approach, the next conclusions can be drawn:

- Although for practical purposes the result of only one profile was shown, in the overall study conducted for the 20 profiles it was discovered that each of the competence components (be it education, expertise or experience) could belong to one or more competences and/or competence categories.
- In our assumption. this is a problem that can be solved with a an approach towards formal description of competences.
- The information analyzed also suggests the need to define levels of expertise within the competence and/or competence categories.

In addition to technical competences, which were the ones most frequently found in our analysis, there should be a consideration of soft skills, too. Each individual has their own soft skills which contribute towards making up an individual competence profile. When a team is formed, individual competences are merged to form a single team competence profile. Competence profiles do not simply add up, but are highly interdependent e.g., soft skills in teams are a result of specific combinations of competences.

The soft skills, which are a part of the competence profile are highly influenced by the various interactions that occur while working in teams. In such cases, the team composition can play a significant role in training or developing soft skills of team members while working on a project. If companies are able to adopt a systematic way of understanding individual competence profiles, it could facilitate further competence development of those employees who are new or lack certain competences. This can be achieved through a strategic assigning of team members to specific project teams where they can contribute to the overall project performance but also develop the soft skills they lack.

7. Conclusion

This paper has shown the role that data acquisition and data analytics approaches can play in research related to data-driven project management. Through this paper, the concept for the analysis of project information and competences extraction in frames of knowledge discovery process was delivered. Data mining and NLP tools were used to extract, analyze and validate competences to understand the value of data-driven approach towards description of competence profiles. In this case, it was project managers' competences that were analyzed, however same approach can be adopted for all types of professions.

In addition, a complete competence profile should include both technical and soft skills so that it is fully representative of the individual education, expertise and experience. Paying attention to operating only with the technical competences does not fully give the whole information about what the individual knows, capabilities and contributions they can make to the overall performance of the project and organization. Soft skills are equally, if not more, crucial in determining success of a project.

In the future outlook of the current research topic there is a need for:

- finding a way to validate whether the result of knowledge discovery applied is indeed a competence; for that a strongly formalized description of the competence concept is needed;
- describing the process to maintain competences categorization: if the competence cannot be categorized in the existing categories of the company, what will it mean for the organization;
- developing a framework on building a competence profile of the project based on description of work packages/required scope;
- developing an approach for automatic assignment of employees to new projects based on formal description of the competences.

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THE ROLE OF THE CROSS-UNIVERSITIES-BUSINESS (CUB) PLATFORM IN THE ISSUE OF EMPLOYMENT OF UNIVERSITY GRADUATES

Christian Reimann [1], Olena Verenych [2], Polina Repka [3]

[1] Dortmund University of Applied Science and Arts
[2,3] Kyiv National University of Construction and Architecture
[1] Dortmund, Germany, [2,3] Kyiv, Ukraine
[1] christian.reimann@fh-dortmund.de, [2]verenych@ukr.net/ORCID 0000-0003-0972-6361,
[3]repka.polina@meta.ua

Abstract: *Tectonic shifts in the modern world affect all spheres of human life today. Wars, pandemics and, as a result, economic difficulties, which are now more or less taking place all over the world, have brought the issue of employment to a whole new level, making it one of the key problems today. Naturally, universities, one of the main tasks of which is the training of competent personnel, cannot stand aside this issue and must take an active part in its solution. How can this be implemented? The authors of this article see that one of the possible solutions that would significantly speed up and facilitate the process of employment of students and graduates of universities is the development of the cross-universities-business (CUB) platform, the main task of which is to simplify communication between students and potential employers. The idea of creating this platform is not new and has already been implemented in some universities in Europe. However, despite the obvious advantages of such a solution, the use of such platforms is not widespread. In the course of this work, we tried to find out the attitude of the main stakeholders of the business process of interaction between universities and business to the prospect of creating such a platform, as well as their vision of how this solution could be optimally implemented in modern realities.*

Keywords: cross-universities-business (CUB) platform, university-business collaboration, digital education ecosystem (DEE), employment of graduates

1. Introduction

A lot of European universities nowadays are actively engaged in the development of the Digital Education Ecosystem (DEE), the creation of which was declared one of the key priorities of the Digital Education Action Plan for the period of 2021-2027 [1]. In this context, the idea of including an important link in this ecosystem, namely employers, interaction with which is, ultimately, the main goal of obtaining education by most students, is increasingly heard. One of the possible options for the realization of this idea is the development and implementation of a specialized CUB platform. However, before starting the development of specific digital solutions, it is necessary to study the market for existing products in this area, as well as to clarify the vision of the main stakeholders of the business process of interaction between universities and business on this topic.

This article presents the results of a research in the frame of the Master Thesis [2] prepared by Polina Repka under supervisors Prof. Dr. Cristian Reiman (Dortmund University of Applied Science and Arts, Dortmund, Germany) and Prof. Dr. Olena Verenych (Kyiv National University of Construction and Architecture, Kyiv, Ukraine) within the framework of the Double Degree Program implemented between Dortmund University of Applied Science and Arts and Kyiv National University of Construction and Architecture.

The main purpose of the study is to analyze the vision of the main university-business cooperation stakeholders about further collaboration process development and identify the best way for the

CUB platform organization to achieve the goal of creating a student-oriented digital education ecosystem [2].

The study involved 3 target groups of stakeholders, namely, employers, university students and graduates, as well as representatives of university administrations. The last 2 target groups fully supported the idea of creating of the CUB platform and expressed their readiness to participate in the development project of this platform. However, the results obtained from the target group of employers were more controversial. Some of the survey participants supported the idea proposed in the survey, and some expressed significant comments that should be taken into account in further work on the project. This article will present the results obtained specifically for this target group, since, from the point of view of the authors, it is their comments made and the contradictions identified that can serve as an incentive to improve the concept of CUB platform, as well as the key to establishing communication with employers who, without doubts are a key link in the business process of interaction between universities and business.

2. State-of-the-Art

The process of modernizing education today poses many different questions for universities. One such issue is the dilemma of how interaction between universities and business, as potential employers for graduates, should be built. In particular, the question of whether universities should take an active part in the subsequent employment of students, or whether it is better to give the latter maximum freedom of choice, is relevant. Representatives of various universities have different views on this issue today. Thus, C. Wolff, C. Reimann, E. Mikhaylova, A. Aldaghmanin, S. Pampus, and E. Hermann suggest that universities can be assigned the role of "the broker in the competence market" [3]. On the one hand, such an approach would serve as a significant support for many graduates. However, on the other hand, the active intervention of university staff in the issue of graduate employment could be regarded by some of them as a factor limiting their personal freedom to choose a professional path.

One of the possible solutions to this contradiction is the creation of a special web platform for direct interaction between students and potential employers. Such a decision, on the one hand, would serve as a significant support for students in the matter of employment, and on the other hand, would provide them with a sufficient degree of freedom of choice. In addition, such a solution would make it easier for employers to access the most qualified personnel and would make it easy to verify the information indicated by job seekers in their resumes.

It should be noted that such platforms are already being developed by individual universities in Europe. However, in order to understand the differences between today's web solutions, we first need to understand what business processes include the interaction between universities and business today. Thus, V. Galan-Muros and T. Davey distinguish the following main areas of interaction:

- "education (joint development of curricula and training of students in cooperation with business partners; continuous education and training of company employees, further employment of students);
- research (staff mobility between universities and companies; joint research and development);
- valorization (entrepreneurship among university staff and students, as well as the commercialization of university research and development);
- management (reflects the strategic nature of cooperation between universities and business; however, this area of collaboration is the least developed, since it requires long-term cooperation between universities and enterprises, as well as a high degree of their transparency)" [4].

Depending on which of the above business processes underlies the creation of the platform (with the exception of management, since this type of interaction is the least developed and, as a rule, is not a priority), CUB platforms are divided into the following types [5]:

- "educational platforms, the main purpose of which is to teach students to perform real-life tasks that they will face while working in companies. Such, for example, are the platforms Poliunibus [6], Edusourced [7], Telanto [8] and Ninblebee [9];
- platforms, which main purpose is to commercialize research conducted at universities, such as In-part [10]; Leadingedgeonly [11] or Seedspint [12].
- platforms, the main purpose of which is partnership between the university and business, as well as the possibility of subsequent employment of students. Examples of such platforms are Konfer [13], Knowledgetransferireland [14] and Oipec [15]" [2].

Each of these platforms is unique and interesting in its own way, however, since in this paper CUB platforms are considered, first of all, as a tool for supporting students in the process of employment, the platforms related to the third type are of greatest interest to the authors of this article, namely platforms Konfer, Knowledgetransferireland and Oipec.

For example, the Konfer platform, presented by the National Center for Universities and Business in the United Kingdom, has a large number of partner companies around the world, which gives students and graduates a huge choice and a large number of potential employment opportunities. As noted in [2] "In total, 72797 companies are represented on the platform (as of February 2022). In addition, the platform offers 125 (as of February 2022) collaboration proposals for independent experts and specialists in various fields of knowledge." However, this platform is represented mainly by researchers and specialists engaged in academic activities, rather than practitioners. Also, the disadvantages of this platform include the lack of the possibility of direct communication with representatives of university administrations for additional information.

Another platform related to the segment we are interested in is "Knowledge Transfer Ireland" (KTI), whose stated mission is "to support business and the research base to maximize innovation from State funded research by getting technology, ideas and expertise into the hands of business, swiftly and easily for the benefit of the public and the economy" [14, 2]. The peculiarity of this platform is that it contains only the contacts of specialists, but the contacts of companies are not presented, which makes communication somewhat one-sided. Companies wishing to become partners of this platform are invited to conclude an agreement on a paid basis, which, "on the one hand, can be a guarantee of the company's solvency, but, on the other hand, adds a certain level of bureaucracy to the process of cooperation and may alienate potential partners at the initial stage" [2].

The Open innovation Platform for University-Enterprise Collaboration (OIPEC) is the project co-funded by the Erasmus+ Program of the European Union, which main objectives are:

"1. Conducting trainings for employees of enterprises in order to improve their skills in the field of innovation management and new product/service development;

2. Developing and managing of the "Collaborative Open Innovation laboratories" (COILabs), whose main areas of work are concept development, rapid prototyping and entrepreneurial area.

3. Experience exchange between European, Russian and Chinese universities" [2, 15].

However, neither alumni contacts nor company contacts are presented on this platform, i.e. this software solution is not aimed at solving the issue of employment of graduates.

Thus, we can conclude that of all the software solutions considered, only the Konfer platform allows solving the tasks that are stated by the main goals of the development of the CUB platform in this work, and studying the experience of using this particular platform can be most useful for this study. However, this platform also has some drawbacks that were described above and could be taken into account when developing a software product of that kind.

3. Results of the Study

In the frame of the research [2], a study was carried out, the main goal of which was to identify the attitude of the main stakeholders of the universities-business cooperation process to the idea of CUB platform development and to find out their vision of the optimal way of its implementation.

Stakeholders were divided into 3 target groups, in particular, the following target groups were identified:

- applicants;
- employers;
- representatives of university administrations.

In addition, representatives of employers were additionally divided into 3 subgroups, taking into account the role they play in the employment process, namely, whether they:

- "are engaged in recruiting new hires, suggesting suitable positions and conducting initial interviews with potential applicants (i.e., in essence, doing HR work);
- conduct interviews with applicants for positions in the department they manage and make the final decision on hiring new employees (middle management);
- develop a strategy for the company's growth and make decisions on the need to create new departments and open new positions (top management);
- sometimes conduct additional interviews with new candidates (play a supporting role in the recruitment process)" [2].

Separate blocks of questions were formed for each of the target groups and subgroups, allowing the most complete disclosure of the representatives' vision. The questionnaire included quantitative questions with multiple answers and scales from 1 to 5, as well as qualitative ones, which main goal was to clarify some additional details or find out the opinions of stakeholders about considered issues.

The survey was disseminated via social networks LinkedIn and Facebook, and was also sent directly to target group representatives. In total, 61 people took part in the survey, 62.3% identified themselves as applicants, 24.6% – as employers and 13.1% - as representatives of the universities' administrations (Fig.1). Most of the respondents who took part in the survey were from Ukraine, however, since this questionnaire was also disseminated through social networks, several responses were also received for the target group of applicants from respondents from Belgium, Switzerland and Russia.

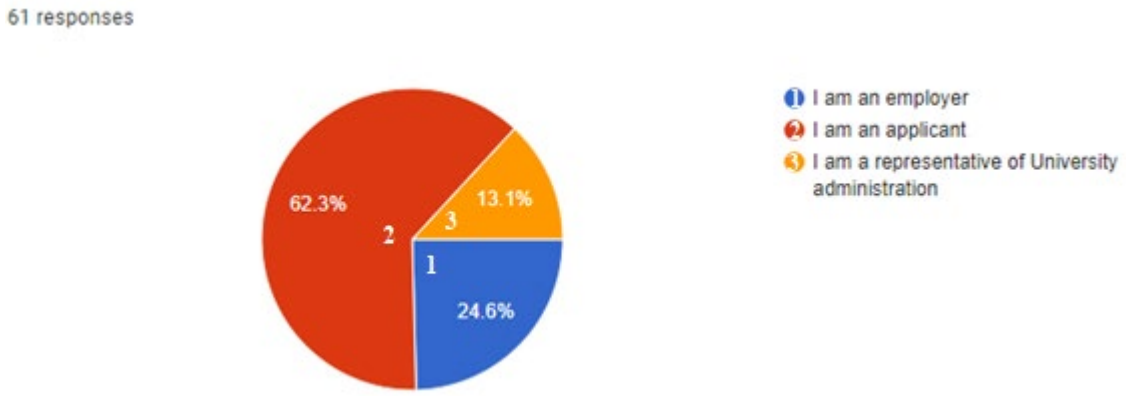

Fig. 1. Target audience represented in the questionnaire [2]

The results obtained during the survey showed that 2 target groups, namely applicants and representatives of university administrations, fully support the idea of creating of the CUB platform and are ready to take part in this project. The most ambiguous results were obtained for the target group of employers, some of which supported the idea, and some spoke negatively.

This article will present the results obtained from the target group of employers, since it is this target group that is the most "problematic" and can serve as an obstacle to the implementation of the project. In addition, comments made by representatives of employers must be taken into account and analyzed in order to avoid possible errors.

As shown in Fig.2, representatives of 4 different fields of activity took part in the survey by employers, namely IT (33.3% of respondents), and design (26.7%), engineering and architecture (20%) and transport (20%).

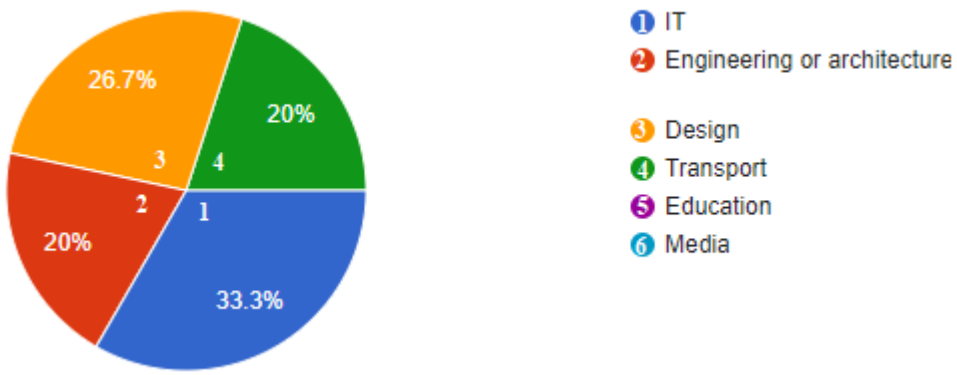

Fig. 2. Occupational spheres of companies, where representatives of employers work in [2]

As mentioned earlier, representatives of the target group of employers were further divided into subgroups, depending on the role they play in the employment process. During the survey, 40% of the answers were received from respondents who search for new employees, propose suitable position in their company and conduct interviews with potential applicants (play the role of HR), 33.3% of responses belongs to respondents, who interview applicants for positions in the departments they manage and make the final decision on hiring new employees (play the middle-management role) and 20% responses refers to those, who develop a strategy of company growth and make decisions of the need to create new departments and open new positions (play the top-

management role) and 6.7% of respondents sometimes play the supporting role conducting some additional interviews with new applicants (Fig.3).

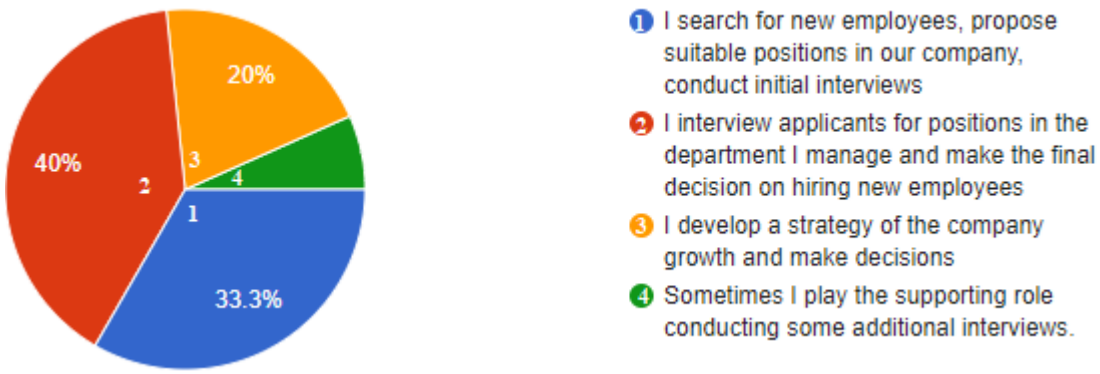

Fig. 3. Respondent's role in the employment process [2]

3.1. Analysis of Responses Received for the Subgroup of Employers Who Play the Role of HR in the Employment Process

As shown in Fig.4, the majority of HR employers who took part in the survey, prefer to use LinkedIn and similar professional networks (80%) and specific websites for job seekers (80%), when searching for new employees. 40% of the respondents also use more informal networks like Facebook, and professional communities' websites, also 40% noted that they write directly to representatives of university administrations in search of the best employees for certain positions. Other options for finding potential employees were not so popular. In addition, it should be noted that only one respondent indicated that he was ready to use a specialized CUB platform to search for potential employees, which most likely indicates a low awareness of representatives of this subgroup about such a digital solution and about the potential of such platforms. (Fig.4).

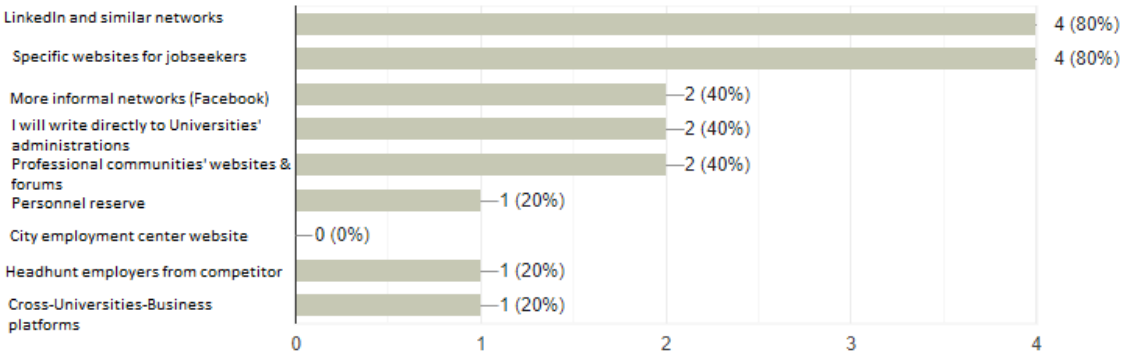

Fig. 4. Preferable sources for searching new employees [2]

Fig. 5 shows the level of awareness of the representatives of this subgroup about the already existing CUB platforms. As we can see, only 20% of respondents indicated that they had heard of such software solutions, but never used them in practice, at the same time, 80% of respondents indicated that they had never heard of such platforms before.

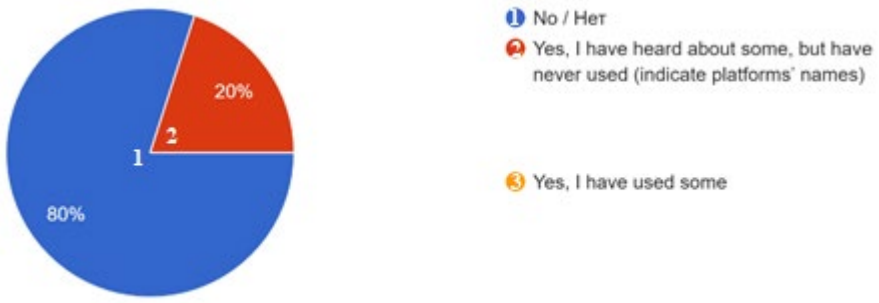

Fig. 5. Awareness of HRs subgroup about CUB platforms [2]

In order to offer employers a software solution for finding new employees that could be of interest to them, it is necessary to understand what is their main priorities when choosing one or another platform. Fig. 6 shows the key positions that representatives of this subgroup consider to be a priority when choosing a web platform for finding employees. As we can note, absolutely all participants indicated that the most important for them are the opportunity to check the information in applicants resumes and the opportunity to hire applicants with the newest knowledge in the field their companies are working in. Also, 80% of respondents noted the importance of the opportunity to hire applicants with the experience of participating in specific projects related to the field the companies are working in, and 20% indicated that the number of potential applicants that are represented in the platform is also an important factor for them (Fig.6).

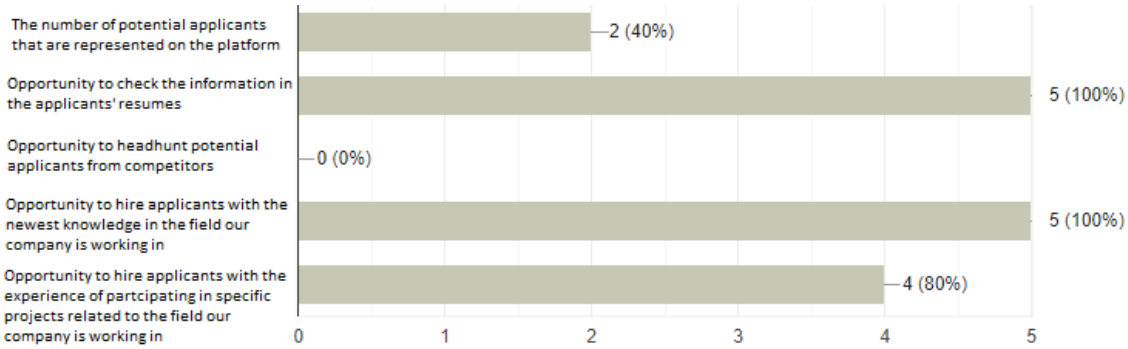

Fig.6. Key points for choosing the platform [2]

It should be noted that this subgroup is the most open-minded among other employers about the perspective of the participation in the project of development and implementation of the CUB platform. As shown in Fig.7, 40% of the representatives of HRs subgroup indicated that they had the strong interest about the participation in the project, other 40% marked an average interest, and only 20% were not sure about the answer.

One of the ideas presented in the Master's Thesis, on the basis of which this article was created, is the possible replacement of traditional students' internship at enterprises by the project-based cooperation. It is assumed that this idea will become one of the options available through the development of the CUB platform. Therefore, in the survey, we also tried to find out the attitude of employers towards such a concept. As shown in Fig.8, the majority of the representatives of HRs subgroup supports this idea, 60% marked that they supported it in general, 20% identified that they strongly supported it and other 20% were not sure about the answer. It should be noted that none of the representatives of this subgroup spoke out against this idea, which, in general, is a very positive result.

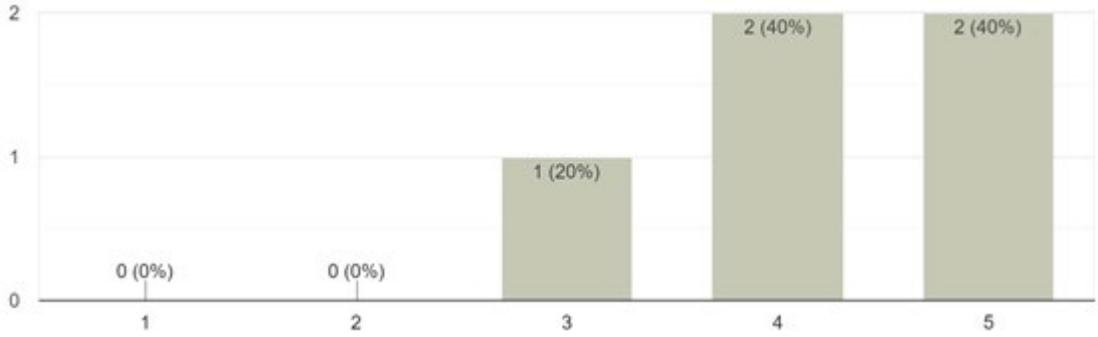

Fig. 7. Consent of HRs subgroup to participate in CUB platform project [2]

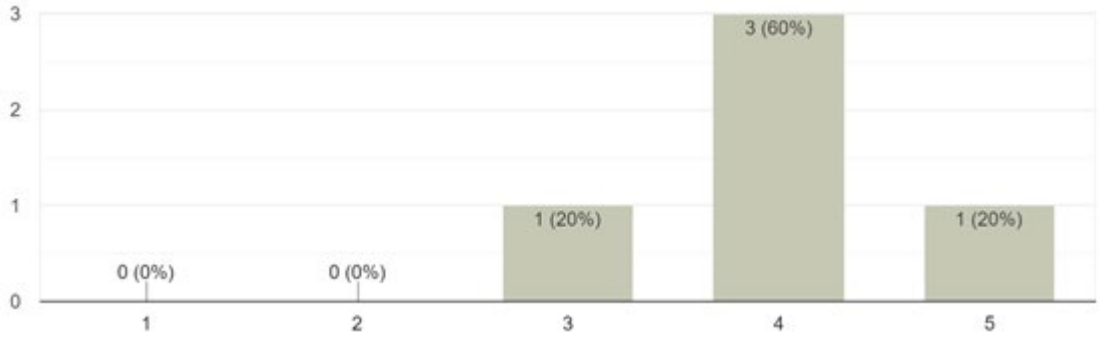

Fig.8. Possibility of project-based cooperation instead of traditional internship (HRs subgroup vision) [2]

3.2. Analysis of Responses Received for the Subgroup of Employers Who Play the Middle Management Role in the Employment Process

One of the key links in making a decision on the employment of job seekers are representatives of the so-called middle management, with whom, as a rule, secondary interviews are held, after which final decisions are made on the selection of candidates for vacancies. Therefore, the opinion of representatives of this category is also of great interest to us.

In particular, since the concept of the CUB platform involves the active support to employers in the process of selecting the best candidates for various vacancies by representatives of university administrations, it was interesting to find out what qualities are priority for representatives of this subgroup of employers when choosing candidates.

As shown in Fig.9, 83.3% of middle management subgroup representatives marked as the most important criterion for the new employees the compliance of the applicants with the standard requirements for the relevant position, 66.7% indicated that the most significant criterion for them is experience in similar projects, and 33.3% answered that having some unique knowledge in the field in which the company is operated by a potential employee is the key criterion.

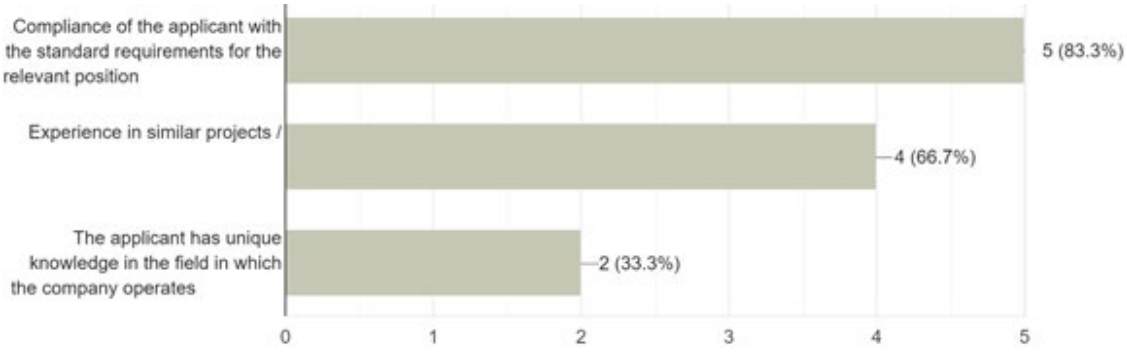

Fig.9. The most important criterion for new employees [2]

As we have mentioned earlier, one of the directions for the development of the student-oriented education is, from the authors' point of view, the implementation of the project-based cooperation between universities and business instead of traditional internship. The CUB platform can become the web-instrument for implementation of this idea. However, we also need to understand he readiness of our partners from the employers' side about cooperation in such format. As shown in Fig.10 the majority of this subgroup representatives (83.3%) are not sure about this idea, and only 16.7% support it. However, it should be marked that nobody of them has expressed the negative attitude to the idea, so it can be regarded as the possibility of the dialog with this subgroup representatives.

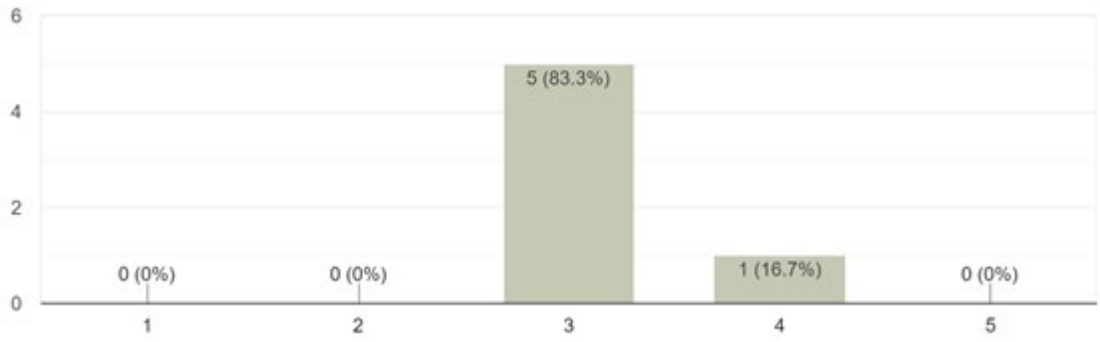

Fig.10. Attitude of middle-management subgroup to replacement of traditional internship by project - based one [2]

Another important factor in the issue of willingness to participate and support the development project of the CUB platform is the level of awareness of respondents about software solutions of this kind that already exist on the market. However, as shown in Fig.11, the majority of this subgroup representatives (83.3%) have not ever heard about the similar platforms, and only 16.7% of them have some information about the issue, but have never used such products in practice. Thus, the level of awareness of this group of respondents can be regarded as low, which may affect the overall willingness of respondents to participate in the development project of the CUB platform.

Fig.11. Awareness of middle management subgroup about CUB platforms [2]

As shown in Fig.12 the half of the middle management subgroup representatives is not sure about their consent to participate in the CUB platform development project, 33.3% has negative attitude to such perspective and only 16.7% has expressed the interest to the participation. As mentioned earlier, this result is likely to be due to the low awareness of the representatives of this subgroup about the already existing CUB platforms and the potential opportunities that they open up for both job seekers and employers.

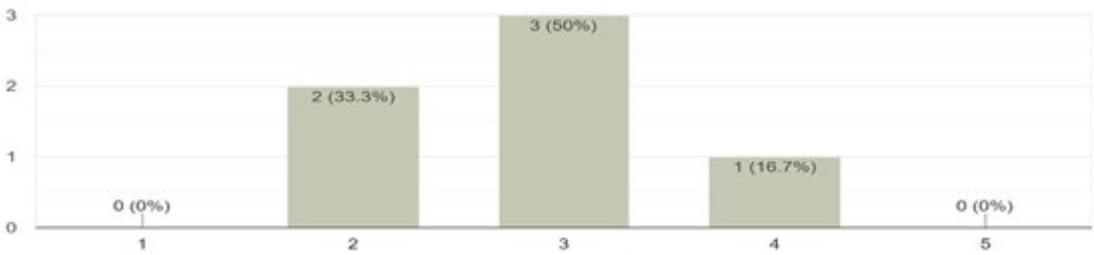

Fig.12. Consent to participate in CUB platform project implementation [2]

One of the most important aspects for understanding the vector of further development of the project is the employers' vision of the functionality that should be presented on the platform being developed. As shown in Fig. 13 the majority of this subgroup respondents (83.3%) identified the opportunity to find new potential applicants for their company, using such a platform, as the most useful function of the CUB platform, 33.3% marked that the opportunity to track some science news for keeping up with the times is the priority for them, and 16.7% expressed the doubt about the usefulness of such a platform as a whole, which once again indicates the low awareness of respondents about such software solutions.

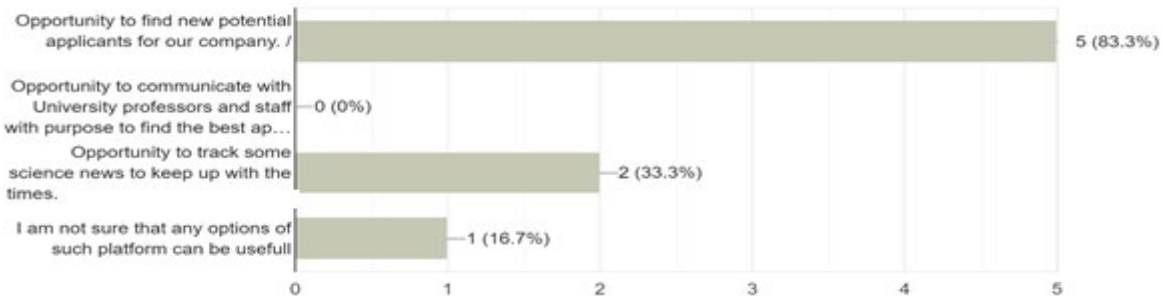

Fig.13. The most important options of CUB platform for the subgroup of the middle management [2]

3.3. Analysis of Responses Received for the Subgroup of Employers Who Play the Top Management Role in the Employment Process

The last subgroup of respondents that we will consider in this article is a subgroup of top management representatives. Although representatives of this subgroup rarely take part in hiring employees themselves, however, due to the fact that they make important strategic decisions about the development of their enterprises, their vision is also important to study.

Unfortunately, only 3 responses were received for this subgroup, which, of course, is not sufficient for a detailed analysis, but even the responses received were enough to identify general trends.

As shown in Fig.14 the majority (66.7%) of the representatives of this subgroup has strongly negative attitude to the possibility of the replacement of the traditional internship by the project-based cooperation, and only 33.3% expressed positive attitude.

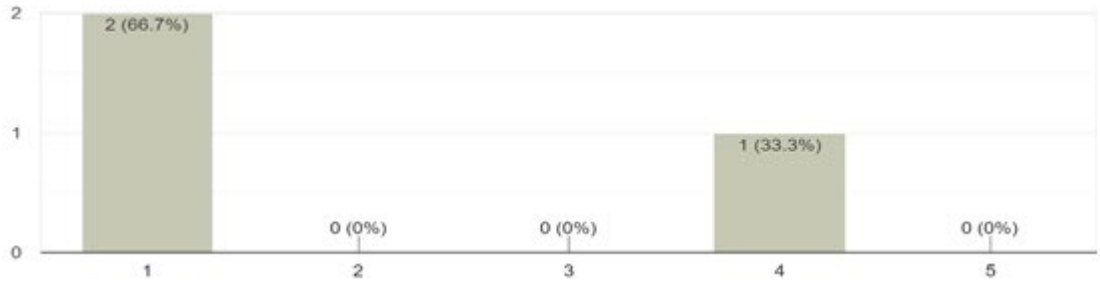

Fig.14. Attitude of top management subgroup to replacement of internship [2]

As shown in Fig.15 the representatives of the considered subgroup also have low awareness about the existing CUB platforms, in particular, 66.7% have never heard about such web products and 33.3% have heard, but have never used, which also affects the general attitude of respondents to the CUB platform project.

Fig. 15. Awareness about CUB platforms of top management subgroup [2]

Low awareness of existing CUB platforms, in turn, negatively affects the willingness of representatives of this subgroup to participate in the project of development and implementation of the CUB platform. As shown in Fig.16, 66.7% of top management subgroup representatives have strongly negative attitude to such perspective, and other 33.3% are not sure about the answer. It should be noted that it is the worst result among all target groups that have been interviewed.

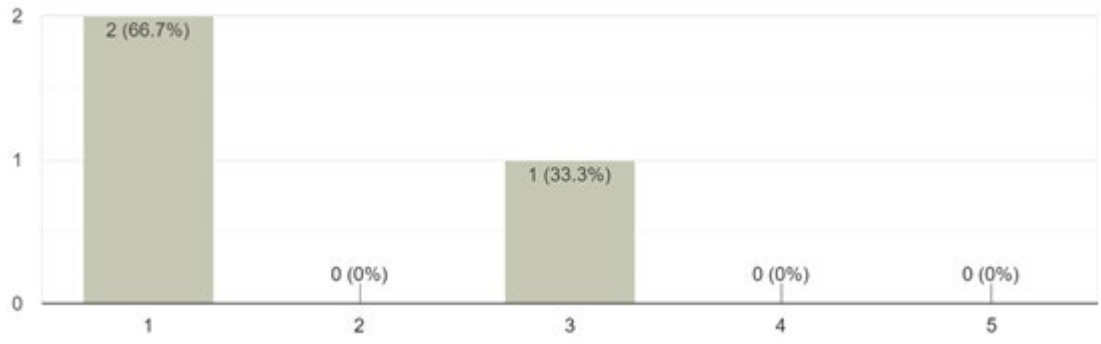

Fig.16. Willingness of top management subgroup to participate in CUB platform implementation project [2]

The authors of the article also tried to find out what functionality of the CUB platform could potentially be of interest to representatives of top management. Unfortunately, the majority of respondents did not see any prospects for the development of the platform at all, and only one participant indicated that he sees in this decision the opportunity to find new potential employees (Fig.17).

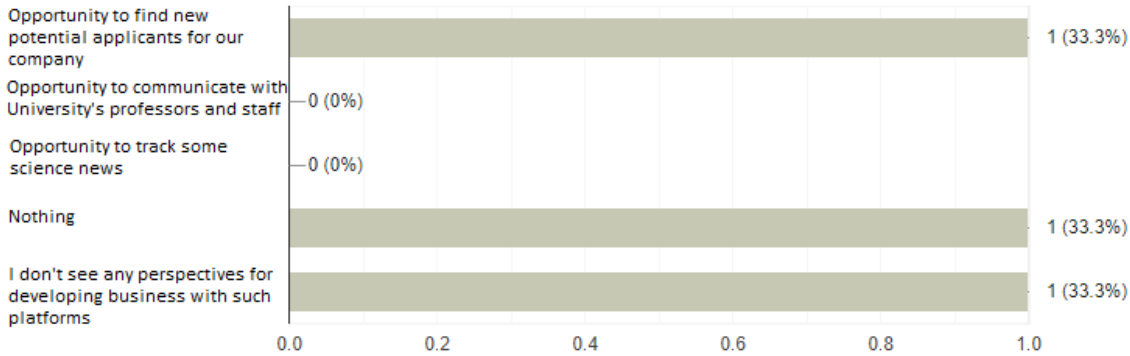

Fig.17. Options of CUB platform, interesting to the top management subgroup [2]

Thus, we can conclude that this subgroup of respondents is the most negative in relation to the development of the development project of the CUB platform. However, it should be noted that the interviewed respondents also indicated the reason for their rejection of this idea. In particular, feedback was received that “It is necessary to clearly define the stakeholders of this platform and take into account modern realities. Hiring an employee in whom you need to invest time and resources is a big risk ... It is necessary to investigate the motivation of business to use such platforms and what benefits can be obtained from them. If a student is hired with the signing of a non-competition agreement (3-5 years of prohibition to take a position for which the student is trained in other companies or something similar) - ok, if this is more "social responsibility" - I personally would not use such a platform [2]”.

4. Conclusion

The study's results showed that depending on the role played by each of the employers' representatives in the process of employment, their attitude to the development of the CUB platform will be different. Thus, respondents who perform the functions of the HRs at their enterprises generally supported the idea of developing the platform, seeing it as a prospect for finding new highly qualified employees. In addition, representatives of the HRs subgroup expressed their support for replacing traditional professional internship in enterprises by the project-based cooperation.

Representatives of the middle-management, in general, showed a neutral attitude towards the proposed innovations, and representatives of top management, in general, spoke negatively, however, noting that they were ready for dialogue if certain conditions were met. It should also be noted that the vast majority of employers showed a low level of awareness of the currently existing CUB platforms, which, of course, influenced the assessments that they gave to the project.

Thus, we can conclude that for the successful development and implementation of the proposed innovations, it is necessary, first of all, to increase the awareness of the employer partners about the prospects that the proposed solutions will open for them. It may make sense to test the proposed solution by running an experimental pilot project. In addition, it makes sense to exchange experience with universities that have already implemented such systems on the basis of their educational institutions, which will allow, on the one hand, to adopt existing best practices, and on the other hand, to avoid possible mistakes.

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THE EFFECT OF COMPANY CHARACTERISTICS ON INDUSTRY 4.0 IMPLEMENTATION: AN EMPIRICAL INVESTIGATION

Malika Aitzhanova [1], Dinara Dikhanbayeva [2], Ali Turkyilmaz [3]

[1,2,3] School of Engineering and Digital Sciences, Nazarbayev University
[3]Business School, University of Stavanger
[1,2,3] Nur-Sultan, Kazakhstan, [3] Stavanger, Norway
[1] malika.aitzhanova@alumni.nu.edu.kz, [2] dinara.dikhanbayeva@nu.edu.kz, [3] ali.turkyilmaz@nu.edu.kz

Abstract: *Nowadays, most organizations aim to increase their effectiveness and stand out better than competitors. One of the latest and most efficient methods is the appropriation of the Industry 4.0 concept to promote the technological and organizational development of the ventures. The benefits of Industry 4.0 are discussed and proven in many ways as research articles, empirical investigations, and practical implementation. However, taking into account the complexity of the concept of Industry 4.0, the question arises if certain factors such as industry, sector, or size of the company affect its implementation and successful results. The lack of literature on the empirical investigation led the authors to present this study, where 205 companies were assessed using a comprehensive maturity model. Based on collected data, analysis shows that size of the company affects Industry 4.0 implementation. Larger companies are more mature in terms of Industry 4.0 implementation. The service industry also shows better results. All companies perform similarly weak in terms of strategy and organization and stronger in workforce development.*

Keywords: Industry 4.0, digital maturity, performance, maturity model, COMMA 4.0

1. Introduction

Industry 4.0 (I4.0), also known as the Fourth Industrial Revolution, can be defined as the next era of industrial production, which is aimed toward more automation and digitalization by creating self-controlled and self-optimized processes [1]. The boost of I4.0 is forcing companies of all levels, sizes, and sectors to start shifting toward it. However, due to the complexity of the I4.0 concept, its implementation varies across different industries, sectors, and types of the company [2]. For example, many studies and research investigate the difference in implementation of I4.0 for multinational enterprises (MNEs) and small and medium enterprises (SMEs), claiming that the latter has more issues and barriers. The most common issues are financial and resource constraints, low awareness level of I4.0 concept, technical capabilities, legal issues, etc. [3]. [4] also develop the claim that multinational companies, have several advantages over SMEs such as geographical dispersion. It includes the possibility for MNEs of having an official office in the country at a low tax rate while locating operations in another country. In addition, location in several geographical regions also provides multinational companies with an advantage in distributing their products and recruiting professional personnel from a global perspective. Despite the obvious challenges for SMEs, many circumstances and conditions of the companies should be taken into account for both, MNEs and SMEs. Additionally, many questions exist if a certain sector or industry is more successful in the implementation of I4.0. However, the lack of studies with statistics and analysis based on empirical data is an obvious research gap in the literature. While such studies could be great resource for analyzing specific peculiarities in worldwide practices and great learning material for companies. Therefore, the research objectives of this study are:
RO1: Based on the collected data analyze the effect of the company size on I4.0 implementation;
RO2: To analyze whether a certain industry type and sector affect the success of I4.0 implementation and application of I4.0 technologies.

The study is based on data collected in the Republic of Kazakhstan, as the absence of such studies not only in Kazakhstan but in the Central Asian region overall is an additional gap. As well, according to [5] a benefit of a single country-based study is in their direct representation of the national strategies toward I4.0 and innovations. A variety of maturity models (MMs) exist as tools of I4.0, dedicated to conceptualizing and estimating the maturity level of the company [6]. In this study, Comprehensive Maturity Model 4.0 (COMMA 4.0), which is dedicated to emerging economies and considers specifics of the region and small-sized companies, was used as a tool to collect the data.

2. Theoretical Background

The concept of I4.0 is often associated with the concept of digital manufacturing, which revolves around the sub-concept of smart factories and involves the next level evolution of the existing automated production supported by embedded electronics and information technology of Industry 3.0 [7]. Taking into account all benefits of I4.0, many companies strive to apply possible technologies and tools. Implementation of new digital technologies requires that the initial capabilities of enterprises will be clearly defined and calculated in a manner to analyze and design the development strategy. Various studies are conducted to identify the dependence between the size of the company and the successful implementation of new technologies [8, 9]. Despite that most of the existing studies are based on one country's perspective, it allows investigation of the various aspects of the implementation of I4.0, whether by SMEs or MNEs. Additionally, such studies can serve as a real-life example of benefits that companies could get after the implementation of I4.0, and its tools [5].

[10] claim that the size of an enterprise plays an important role in terms of gaining benefits and leveraging risks in an efficient and effective manner within the context of open innovation project implementation. In the same vein, [11] supports the view that the size of enterprises has a direct relation to receiving greater benefits in terms of individual and organizational effects, and also it impacts the transition between knowledge retention and knowledge transfer competencies. In that regard, there are some differences between multinational corporations and medium and small corporations that have an impact on their competency level in implementing I4.0 concepts. In the study conducted by [12] organization size and business process management (BPM) adoption are determined to be independent. Additionally, the authors claim that the adoption of BPM is similar for both, SMEs and MNEs. The same conclusion was made by other similar studies by [13] and [14]. However, the results regarding sector dependence on BPM adoption differ. In the study by [12] authors claim that product-oriented private organizations are higher in maturity than service-oriented organizations and public organizations. While studies by [13] and [14] concluded statistical insignificance of both size and sector. Other studies show that SMEs tend to implement one I4.0 project at a time, to monitor cost-benefit analysis, rather than changing the strategy of the whole organization. Additionally, only limited technologies are preferred by SMEs such as the Internet of Things and cloud computing [15].

The data for this study was collected in the Republic of Kazakhstan. Kazakhstan's economic sector is mainly contributed by the extractive industry (16.3%), in which oil and gas production accumulates for 13.3% of gross domestic product (GDP). Trade sector contributes with 17.3%, while the manufacturing and transportation industries are 12.7% and 10.8%, respectively. Also, the oil and gas sector is the most attractive for foreign investors, taking more than 50% of all international investments in the country [16]. As can be seen from this data, Kazakhstan is developing vastly due to rich natural resources and a well-established mining industry. For instance, it takes a leading role in uranium production, attributing to 39% of the world's output [17].

3. Methodology

3.1. Data Collection and Data Analysis

The sample set is derived from the data collected using the survey of the COMMA 4.0 model [18]. The survey was distributed to more than 400 Kazakhstan companies electronically through emails and was supported by computer-aided telephone interviews due to Covid restrictions in 2021. The survey consists of 40 questions that ask for general information and company characteristics, as well as about the current state of a company in terms of I4.0 across several indicators. Indicators are grouped by common dimensions such as strategy and organization, development of workforce digital skills, smart processes, smart factory, and smart products and services. The survey questions are designed as 5-scale Likert-type questions. The scale corresponds to the following maturity levels: 1 – entrant, 2 – beginner, 3 – learner, 4 – integrator, and 5 – expert.

205 companies have completed the survey in full providing sufficient information. All of the companies were operating in Kazakhstan and represented different cities where the majority of companies came from Kyzylorda, Aktobe, Almaty, and Nur-Sultan cities. Information on the education level and management level of respondents, the number of employees, and industry types is presented in Table I.

TABLE I. Characteristics of the Sample Companies

Education Level	**Share**	**Management Level of Respondents**	**Share**	**Number of Employees**	**Share**
PhD	3%	Senior	51%	10-50 employees	40%
Master degree	58%	Middle	31%	50-100 employees	18%
Bachelor degree	23%	Junior and other	18%	100-200 employees	19%
Secondary and other	7%			over 200 employees	24%
Industry	**Share**	**Sector in Manufacturing**	**Share**	**Sector in Manufacturing**	**Share**
Manufacturing and construction industry	69%	Food, Beverage, and Tobacco	30%	Primary metal, fabricated metal, and machinery	6%
Financial and real estate activities	22%	Textiles, Leather, and Apparel	14%	Electric Equipment, Appliances, and Components	8%
Mining, petroleum, and gas extraction	5%	Wood, paper, and printing	6%	Furniture	9%
Agriculture, forestry, and fishing	2%	Petroleum, Coal, Chemicals, Plastics, and Rubber	5%	Miscellaneous Manufacturing	16%
Other services	2%	Nonmetallic Mineral	6%		

More than 80% of respondents hold senior (51%) and middle-level (31%) positions. Similarly, 81% of respondents had bachelor's degrees and 58% held master's degrees. The majority of companies had from 10 to 50 employees (40%), followed by middle-sized companies (40%), and 24% of large companies with over 200 employees. In addition, the share of product companies was three times more than service companies (76% vs 24%). Nearly 70% of companies operating in the manufacturing sector, while 22% represented the financial and real estate sector. 30% of manufacturing companies were from food, beverages, and tobacco production, 14% from textile, leather, and apparel, 9% from furniture production, and 8% from electric equipment, appliances, and components.

4. Results

To answer the RO1 the I4.0 readiness of the companies grouped by the number of employees is analyzed (Fig. 1). Medium (50-200 employees) and large companies (200+ employees) show more or less similar results. However, small companies (10-50 employees) show a different pattern. For example, the share of small companies at an entrant level is almost one and half times bigger than that of medium and large companies, 38% and 26% respectively. Similarly, at a beginner level, there are also more small companies (28%) rather than medium (25%) and large ones (20%). As a consequence, as the level of I4.0 maturity becomes more advanced such as learner, integrator, and expert, the number of small companies decreases while the share of medium and large companies becomes almost twice higher than that of small companies.

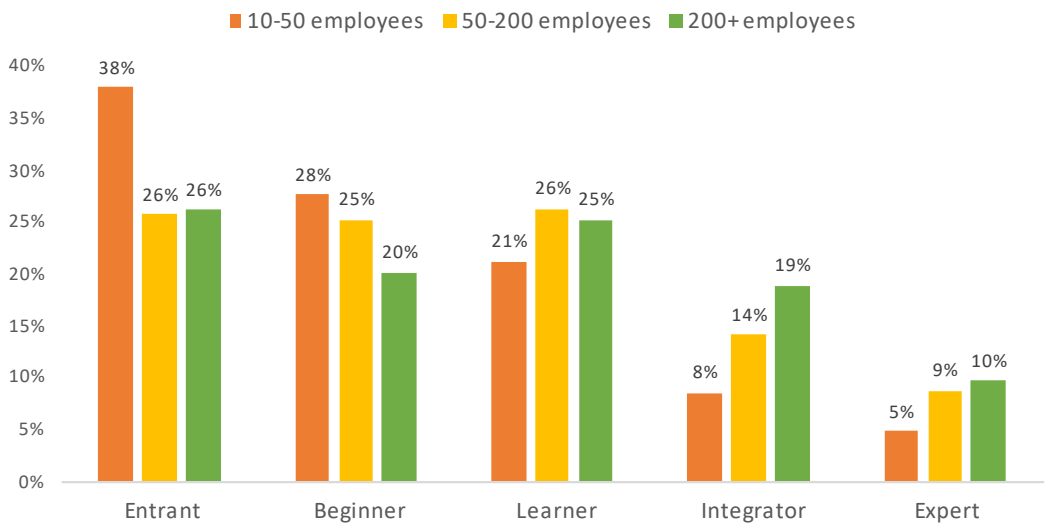

Fig. 1. I4.0 readiness by the number of employees

To analyze in what particular I4.0 factor companies differ, the I4.0 readiness of companies by the number of employees and dimensions is depicted in Fig. 2. More than half of the small companies (52%) are at the entrant level in terms of strategy and organization, i.e. those companies do not have any strategy directed towards I4.0 for their organization. This also means that no ICT or budget for ICT is organized. There is also no innovative environment present because top management is not aware of the I4.0 and the benefits it can bring to the organization. 31% of medium companies are also at the entrant level in strategy and organization, while only 23% of large companies are found at the entrant level. However, almost an equal percentage of small, medium and large companies are present at the beginner level, which means that companies are gradually turning their heads towards I4.0 and trying to adapt to the changing environment of the fourth industrial revolution. At a learner level, there are more medium (26%) and large companies (25%), rather than small ones (21%). At this level, companies have their I4.0 strategies formulated, however, the actions are taken only partially, at a departmental level, and only small investments are made. At the integrator level, the difference between large and small is almost threefold, and between medium and small is twofold. A similar situation is present at the expert level as well.

In terms of workforce development, all three groups of companies have the majority at the learner level (Fig. 2), i.e. employees have a moderate level of digital competency, companies provided training for critical personnel and employees are eager to accept transformational changes in the organization if the benefits are clarified for them. As expected, small companies have a larger share of companies with entrant (12%) and beginner levels (28%) of I4.0 maturity. On the

contrary, large companies have more companies with integrator (27%) and expert (13%) levels of I4.0 maturity, where employees are advanced users or/and developers of computer programs, and analysis tools, companies have a specific budget allocated for training and the level of acceptance of change by employees is also high or very high, i.e. they have a positive attitude for changes and act proactively. In this dimension, small and medium companies show a similar trend in responses. Nonetheless, small and medium companies show better results in this dimension among others. In terms of the development of smart processes and smart factory features in three groups of companies, medium and large companies show a similar tendency, i.e. greater shares of companies in a more advanced level of I4.0 maturity, while small companies are more aligned toward the lower levels of I4.0 maturity in the following I4.0 factors: automation of production system, equipment upgradability, level of machine-to-machine communication, supply chain communication and integration, digitization of enterprise data, observability of production, ICT architecture, use of cloud services, standardization of business processes, use of automation and business information systems, data-driven decision-making, maintenance approach, and quality management systems.

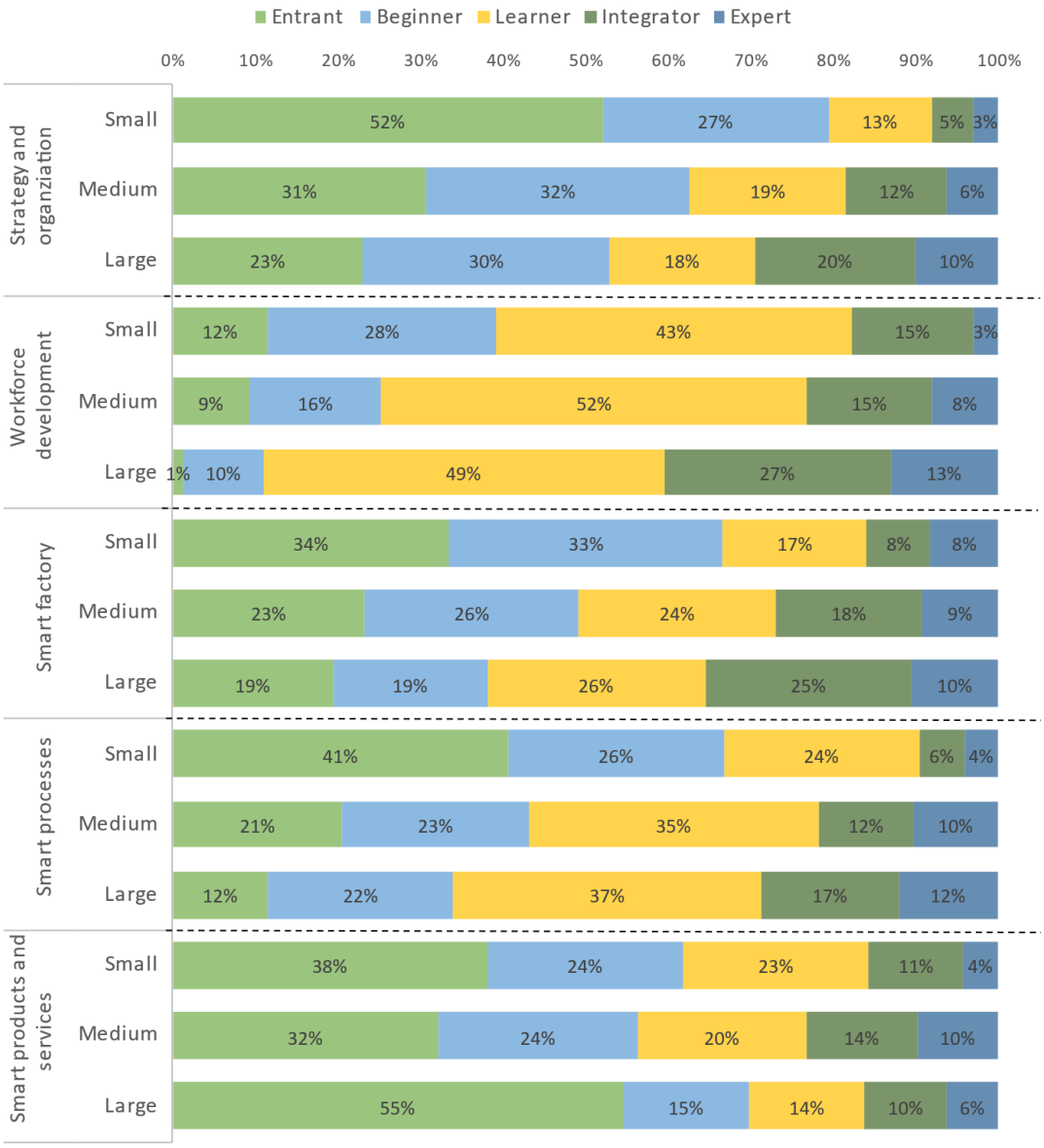

Fig. 2. I4.0 readiness of companies by the number of employees and dimensions

However, in terms of smart products and services dimension, the survey results show a similar pattern between small and medium companies in comparison with large companies. The results suggest that there are larger companies at an entrant level (55%), i.e. where no digital features are present in products and services, as well as there is a low product customization degree, products/services are upgraded very rarely, and customer data is not used for decision-making.

Overall, the differences across dimensions by company sizes are seen in Fig. 3 below. The weakest point of small and medium companies is strategy and organization factors, while for large companies the smart products and services dimension show the worst results. However, for all companies, the workforce development factors can be considered the strongest I4.0 readiness dimension. On average, smart processes and smart factory readiness factors show equally similar results within each company group, while medium and larger companies show more similar and higher results in comparison with small companies, e.g. scores for the smart processes are higher than scores for smart factory for medium and large companies, while the opposite can be seen for small companies.

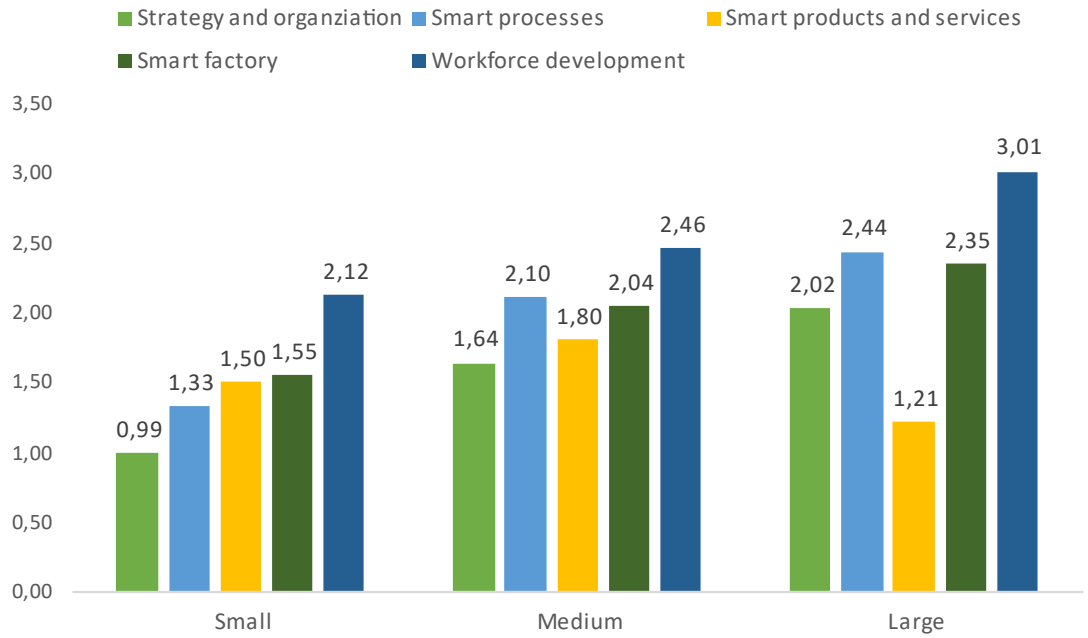

Fig. 3. I4.0 readiness scores by company size

To test statistically whether the I4.0 readiness scores differ across all dimensions for small, medium, and large companies, a non-parametric Kruskal-Wallis test has been performed [19]. The test results show that there was a statistically significant difference in I4.0 readiness scores among small, medium, and large companies with p-values less than 0.05.

To answer the RO2, the I4.0 readiness of companies by dimensions grouped by industries is presented. First, responses of product and service companies are compared (Fig. 4). The product companies include companies operating in the following industries: manufacturing and construction (141 companies), mining, petroleum, and gas extraction (10 companies), and agriculture, forestry, and fishing (5 companies). Service companies mostly include representatives from the financial and real estate activities sphere (45 companies).

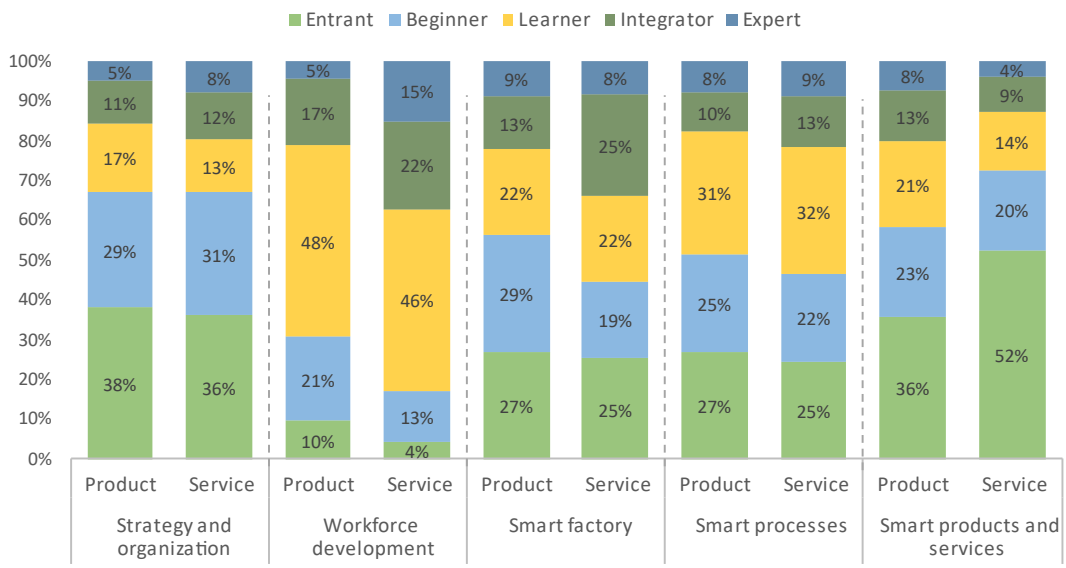

Fig. 4. I4.0 readiness of product and service companies

In terms of strategy and organization, smart factory and smart processes dimensions product and service companies show a similar pattern of I4.0 maturity where companies are mainly represented by entrant and beginner levels of maturity. However, in terms of workforce development, service companies have three times more companies at the expert level of I4.0 maturity and twice lower number of companies at the entrant level. On the contrary, product companies are more advanced in terms of smart products and service factors. On average, service companies show better results in terms of I4.0 readiness scores in comparison with product companies in all dimensions except for smart products and services dimension. The I4.0 readiness score for service companies in smart products and services is 1,14 (out of 5) compared to 1,67 (out of 5) for product companies.

The next Fig. 5 presents the results for I4.0 readiness for the companies in different sectors of the manufacturing industry.

The graph shows the I4.0 readiness scores for companies in different sectors of the manufacturing industry across all five dimensions studied in the paper. I4.0 score is rescaled to show results from 0 to 5. It can be seen from the graph that there exists a similar trend for I4.0 readiness in different dimensions for companies from all sectors as the lowest scores for companies are found in the strategy and organization dimension and the highest ones come from the workforce development dimension. The Kruskal-Wallis test also confirms that there is a statistically significant difference in the I4.0 scores across manufacturing industry sectors. The peak results of workforce development found in the petroleum, metal, and electric equipment sectors can be explained by the size of these companies as well, as these sectors are one of the largest in the economy of Kazakhstan.

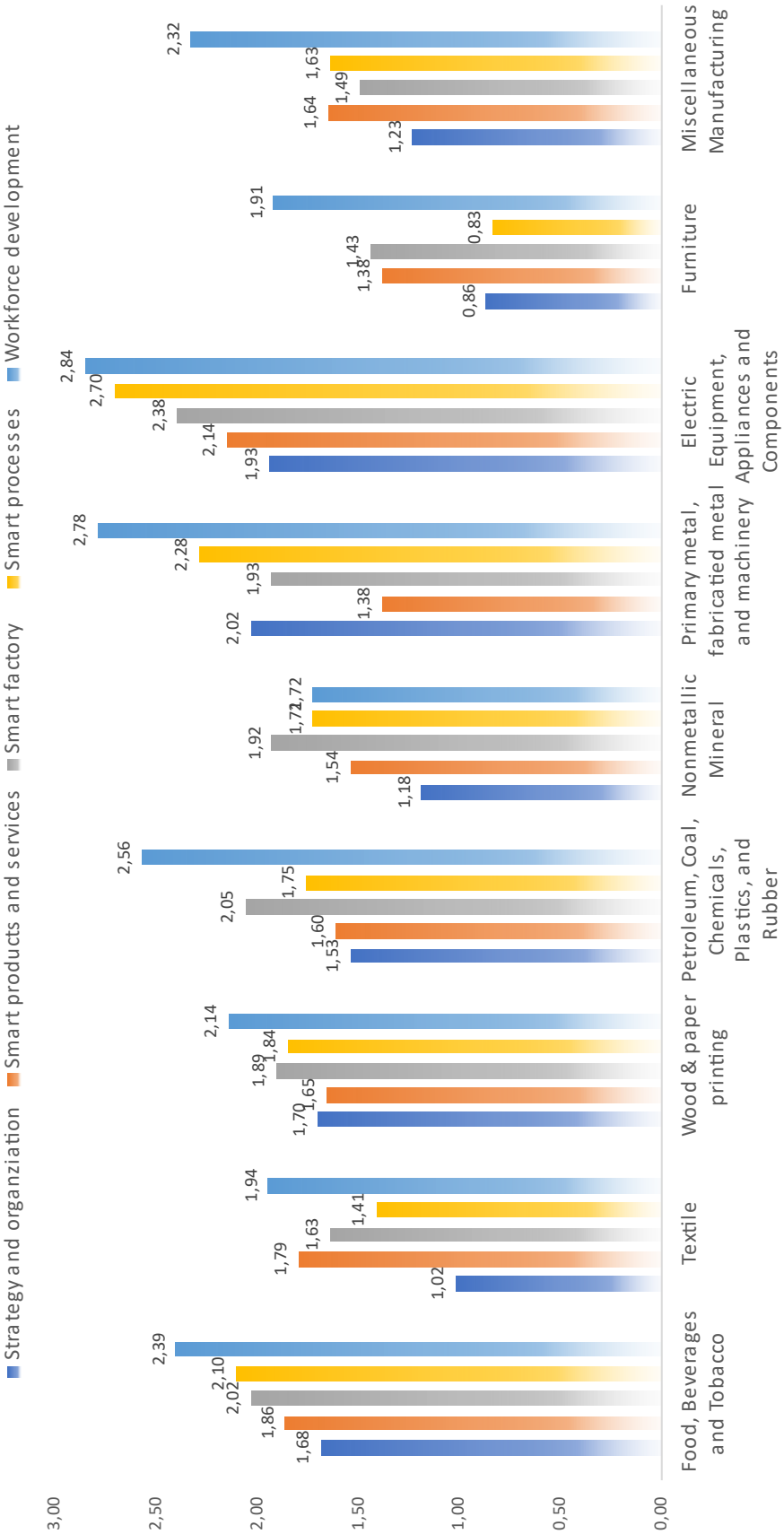

Fig. 5. I4.0 readiness of companies by sectors

5. Discussion

According to the results, small companies are less mature in terms of I4.0 readiness in comparison with medium and large companies across four dimensions out of five such as strategy and organization, workforce development, smart factory, and smart processes. The highest maturity levels (learners, integrators, and experts) in terms of I4.0 maturity were taken by medium and large companies. In this case, it confirms that the level of I4.0 implementation depends on the size of the company, which was also stated in studies by [9, 20]. [21] identified that MNEs in comparison with SMEs are more likely to implement relevant I4.0 technologies. [22] clarifies that large companies have a special person/department responsible for digital transformation in comparison to SMEs. This fact makes small and medium companies more prone to challenges of correct I4.0 implementation process. In addition, short-term planning is more tended by small companies, while MNEs are long-term oriented, i.e. strategic and organizational issues are within the priorities of such companies [23]. [21] also states that due to lack of resources, management in SMEs usually does not have an appropriate methodology for digital transformation and I4.0 implementation. [24] indicate that company size even within SMEs plays a critical role in the implementation of I4.0. According to his study, medium-sized companies support the implementation process starting with strategic planning and formalization of business processes and systems, while small firms pay more attention to operational factors of the implementation process. On the contrary, [25] based on the data from German and Danish companies, found that the company size neither by the number of employees nor by turnover does not have a statistically significant effect on the implementation of I4.0. Regardless of this fact, they conclude that large companies are more likely to implement I4.0 in comparison to SMEs [25].

In terms of the development of digital skills of the workforce and their acceptance of changes, large companies are more successful. It can be explained by the point, that the employees' aspect is covered by the strategic planning, i.e. puts larger companies ahead of SMEs in this domain. However, among other dimensions, the results of this study show that SMEs have better results in workforce development which creates a potential for faster application for I4.0 implementation [26]. Through further improvement of this dimension, SMEs might create a better starting base for digital transformation [25]. Next, MNEs show better results in terms of technology development, which can be predicted due to the availability of resources. On the other hand, SMEs due to their constrained resources can allow partial digitization of operations [27]. However, in terms of smart products and services dimension, large companies show lower results, which can be explained by a lack of flexibility in terms of product change/customization. Overall, this study concludes that when compared by the number of employees, the differences between small, medium and large companies are statistically significant.

With regards to industry and sector type, product companies are more mature in terms of smart products and services dimension, while service companies are mature in terms of workforce development. This can be explained by the fact that it is easier to digitize physical products and that companies in Kazakhstan are not yet fully exploiting the product-service system (PSS) and put their efforts and emphasis on the development of operational production as similarly found in [22]. In terms of strategy and organization, smart processes, and smart factory dimensions, service companies show higher maturity in comparison with product companies. According to the results of the sector comparison, the results suggest that the strength of the manufacturing companies of Kazakhstan is in human resources' digital readiness, while the weakness lies in strategy and organization. These results are in line with the conclusions found in the literature such as [27] and [22]. Both studies point out the importance of the development, formulation, and application of the I4.0 strategy to reach the successful implementation of I4.0 transition and obtain a competitive advantage in the era of the fourth industrial revolution. Companies should also make use of their strengths and utilize their human talent and train it further to smoothly introduce technological advancements [28].

6. Conclusion

The importance of Industry 4.0 implementation is significant nowadays. To be able to satisfy customers' demands, many companies investigating their ways toward I4.0 implementation. Taking into account the specifics of the I4.0 concept, and that initially it was designed and applied in the manufacturing industry, and widely get accepted and evolved mostly in developed countries, many questioned if company size or industry/sector type affect I4.0 implementation. This study is one of the first to investigate the dependence of company size and industry/sector type when implementing I4.0 in a developing country, Kazakhstan. It was identified that the larger the company, the better it performs in terms of I4.0 transformation. Even though this conclusion seems straightforward, when compared across different I4.0 dimensions, further insights can be gained. All companies show similar results in terms of their weak (strategy and organization) and strong (workforce development) points. This information can be used by the companies when developing their I4.0 transition process.

One of the limitations of the study is the sample size that can be extended in the future. The study also can be increased by involving different countries to obtain a better picture and have comparisons. Also, regression models can be utilized to study the effect of the company size and industry on the I4.0 maturity.

7. Acknowledgments

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SUSTAINABILITY OF EUROPEAN PROJECTS IN HIGHER EDUCATION INSTITUTIONS: AN INSIDE VIEW

Gulnara Zakirova[1], Rahat Bekboyeva[2]
[1]PhD (pedagogics), Associate Prof, International Information Technology University
[2] PhD (Economics), International University of Kyrgyzstan
[1]Almaty, Kazakhstan, [2] Bishkek, Kyrgyzstan
[1]gzakirova@fulbrightmail.org, ORCID 0000-0002-9768-1919, [2] r_bekboeva@mail.ru

***Abstract**: The internationalization of higher education in Kazakhstan is one of the tools to improve the reputation of the university at the national and international level, a way to enhance the quality of education. The key components of external internationalization, as stated by a number of researchers, are academic mobility, joint research projects with foreign universities, implementation of joint and dual diploma programs, and participation in international projects. Projects under the European Tempus program, and then Erasmus + are very popular among universities in the country. They made a huge contribution to the reform of Higher Education of the republic, allowed to bring an international component to the educational and research process in universities. Basically, projects last for one year and several years and the question arises as to what extend they are sustainable, how long the results of the project are in force, do they develop gained experience etc. The article presents the analyses of several projects in the Republics of Kyrgyzstan and Kazakhstana, identifies the factors on which the sustainability of projects is based, provides examples of questionnaires conducted among stakeholders, identifies the main reasons for the lack of sustainability, and proposes recommendations for use in further projects.*

Keywords: sustainability, internationalization, project, academic, mobility, Tuning, enhancement, technology

1. Introduction

Integration leading to the internationalization of Higher Education (HE) is an important aspect to achieve Kazakhstan's intentions to become a more competitive country, which is to introduce international aspects into all areas of education and research, both at the level of national policy and at the level of educational institutions. [1] Almost every institution of HE has the internationalization of education in the list of priority areas, practices various forms of internationalization in the form of mobility programs, partnerships with foreign universities, creating programs in foreign languages, inviting foreign teachers, and so on. Not only the forms of university activity are internationalized, but also the implementation of educational programs, the content of education, the content of educational programs and courses, methodology and pedagogical approaches and participation in the projects of European Commission as Tempus, Erasmus+ etc.

All projects usually have their own plan for achieving the goals and objectives of the project, which are carried out with varying levels of success and also have their own strategy for ensuring the sustainability of the project.

The sustainability of projects implies the continuation of project activities and sustenance of project outcomes after the expiration of the grant period. This means continuing to perform and deliver project benefits to the target groups:

Direct beneficiaries: the academic staff, the governance and administrative staff as well as students following Bachelor's, Master's or Phd Degree Programs.

Indirect beneficiaries: Local, Regional and National Governing Bodies responsible for the educational policy; University networks, Higher Education Institutions in the Partner Countries, Business, Associations of Employers, etc.

Sustainability planning is an important step as it prepares organizations to achieve a positive result in the absence of primary funding. There are various aspects of sustainability that need to be taken into account when developing the organization's steps to sustainability. The following types of sustainability should be considered:

1. Financial sustainability: It refers to ensuring the necessary funds for maintaining and continuing the work as well as the usage of the proposed methodology, results and outcomes achieved in the project framework.

2. Organizational (institutional) sustainability: It refers to ensuring proper working of the organizational structures that were developed as part of the project related to the human resources development and modernization of the HE.

3. Programmatic sustainability: It means to continue the project activities related to the HE modernization after the project end as well as mainstreaming of best practices identified at institutional/national /international level in the educational policy of the organization.

Sustainability factors and sustainability objectives which will be addressed after the end of the project are presented. The actions and steps towards sustainability, described here, are of a recommended nature and should be implemented through a flexible approach and adaptation to specific contexts and dimensions that differ from organization to organization and country to country.[1]

Sustainability of a project is based on factors that have been identified at the project /institutional/national levels.

At the project level it is based on:
1. Quality of project design in meeting academic, professional and/or social needs;
2. Involvement of consortium members: sense of ownership and motivation;
3. Effective management and leadership;
4. Active participation of the direct target groups;
5. Capacity for securing adequate resources for continuation.

At the institutional and national levels:
1. Academic and Institutional support;
2. National support
3. Socio-economic support

One completed project of the Tempus program and three projects of the Erasmus+ program were taken to consider the sustainability factors of the project results.

2. Methodology

In the study the following general scientific methods were used:
1. Generalization - to identify the similar factors of sustainability through ball projects;

2. Observation necessary for a systematic, purposeful perception of the process of the process of building a sustainability strategy in each project.
3. Comparative analysis of the results of work on the sustainability of projects in each individual case.
4. Methods of interviews and questionnaires, the use of indirect indicators of the involvement of not only project participants, but other stakeholders, including employers. When using these tools, it was taken into account that one of the diagnostic tasks is not only to obtain quantitative and qualitative indicators, but also to create conditions for the further development of reflection in professional activity, and, consequently, the development of personal qualities and the formation of an emotional and value attitude to activity.
5. Synthesis - to get a new idea about tools and forms of Sustainability development activities.
6. Analysis of the use of various forms of collaborative efforts of project partners to provide sustainability.

The study also used other different empirical and scientific methods. To get the required result, interactive methods were used, including communicative and reflective discussions, in which cooperative reflection was manifested, which makes it possible to ensure the active involvement of respondents in the process of creating new content, and in the processing and analysis of the results.

3. Findings

Sustainability of a project is based on factors that have been identified at the project /institutional/national levels.

At the project level it is based on:

2. Quality of project design in meeting academic, professional and/or social needs;
3. Involvement of consortium members: sense of ownership and motivation;
4. Effective management and leadership;
5. Active participation of the direct target groups;
6. Capacity for securing adequate resources for continuation.

At the institutional and national levels:

1. Academic and Institutional support;
2. National support
3. Socio-economic support

Three projects, Tempus TuCAHEA and Erasmus + ECCUM and ACADEMICA can serve as an example.

The Tempus project "Towards a Central Asian Higher Education Area: Tuning Structures and Building QualityCulture" (TuCAHEA) was aimed at integrating the Central Asian Higher Education Area into the broad international context of Tuning, which was previously developed in Europe, Latin America, Africa, Russia, the USA, Canada. Internationalization is carried out through the "accession of Central Asia, namely Kazakhstan, Kyrgyzstan, Uzbekistan, Tajikistan and Turkmenistan to the Tuning process, which is based on a special methodology.

The sustainability of the project was supposed to be achieved if the stakeholders use the tools of the competence approach to improve the quality of curriculum development. Though the development of descriptors for training programs enabled pilot groups of project participants to formulate key general and subject-specific competencies in 8 subject areas, prepare manuals for

use by all interested people, and also test their achievement through the organization of students' mobility, in two years after the end of the project, the results were hardly taken into account in the educational process.

It is to be hoped that the results of the project have contributed to the improvement of regional higher education systems. However, if we compare the Tuning process in Europe and Central Asia, we can not speak of an equal component of the level of the content of the result. For example, to analyze the impact on the system of higher education of the Kyrgyz Republic in 2018 the questionnaire was proposed for 29 experts, which represent 6 groups:

- Committee on Education and Science of the Parliament of the Kyrgyz Republic; Ministry of Education and Science of the Kyrgyz Republic;
- National experts on reforming higher education in the Kyrgyz Republic;
- The universities of the consortium of projects Tuning in Kyrgyzstan (Tuning KG) 2005-2007, Tuning in Central Asia (TuCAHEA) 2013-2016; Independent accreditation agencies; Other experts (non-governmental organizations, other universities). [3]

The results of the questionnaire of experts were carefully studied and analyzed. The starting question was the question of understanding the reforms in the republic in general. The answers showed not quite a consoling result as it is in Table 1 and Fig.1.

3.1 Analysis

Question - What do you understand by reforming the system of higher education in Kyrgyz Republic?

Basic concepts of changing the content of higher education

TABLE 1. Results of the Questionnaire (Kyrgyzstan)

1.	Implementation 3 cycles (Bachelor, Master, PhD)	60%
2.	Implementation of the state standard on Tuning methodology	90%
3.	National Qualification Framework	35%
4.	Development of quality assurance and accreditation systems	50%
5.	Organization of educational process on the credit system	80%
6.	Improvement and development of interactive educational technologies	60%
7	Change of the content of the discipline, in order to achieve the expected learning outcomes	80%
8	Strengthening the integration of education and science	70%
9	Internationalization of the educational process	65%

Question – Have you ever heard about Tuning in Kyrgyzstan?

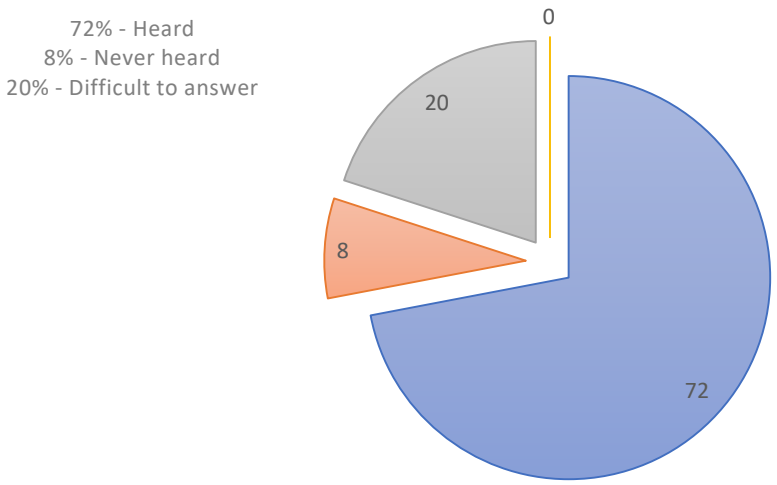

Fig.1. Results to the question "Have you ever heard about Tuning in Kyrgyzstan?"

Other questions related to topics such as:

- Has the Tuning methodology influenced on the implementation of the principles of the Bologna Process in the Kyrgyz Republic?
- How did Tuning methodology influence on the higher education reform in Kyrgyzstan?
- The influence of the Tuning methodology on the number of defended candidate and doctoral dissertations, the number of publications, scientific articles.
- How did Tuning methodology influence on the quality assurance?

Of particular importance are the answers about the impact of the project on the internationalization of higher education in general and each university in particular. Fig. 2.

Question - The influence of Tuning methodology on the internationalization of the university

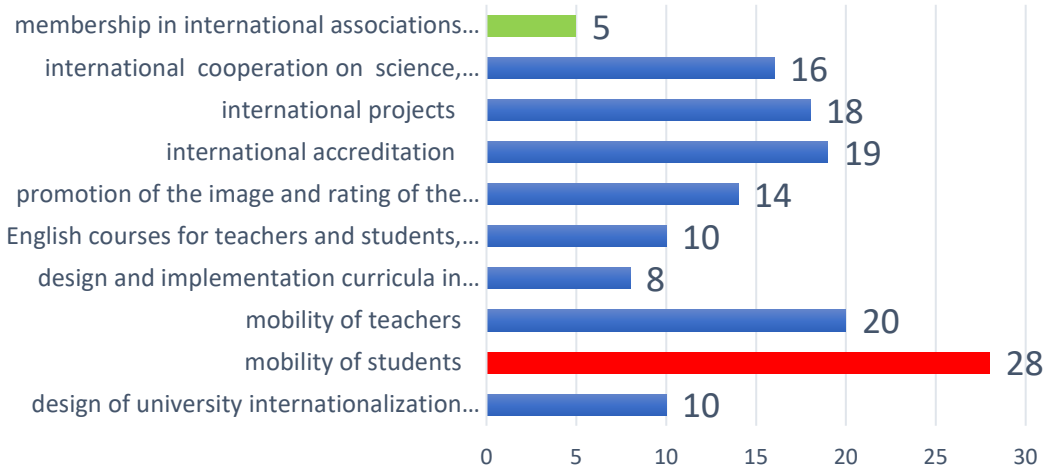

Fig. 2. The influence of Tuning methodology on the internationalization of the university

Thus, the analysis found the following problems:

- There is no connection between HE and VET (the need to new pilot project to create programs)
- Accreditation agencies do not know Tuning methodology (there is no connection between universities and agencies) - need trainings
- Many universities applied the credit system "technically";
- There is now accumulation of credits - need more trainings on regular bases;
- In practice, the employers' survey to determine professional competencies according to the Tuning methodology was formal and limited, the labor market is not developed
- "Technical" implementation of the state educational standard in many universities, not all teachers understand the methodology of tuning correctly, Tuning methodology is not used by all universities, recognition of learning outcomes - need more trainings on regular bases.

The activities of Kazakhstani 6 partners to work on the sustainability of the project included the creation of 6 Tuning Centers, 3 Competence Centers (IITU – Centre of competence (IT), Narxoz – Centre of competence and employability development (19/10/17), KSU – History), 12 new educational programs, recognition of accreditation agencies - European Chemical Thematic Net (SKSU), Computer Engineering ASIIN Germany – IITU, ISEKI –Food Association (SKSU) as well as synergy with other projects - European Chemical Thematic Net (SKSU), Computer Engineering ASIIN Germany – IITU, ISEKI –Food Association (SKSU).

Within the internationalization of higher education, information and communication technologies (ICT) are an indisputable tool. The Erasmus project "Towards a Central Asian Higher Education Area: Tuning Structures and Building Quality Culture" (ACADEMICA) seeks to modernize and improve the educational process in higher education institutions in Central Asia on the basis of ICT, in order to modernize curricula, scientific cooperation and knowledge transfer. The use of distance learning, learning management systems, comparison of traditional and e-learning, training courses for the masses, mixed and virtual learning, the use of social networks and mobile applications is the essence of the project. [4]The sustainability of the project implies the continuation of project activities and sustenance of project outcomes after the expiration of the grant period. [5]

This means continuing to perform and deliver project benefits to the target groups:

- Direct beneficiaries: the academic staff in Engineering Sciences as well as students following Bachelor's or Master's Degree Engineering Programs.
- Indirect beneficiaries: Local, Regional and National Governing Bodies responsible for the educational policy; University networks, Higher Education
- Institutions in the Partner Countries, Business, Associations of Employers, etc.

Various aspects of sustainability that need to be taken into account when developing the organization's steps to sustainability, such as Financial sustainability, organizational (institutional) sustainability and Programmatic sustainability. The job market for graduates from the course, and the knowledge, skills and attitudes required by potential employers, will need to be monitored regularly in future by the course teams to underpin changes in curricular content and pedagogy. The project completed in November 2018 and a year later a sustainability analysis of the project was also done at IITU. The results are as follows: out of 34 teachers who completed the training on the modernization of programs and courses, 26 successfully implemented the modernized courses in the educational process, prepared training materials, the Project Center is still working, and cooperation with interested business partners continues. However, it should be recognized that modernization in the range of 30-60% is a common requirement of the educational process at the university and it is not certain that the updated courses are the result of the project, although, of course, the use of project materials is obvious.

The Erasmus Project + Establishment of Computing Centers and Curriculum Development in the Mathematical Engineering Master Program (ECCUM) is aimed at the development of a new master program, aimed at learning to work with software, as Matlab and Comsol, to solve production problems. It is assumed that the master's thesis will be aimed at solving a specific production problem to strengthen the links between the university and the socio-economic environment. Creation of an online platform for the interaction of academic scientists, and a joint program, suggest academic and scientific partnership, but not the competence of teachers of European universities and universities in Central Asia.

4. Conclusions

Thus, the current trends in the regional integration of national education systems into the international, and through Erasmus + projects, to the European educational space, certainly contribute to the creation of common educational spaces, but whether it is sustainable or not – it should be analyzed and decided as the issue impact of projects are still a matter of debate.

To mobilize resources required to sustain the project beyond its initial grant, it is not enough that the project attains its objectives. The advertisement of the project's effectiveness not only to the stakeholders but also to the general public serves as a meaningful predictor of the sustainability. [6]

Reasons for the instability of some projects:

1. Staff turnover, project participants, project coordinator;
4. In the sustainability of the project, an important role is played by the personal characteristics of the project coordinator, his team, as well as the political support of the head of the university;
2. Insufficient dissemination of information about the project and its results among university staff who do not support the results of the project in the future, after its completion;
3. Low motivation to work on the sustainability of the project after completion, as there is no proper support among the university management, both organizational and financial. For example, remuneration of employees of structures created within the framework of the project; provision of material and technical base, Internet, etc.;
4. Change of university development priorities. For example, there was a change in the priority of strengthening the internationalization of the university in terms of attracting foreign students by country, etc.;
5. Change in demand for the developed program within the framework of the project;
6. Weak level of knowledge of a foreign language among both teachers and students;
7. Lack of university internal control on project sustainability;
8. As a rule, the project of sustainability within 2-3 after the end of the project, since the mechanism of sustainability of the project is laid incorrectly, at least not so strictly;
9. Weak consortium of universities within the country, no incentive to follow. [7]

Based on the above analysis, it is possible to make recommendations to project participants on working on project sustainability to develop such activities as: develop new partnerships in order to ensure further exploitation of the project results and outcomes, boost existing relations - along with investing resources on developing new partnerships it is equally important the existing relations with partners, stakeholders and beneficiaries to be managed in a proper way. Also develop strong communication strategy that can help you in showcasing the project results to the stakeholders and a large audience. The integration of project activities into the structure of the organization will contribute much to the sustainable results as well as broad dissemination project impacts to the organizational leaders and other stakeholders. Sensitizing the community about the

benefits of a particular project and then initiating a policy advocacy can also ensure sustainability in the long run.

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THE SUSTAINABLE DEVELOPMENT STRATEGIC LIFE CYCLE

Sergey Bushuyev[1], Natalia Bushuyeva[2], Victoria Bushuieva[3], Denis Bushuiev[4]

[1,2,3,4] Project Management department, Kyiv National University of Construction and Architecture,
[1,2,3,4] Kyiv, Ukraine
[1]Sbushuye@ukr.net; [2]natbush@ukr.net; [3]bushuieva.v@gmail.com, [4]bushuievd@gmail.com

Abstract: *The current area of development of the new paradigm of innovative technology is an entrepreneurial activity. In contrast to educational, industrial, and scientific activities, it is more dynamic and open. In modern ideas, sustainable development behaviour is associated with the personal new initiative, the risk of the contribution of resources, and making a profit in the condition's specific environment. Creative activity is like strategic entrepreneurship, but the time it is a resource, and profit is difficult to evaluate, but it fascinates the creator like development power. Based on the application of innovative technology, strategic entrepreneurial activity can be expressed as a new form of behaviour based on the appropriate use of information technology to search, generate and select commercial initiatives and ideas, minimizing the risk of the contribution resources and maximizing profits. Discussion of the environmental feasibility of strategic entrepreneurial behaviour and its consistency with general processes of nature is limited to the strategic development life cycle and only the expansion of creative elements in the organization.*

Keywords: sustainable, strategy, development, life cycle, creativity, model, project, program

1. Introduction

In recent years, the understanding has come that management (management), in particular project management, is a special art that can be distinguished and studied. Project management methodology is completely different from the purely technical methodology that is often associated with most projects. In real life, there are many aspects of a project that lie outside the boundaries of technical areas and that need to be organized with the greatest possible care and attention [1]. That is, to achieve the goals of the project with optimal use of resources and maximum satisfaction of the project participants, such non-technical aspects of projects must be well managed, and this largely depends on the competence of project managers and project management teams [2].

Project management is not something unusual - it is the most effective means of achieving results. For better or worse, depending on the skill, intuition and luck of managers, projects should always be manageable.

The situation is most obvious in the case of project management from sustainable development strategic point of view, based on the understanding life cycle of the development process supported by projects and programs in the construction industry, numerous government organizations, aerospace research, medicine, electronics, etc. Unfortunately, the different managers put different meanings into the term strategic development project management, and, naturally, there are different opinions about what and who is involved in such management [3]. Related to this is a certain diversity of the new and dynamically developing profession of project manager [4]. As a result, however, it is difficult to find a real connection here, especially where modern strategic development models are complex and interdisciplinary coordination is needed.

Projects are carried out by people with their respective skills and abilities. But the number of people and their qualifications change during the life cycle of the project following the level of

effort involved. Consequently, many of the project participants are required only for a relatively short period [5].

Today, inspiring intuition is of great importance in project and program management as a holistic tool for assessing and implementing strategic development innovations. This area of expertise in sustainable strategic development project management has not yet been sufficiently explored. Intuitive competence plays an important role in preparing and making decisions when the required data is ambiguous or missing [6]. At the same time, sustainable development project managers have to resolve difficult situations, conflicts and bifurcation in the management processes.

Through intuitive analysis and pattern recognition, project managers must quickly understand and evaluate complex functional and structural decisions rationally and emotionally. Intuitive competencies in sustainable development and strategic project management help in creative thought processes, planning and forecasting in dynamic environments [7], [8].

With the help of intuition, managers can anticipate new ideas and areas of knowledge in decision-making processes. Such foresight cannot be planned purely rationally, they require "gut feeling". Vision and imagination open up opportunities for action beyond the traditional and conventional ways of preparing and making decisions [9]. Rational thinking remains in the old traditional paradigm of sustainable development project manager competencies. For evolutionists or revolutionaries, the ideas would remain on paper without their implementation. Consider inspirational intuition as the driving force behind sustainable development and strategic project innovation [10]. In education processes, managers must acquire existing knowledge and competencies. At the same time, inspiring intuition and creativity should ensure the mining of new knowledge on the way of development. Through the rational interaction of existing knowledge and knowledge generation, continuous change and innovation can be achieved [11].

The Strategic Sustainability Framework helps to fully understand and model the context of the global sustainability challenge, and move strategically towards a sustainable development mission. At the same time, the negative impact on the ecological and social systems is gradually reduced by using innovative opportunities, including new business models, exploring new markets and gaining new market shares, as well as by reducing risks and operating costs [12], [13].

In particular, the application of the Strategic Sustainability Framework helps to manage system domain and trade-offs more effectively allowing modelling and evaluation of the sustainable potential of various materials and methods before investments are made, and offers the opportunity for more effective collaboration across disciplines and sectors, regions, value chains and stakeholder groups [14].

At the same time, the application of the Basis for Strategic Sustainable Development model makes it possible to prevent damage even from still unknown problems and, importantly, to direct the selection, development and combination of additional methods, tools and other forms of support, which allows increasing their usefulness for strategic sustainable development [15], [16].

The purpose of the paper is to create a sustainable development strategic life cycle model base on Strategic Sustainability Framework.

2. Principles of Sustainable Development Strategic Management

The uncertainty of sustainable development projects is an objective factor and is associated with probability and risk. A professional project manager will take steps to reduce the possibility of realizing a less favourable outcome by reducing the risk of the project if this can be achieved effectively. This brings us to the need for a concise understanding of the nature of the project in the first place, especially if it is complex and cross-sectoral. All these functions are performed in risk management [17].

Any sustainable development project starts with the idea of changing someone or something [18]. Ideas for changing the world around us (including ourselves) appear in various areas of human activity - science, art, production, economics, everyday life, etc. These ideas can capture functions of various scales, from restructuring the country's economy and renovating a factory to buying a vacuum cleaner. Some of these ideas provide the study by mankind of the secrets of the universe and the universe.

It follows from this that the world of sustainable development projects is limitless and can be defined in a huge number of various features that divide projects into categories: research, product development, cultural development, financial and investment activities, etc.
From where and how the idea of the project is born, its characteristic features depend. We do not think about why a cat has a kitten, and an elephant has a baby elephant.
Sustainable development projects are born in a certain environment and very often in the same agony as all living things. The project environment "feeds" it with various ideas, approaches, tools, resources (including money) and means of solving project problems - it forms the project environment. As for a person, clothing, housing, habitat and communication, etc. form an environment.

It should be noted that today the environment of sustainable development projects adversely affects the process of their birth. This refers to the investment climate and the increased risk of project implementation under conditions of unstable and imperfect legislation, corrupt officials, etc. Thus, in our state, the problems of the human factor and leadership in projects are of paramount importance.

The traditional sustainable development project life cycle includes four main phases:

- pre-investment;
- preparation of the project and executors;
- project implementation;
- completion of the project.

From the point of view of project managers, within the sustainable development framework of these phases, the classical scheme of their participation in the project often works. This scheme is superimposed on the main phases of the project and characterizes the emotional and psychological state of the project managers and the management team. The scheme includes six main stages of project development from the point of view of managers:

- enthusiasm;
- disillusioned;
- panic;
- search for the guilty;
- punishment of the innocent;
- encouragement of non-participants.

Parallel development and the intersection of the project implementation process and changes in the emotional and psychological state of the management team depend on many factors. The main ones are the level of professionalism of individual managers and the team as a whole, the complexity of the project and the process of its implementation, the motivation of the customer, financing structures and project participants, and the level of the general culture of project management in market conditions, etc.

The project manager's enthusiasm is seen in the due diligence and project preparation phases. At this stage, the bank mission together with the project manager takes part in the preparation of the project, and the project is financed, as a rule, at the expense of the grant money.
The loss of illusions occurs at the moment when the draft, signed by the bank, is submitted for ratification in our parliament. At the same time, a high level of uncertainty and a significant delay in time contribute to a complete loss of enthusiasm at the stage of forming a team of managers to support the project.

Panic is characteristic of the project preparation phase - the opening of a special account in one of the banks of the first category. At the same time, intractable problems arise in obtaining a license from the National Bank of Ukraine to open a special account abroad. And even if this stage is successfully passed, then a second even more powerful wave of panic rolls in at the time of preparation and conduct of the first tenders. If the management team conducts tenders for the first time, then all hope is transferred to the consultant. More than one volume of memoirs could be written about the work of foreign consultants and volunteers. The professional growth of sustainable development project managers is accompanied by more and more frequent conflicts with consultants, which leads to the rejection of the latter. At the same time, an important factor in the growing instability of relations is the catastrophic difference in the salaries of project managers and foreign consultants. Sometimes such a difference is determined not by percentages, but by 20-40 times with the full responsibility of the project manager for the result.

The search for the guilty, as a rule, occurs when the money for the sustainable development project is spent, the time for its implementation comes, and the result is still very far away. The project goes beyond the allotted time. In this situation, there is usually a change in the project leader and managers. The new team at the formation stage is not able to hold back retribution for a long time. And, as a rule, in the phase of project implementation, there is a transition to the next emotional-psychological state.

Punishment of the innocent occurs mainly at the end of sustainable development project funding when a letter is prepared to ask for an extension of the project. At this stage, the dead season begins for project managers, and each of them begins to urgently look for a new project for themselves. And the situation in the present project acquires special colouring.
In real life, the sustainable development project team is also required only temporarily. However, much attention must be paid to the selection and coordination of its members, ensuring that they clearly understand the roles and responsibilities in the temporary organizational environment. This is where human resource management comes into play.
Consequently, there is a need for a constant forecast of the final result, including the consumed resources. Based on such a forecast, especially if the forecast is unfavourable, one can change direction by applying control.

Control makes sense if all sustainable development project participants clearly understand their roles and responsibilities - the result of careful planning and coordination. In addition, the current state of the project becomes apparent after its comparison with the planned one. Often such a comparison can only be made by interpreting both the external and internal design environment. All this relates to communication management.

But the presence of people and communications is not enough to successfully implement the project. We also need services provided by people. It is common knowledge that the project manager must devote most of his time to coordinating the responsibilities of the staff and the goals of the project.

However, after the completion of the sustainable development project, his management is frantically looking for a positive result. At the same time, the result is often not considered in the context of time and costs. And the project moves on to the stage of rewarding the uninvolved.

The specifics of managing sustainable development projects and the problems of dynamic leadership lies in the particular complexity of the tasks that project managers constantly have to solve, and the low level of performance culture among project participants: customer, investor, funding organizations, project managers, performers project work, surrounding organization, control services (technical, financial, tax, etc.).

In this case, project management is considered a universal language of communication between sustainable development project participants. From the unambiguous and professionally correct understanding of the language of project management, the result of the implementation of a complex project largely depends on the selected criteria (time, cost, quality, etc.).

The main problems of managing complex projects are formed around the following factors:

- customer requirements for the project and increasing their competence. At the same time, the principle “appetite comes with eating” works;
- the complexity of the resulting products or projects. This complexity is considered an objective property of the system, which requires the decentralization of management functions and the use of hierarchy as a means of dealing with the complexity of management tasks. Typically, in such a management scheme, a significant number of conflicts arise when decisions are made by managers of the same level. Every manager tries to "pull the blanket over himself";
- relationship and mutual influence with the external environment of projects (economic, political, environmental, social, cultural environment). Such connections quite often negatively affect the progress of the project;
- degree of uncertainty and risk. In complex projects, the degree of risk is always much higher, as it is balanced by the effect of project implementation. Here the folk wisdom “you have to pay for everything” works;
- organizational restructuring. Such restructuring is inevitable since the project management system must reflect changes in the control object, which consist of changes in the structure of the reorganization. This is an objective property of any complex project, and the absence of changes in a complex project in the process of its implementation is "not the rule, but the exception";
- frequency of technology change. This property is determined by the significant duration of the project, on the one hand, and the desire of the customer to obtain a result that corresponds to the latest technological advances, on the other. The inevitability of replacing technical and technological solutions makes it possible to satisfy the customer's expectations of the type “I want this, but I don’t know what”;
- planning and pricing errors. These errors are an essential attribute of any complex project. In this case, project managers are always under the "crossfire" of the designers, the customer and the contractors. This triangle is the source of most of the problems that arise in the process of project monitoring.

The majority of innovative technologies are based on imitation, benchmarking and copying of various natural processes and phenomena. Innovative technologies are no exception, they try to simulate the creative behaviour of an individual and are based on historical traditions of different cultures. Formerly the main object of diverse innovative technologies was an individual or a group, the task was to upbringing, education, and organization of new behaviour in adverse, deadly and aggressive external conditions. The traditions of these schools cover various aspects of activity: philosophy, preaching, commerce, aggression, intelligence, diplomacy, and politics. Now, in connection with the rapid development of information technology, a new association has arisen, consisting of a deeper use of computer systems and networks in innovation activities: artificial intelligence systems, and expert systems. The trend of such penetration is significantly growing and expanding, so there is a need for a new organization of innovative activities with wide involvement of information technology.

The current area of sustainable development of the new paradigm of innovative technology is entrepreneurial activity; in contrast to educational, industrial, and scientific activities, it is more dynamic and open. In modern ideas, entrepreneurial behaviour is associated with the personal new initiative, the risk of the contribution of resources, and making a profit in the condition's specific environment. Creative activity is like entrepreneurship, but time is a resource, and profit is difficult to evaluate, but it fascinates the creator like power. Based on the application of innovative technology, entrepreneurial activity can be expressed as a new form of behaviour based on the appropriate use of information technology to search, generate and select commercial initiatives and ideas, minimizing the risk of the contributing resources and maximizing profits. Discussion of the environmental feasibility of entrepreneurial behaviour, its consistency with general processes of nature is limited by legislation and only the expansion creative element in the organization of commerce brings an encouraging note into the general motive for the development of market clones of a democratic society.

3. Strategic Sustainable Development Life Cycle

This study is defined a holistic model of the Strategic Sustainable Development Life Cycle for addressing the social and environmental aspects of sustainability. This allows an approach to quickly identify the most important high-level sustainable development issues (bifurcation point) that can help address the necessary solutions and actions, and then, if necessary, offer additional analysis. The Strategic Sustainable Development Life Cycle displays hotspots that are especially important for sustainable development. As the tools of simulated Sustainable Development Life Cycle apply Markov chain or Markov process models. This is a stochastic model describing a sequence of possible events (in our case Bifurcation points) in which the probability of each event depends only on the state attained in the previous event. A countably infinite sequence, in which the chain moves state at discrete time steps, gives a discrete-time Markov chain.

A Markov chain is a collection of random variables (or vectors) $\Phi = \{\Phi_i: i \in T\}$ where $T = \{0, 1, 2,\ldots\}$. The evolution of the Markov chain on a space $\Omega \subseteq \Re p$ is governed by the transition kernel

$$P(x,A) \equiv Pr(\Phi_{i+1} \in A | \Phi_i = x, \Phi_j, j<i) = Pr(\Phi_{i+1} \in A | \Phi_i = x),\ x \in \Omega,\ A \subset \Omega,$$

which embodies the Markov assumption that the distribution of each succeeding state in the sequence, given the current and the past states, depends only on the current state [19].

In general, in the context of Markov chain simulations, the transition kernel has both a continuous and a discrete component. An example of the Discrete-time Markov Chain is in

which states (the bifurcation points) are represented by Sustainable Development Life Cycle and transition probabilities between states.

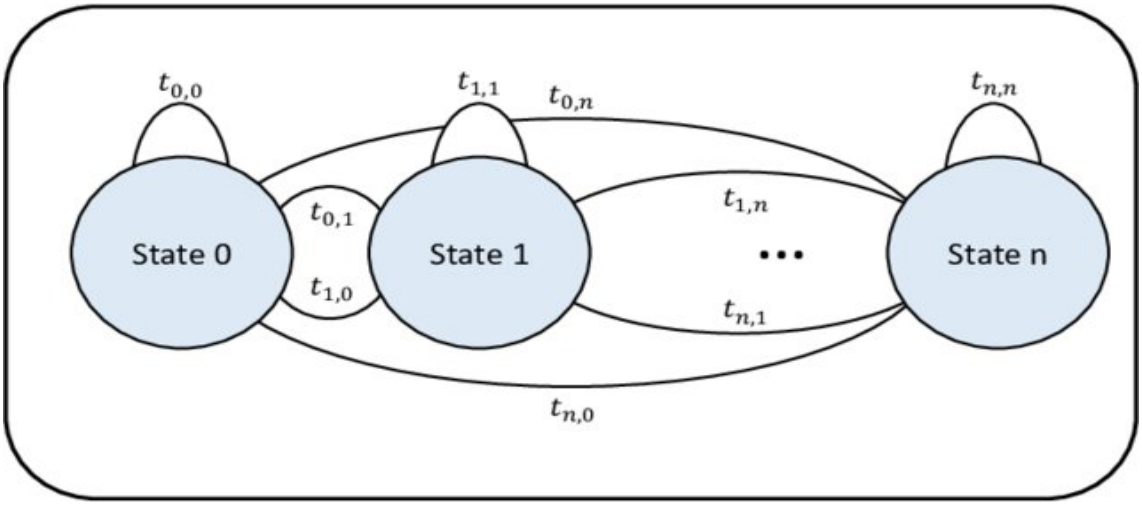

Fig. 1. Example of Discrete-time Markov Chain, in which states are represented by Sustainable Development Life Cycle and transition probabilities between states are assigned by $t_{a,b}$

As part of a sustainable strategic management process (in Fig. 2 the direction indicated by the arrow) for the model necessary organizational changes at each point of bifurcation are determined. "At the same time development program is formed by taking into account the planned duration of implementation of each project and the very late date of completion of the program, tied to a particular point of bifurcation.

It is clear that in preparing the program interconnected chain of projects at certain levels of vision appeared. At each stage, the vision of the project is refined and synchronized [1]". Typical bifurcation points of the model are given in Table 1.

TABLE 1. Bifurcation Points of the Life Cycle Model of Organizational Development (within the same Activities)

№ of point	Name Characteristic of the state
1	Market vulnerability Bringing to market the first product
2	The crisis of transition to professional management ineffective management of the organization and its development
3	Crisis of autonomy Mid-level management manages unprofessional
4	The crisis of corporate relations Corporate conflicts of "Center - Regions"
5	Crisis of losing control as a result of the decentralization of power
6	Crisis of trust
7	The crisis of competitiveness Reducing the rate of sales and product competitiveness

This example shows the Sustainable Development Life Cycle of Distributed Organization finished on the bifurcation point 6. After that Sustainable Development Program Manager need to implement a new concept and Sustainable Development Program.

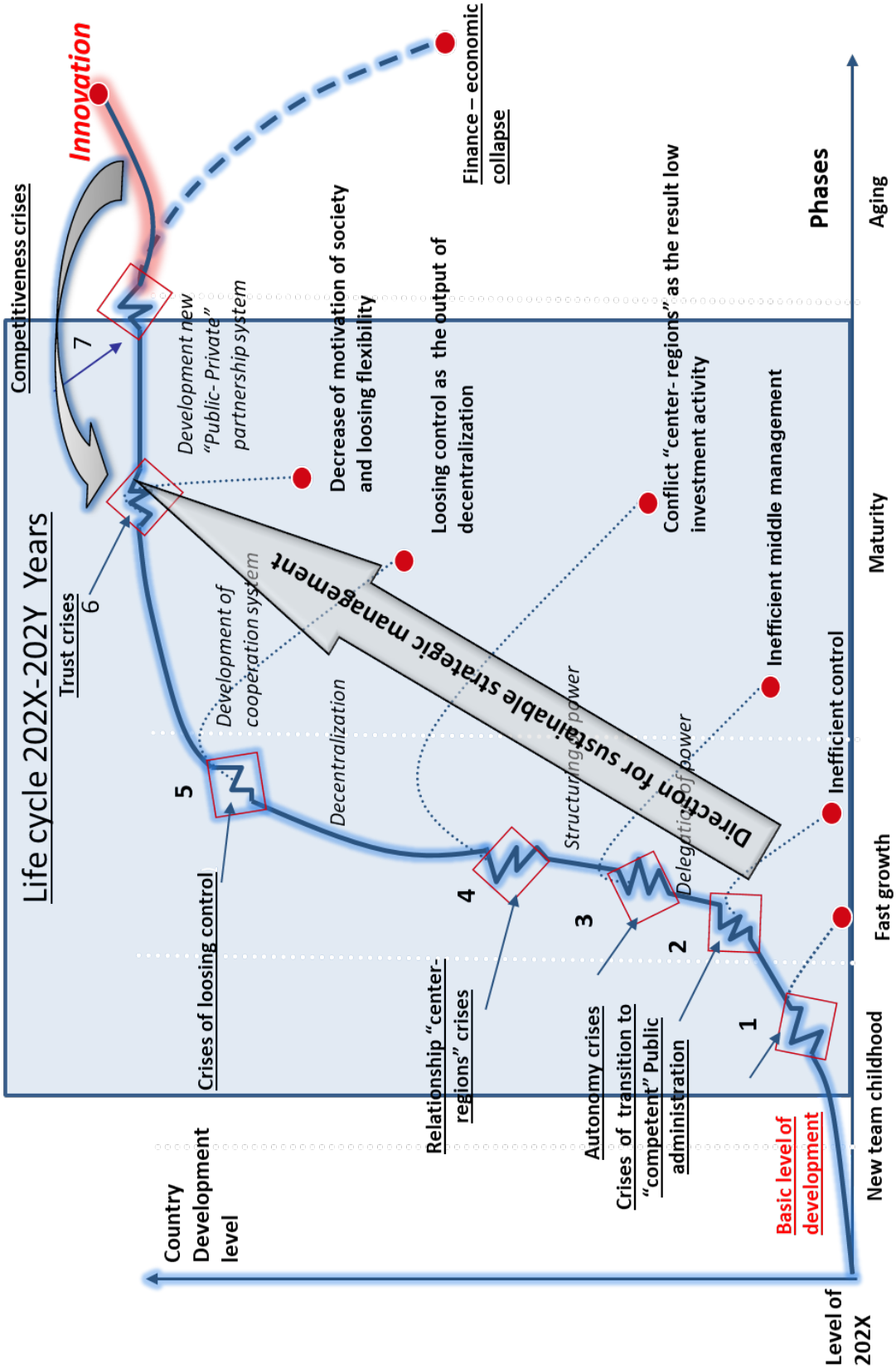

Fig. 2. Example of Strategic Sustainable Development Life Cycle Distributed Organization [1]

4. Key Issues Sustainable Development Programs

Let's look at the behaviour and issues for managing the Sustainable Development program.
Fest of all program managers needs to find the answer to the next questions.

- Can you manage your organization's growth cycle to reach its full potential?
- Can you "start" the growth cycle to ensure a dynamic competitive advantage and a sustainable increase in profitability?
- Finally, how dynamic is the understanding of corporate strategy?
- Do you manage the growth cycle?

Growth accelerators are the elements from which the growth cycle is formed. Therefore, the detection of potential accelerators is the starting point for creating a cycle. However, for the strategy to succeed, two more steps are needed - to create an effective combination of accelerators and to organize their constant updating.

Detection of growth accelerators. In most industries, some common accelerators have become so widespread that their presence is required for easy participation in the competition. Successfully developing investment banks thrive on their ability to manage staff. Leading producers of consumer goods form an effective growth cycle based on the market image. First-class retailers use power over partners and the ability to reproduce. In many cases, all market participants play essentially the same game, and success is determined by the ability to take the toughest action.

This means that new game strategies can only be implemented if new growth accelerators are put in place.

However, although this approach may favour the organization for several years, there are some risks. There may be a weakening of interaction with traditional buyers and a danger to future products, as rivals may strike back. Moreover, any competitor who wishes to enter the same market can reproduce this strategy. Therefore, a single accelerator can give a boost to growth but hardly has enough potential to support sustainable growth.

Creating a combination of growth accelerators. Therefore, one or two accelerators are not enough for rapid growth. A combination of three, four or more accelerators are required to form a powerful growth cycle.

The reason is simple. Each loop of positive feedback is by its nature self-reinforcing, but the loops connected with a common element multiply the effect of each other. In a combination of loops that include the customer base, each loop stimulates the action of others. And since any positive feedback loop becomes the basis for exponential growth, mutually activated loops form not just accelerated, but exponentially accelerated growth.

Recovery of growth accelerators. Even a combination of several accelerators cannot guarantee eternal growth. Growth cycles collapse under the pressure of internal and external factors like competition, market evolution and internal corporate problems. In this case, using traditional accelerators in emerging industries does not stimulate growth, although abandoning their use almost inevitably accelerates the collapse.

To use growth cycles for as long as possible, fast-growing organizations are constantly inventing new series of positive feedback loops. In this case, very often we ask the next question. Can we "start" the growth cycle and gain a dynamic competitive advantage?

“Some growth cycles are more powerful than others. These cycles differ in what we have called dynamic competitive advantage - a sustainable advantage that grows over time, which cannot be copied even with significant financial resources. This advantage generates a powerful growth cycle that can provide a significant increase in profitability for a long time”.

Dynamic competitive advantage is created when the growth cycle is protected by very strong principles and tools (sometimes called the "architectural control system"). The main thing here is to generate high costs for switching to other products for business network partners and, most importantly, for end users. Only this can ensure the insensitivity of the cycle of growth of attacks by rivals.

Of course, not every organization can build a powerful growth cycle with an effective protection system. However, there may be hidden opportunities.

How dynamic is the understanding of corporate strategy?

Growth accelerators, growth cycles and dynamic competitive advantage are the concepts based on which a dynamic understanding of corporate strategy is possible. The "tigers" we studied can teach several lessons, and it should be noted that they contradict the traditional management philosophy.

To determine the need to implement tools and methods of the project approach in the management of the company, it is necessary to present at what stage of the life cycle it is.

Stage of development based on creativity. This is the stage from the beginning of the organization to its first organizational crisis - the crisis of leadership. The organization appears as a result of the entrepreneurial efforts of managers and develops due, as a rule, exclusively to the realization of the creative potential of its founders. The main focus during this period is on product development and marketing. The organizational structure of the organization often remains informal. However, as the organization grows, its founders need to monitor and direct its development in specific areas, which requires new specialized knowledge, which they do not yet have.

5. Conclusion

Sustainable development program manager behaviour is associated with the personal new initiative, the risk of the contribution of resources, and making a profit in the condition's specific environment.

The principles of sustainable development strategic management defined key elements of the program with a bifurcation point that concentrate on risks, opportunity, issues and problems.

The Strategic Sustainable Development Life Cycle is the basic concept of managing projects and programs.

The strategic entrepreneurial behaviour and its consistency with general processes of nature is a limited strategic development life cycle.

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PROJECT MANAGEMENT MATURITY MODEL AS THE DIRECTION FOR IMPROVEMENT: CASE STUDY FOR INTERNATIONAL PRIVAT SMALL ARCHITECTURE BUSINESS

Olena Verenych[1], Anatolii Osadchyi[2]

[1,2] Project Management Department, Kyiv National University of Construction and Architecture
[1,2] Kyiv, Ukraine
[1] ORCID 0000-0003-0972-6361, [2]osadchy.am@gmail.com

Abstract: *Project management approach is efficient these days. It is used in any business in order to create a new product or service. There are a lot of companies indicating that they use this approach. They use the concepts "project", "project management", and "project manager". However, if anybody tries to assess their organizational structure and employees' responsibilities, they cannot find any similarities. The incorrect usage of the concepts can lead to the future problems in management. Once it can be finished by the "death" of the business. For controlling the situation some models that are directed on the business development can be used. They are the maturity models and the organizational models. If the top-management can find the problems in the business operation they can use these models for improving the situation. The paper presents some first steps on the business reorganization into the project-oriented company. The top-management of the young international private small business have defined the problems and are now trying to implement the changes for growing from uncontrolled work into the fully controlled.*

Keywords: project management, maturity model, IPMA Delta, Adizes's methodology, architecture

1. Introduction

In current times, the approaches and techniques of project management are used in wide areas. Using a project-oriented approach is an "unofficial" standard for introducing all changes, improvements, and innovations in production, product creation, and service. The necessary specialists are prepared by a sufficient number of universities. However, the availability of specialists is not always the mainstream to successful implementation of several projects simultaneously and expanding the portfolio of projects in the organization. This is most often due to certain management problems, such as organizational processes within the enterprise itself. The presence of project managers in the organization is not a confirmation of project-oriented management. This approach requires some changes in the organizational structure and responsibilities of employees [1]. Changing the organizational structure is not an evolutionary process. The drivers for these are either external or internal challenges, which should be adequately supported by top-management. The organizational structure change is a certain "milestone" in the organization that will either become a push for development and growth, or decline.

In order to improve the management processes for product creation and project management, as well as to conduct an external evaluation of the organization's ability to manage the project portfolio in the 1980s, successful attempts were made to establish a system for evaluating the organization and indicating ways for improvement. This evaluative system is called the maturity model [2]. For the first time, it was designed to assess an organization's ability to develop software for selecting or finding companies that are capable of implementing information projects on time, quality, and budget.

However, over time, the approaches developed have been evaluated and expanded for both product development and management processes. They have also become widespread in project

management as “guiding approaches” to improving project processes and improving project implementation.
The application of organizational assessment approaches based on the maturity model allows the company to focus on improvement, find "weaknesses" in management and identify ways to gradually improve. It should be noted that the assessment of the organization in the context of the maturity model from the project management approach is usually provided if the company already has project managers who understand what a project is, project management, and certain approaches to its application and implementation. In this material, the issue of the existence and evaluation of project managers will not be considered.
The goal of the paper is to present the practical steps that are being taken for organizational structure and responsibility changing to improve project management in an international private small business in the field of architecture based on the application of the maturity model for the organization and approaches of the Adizes’s methodology for corporate lifecycle management.

2. The Maturity Models

The maturity model development was preceded by some work that was pushed by the need to find a solution to the question of how to evaluate a company that provides software development services. Before this, it was a time slot when the software development companies were not able to complete contracts within the set deadlines and budgets. To address the issue, the US federal government has asked scientists to find a solution. To achieve this goal, the researchers developed a list of questions, the answers to which allowed them to assess the company's ability to implement projects on time and within a budget. However, the companies among which the questionnaire was tested began to consider it an approved model. After some refinements, the questionnaire was transformed into a model called the Capability Maturity Model for Software (CMM) [3]. This was the impulse for the maturity model development for different areas. Today, there are at least the following models of maturity: the Safe Management Maturity [4], Process Grid [5], Energy Management Matrix [6], Measuring R&D Effectiveness [7], Knowledge Management Maturity [8], the Information Process Maturity Model [9], the Business Process Maturity Model [10], the Process and Enterprise Maturity Model (PEMM) [11], Communication Grid Method [12], etc.
Each of the models was developed for a specific area of knowledge to assess and identify areas for process improvement.
The project management area was not left out. It was noted that the success of a project-oriented organization depends not only on the qualifications of employees but also on the quality of organizational processes. You can have highly qualified specialists in your field, know the approaches to project management, have the appropriate software, a sufficient number of projects and still have problems with the project implementation on time, with appropriate quality and within the budget. All of them point to problems in management. How can the management level in the organization assess and how can it identify ways to improve? Maturity models are best suited for this. However, the above models did not take into account the specifics of project management.
Therefore, in the late 90's, project management began to conduct research to create a maturity model of an organization from the project management point of view. The first attempts were made in the early 90's by German researchers. Experts from the German Project Management Association have developed two models. The first was called the Project Excellence Model. "It was based on a concept of the European Foundation for Quality Management (EFQM) and adapted to assess enablers as well as the results of a project" [13]. This model has been used since 1997, and since 2002 it has been used in the International Project Excellence Award.
Another was named "PM Delta". "It was based on the former DIN 69904 "Project Management Systems", a standard with an organizational view on project management, defining a wide range of aspects" [13]. In 2007, it was improved in the context of changes in project management, and in 2009, together with experts from Eastern Europe, it was finalized and named "IPMA Delta®"

and "used for the purpose of assessing and certifying organizations" [13]. Currently, this is one of the basic models for assessing the maturity of the organization, which allows one to understand the actual state of competence of the organization in project management, programs, and portfolios in relation to international best practices, as well as to plan activities for further development of the organizational environment [14].
The model has 5 levels:
"Initial: achievements in project management at the level of individual employees. Some employees work satisfactorily, well and even perfectly, but there is no single standard for the entire organization, and the management of project portfolios and programs is generally unsatisfactory. The organization has no formal standards and processes in this area" [15].
"Defined: there are certain standards for managing projects, programs and project portfolios (RFP), project management structures and processes are used occasionally on individual projects.
Standardized: there are processes, structures and standards of management (PPP), which are mainly used in the organization (there is no full coverage and integration)" [15].
"Managed: there are standards, structures and management processes (PPP) that are applied throughout the organization and are controlled by the management (full coverage and integration)" [15].
"Optimized: there are all the necessary standards, structures and management processes (PPP) that are applied throughout the organization, are monitored by management and are constantly being improved" [15].
According to this model, an organization assessment allows one to identify weaknesses in management positions and make a purposeful move to improve the organization's development improving through the business drivers' development.
More than 30 maturity models are now available that can be used in project management [16].

3. The Adizes's Approach to Managing Corporate Lifecycles

There are a sufficient number of specialists who develop and implement various models and approaches to identify problems and improve the functioning of the organization (Michael Porter [17], Manfred Ke de Vree [18], Henry Minzberg [19], etc.). One of them is Ichak Adizes. He is one of the world's leading experts in improving the efficiency of doing business and government by making drastic changes that do not create chaos and destructive conflicts that hinder change. His practical experience in implementing change management systems is formalized in the "Adizes's methodology", presented in a series of the author's books.
According to the methodology, the author compares the life cycle of the organization with human life. He uses names, which are associated with different human life periods (Fig. 1) [20].

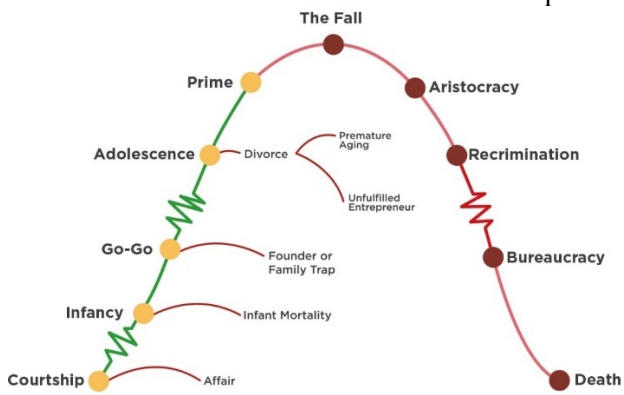

Fig. 1. The Adize's approach to the life cycle of the organization [20]

The organization is born, then lives the difficulties and joys of adolescence and youth. Then it reaches its prime. And then many organizations begin to age, gradually ceasing to exist.

According to Adize's study, aging is not how many years of an organization's existence but the presence or absence of certain changes that lead to the decline of the organization and its disappearance from the market.
However, there are a lot of organizations that have been successful for more than a decade. Adizez conducted relevant studies and came to the conclusion that each stage of the organization's life cycle is characterized by its own characteristics. And if the organization's development isn't controlled and made the appropriate changes typical of the stage, "death" occurs.
Adizes bases its approaches to change in the organization on the presence or absence of individuals who have the psychological characteristics needed for relevant leadership positions. He says that individuals with appropriate individual and psychological traits can influence various aspects of an organization's development and functioning. In the frame of certain stages, such individual traits are the impulses that lead the organization to either development or decline.
In his methodology, each organization's lifecycle stage is described as follows:

- **Courtship** means that the organization does not yet exist, there is only an idea.
- **Infancy** means that the organization is like a baby with product orientation. The main thing is not an idea. The main things are product sales and a profit.
- **Go-go** means that the idea works, the organization has a set financial income, and its sales grow, the organization prospers, and its founder becomes self-confident. The organization is beginning to "grab" many projects at once.
- **Adolescence** means that the organization has a rebirth, but in contrast to infancy, it is an "emotional" rebirth—receiving energy not only from the founder but also from managers who begin to behave in the same way as the founder.
- **Prime** means that the organization has the optimal state between flexibility and self-control. This condition is not permanent. If it is not controlled and maintained, it passes.
- **Aristocracy** means that the organization separates from its customers, less and less change, more and more important "peace" and less conflict.
- **Recrimination** means that the focus is not on solving problems but on finding those who created them. The focus is on interpersonal conflicts, not customer needs.
- **Bureaucracy** is the artificial maintenance of the organization's life through subsidies or nationalization.
- **Death** is the lack of resources to reward employees for their work.

4. Adizes's Methodology and the IPMA Delta Maturity Model

Adizes's methodology allows one to assess the organization's development stages and identify the main issues to be addressed at each stage.
The IPMA Delta maturity model allows us to evaluate the organization of the project approaches effective application and outlines areas for further improvement development.
Both Adizes's methodology and IPMA Delta's maturity model aim to improve the organization's development in its various aspects. Let's try to combine these approaches and determine which the organization's development stage corresponds to what the maturity model level (Table 1).

TABLE 1. Adizes's Methodology and the IPMA Delta Maturity Model Correspondence (own source)

The organization's development stages	**Maturity model level**				
	Initial	***Defined***	***Standardized***	***Managed***	***Optimized***
Courtship	absent	absent	absent	absent	absent
Infancy	exist	absent	absent	absent	absent
Go-go	exist	exist	absent	absent	absent
Adolescence	exist	exist	exist	absent	absent
Prime	exist	exist	exist	exist	exist

The organization's development stages	Maturity model level				
	Initial	***Defined***	***Standardized***	***Managed***	***Optimized***
Aristocracy	Absent, the entrepreneurial energy is almost absent in the organization at these stages, and there are only procedures and rules that are more focused on maintaining order than customers				
Recrimination					
Bureaucracy					
Death					

Thus, as the organization grows and develops, the application of the maturity model is its guideline for development. Once an organization declines, the maturity model can no longer be seen as useful. At this stage, formal approaches take precedence over entrepreneurship. The maturity model is no longer an incentive for the organization's own development.

5. Case study of the International Privat Small Business

The International Private Small Business in the architecture area has more than 5 years of experience in implementing projects in the international field. It was founded by people from Ukraine. The company operates in the US market. The field of activity is the development of "turnkey" architectural projects for house construction. US citizens are customers. However, the project is directly developed by specialists from Ukraine who are located in Ukraine. Customers are found by the company's founders, who are located in the US. Further cooperation with the customer at the stage of project approval takes place online, and project coordination with US regulatory authorities takes place "on site". Thus, the organization of work at the business is implemented as a distributed team.

The main staff are specialists in architecture and construction. Order implementation is carried out through the project approach application. And if in the early steps of the business, when it was in the "*courtship"* and "*infancy"* stages of development, the main thing was to find customers and provide a profit. At present, the business, being at the stage of "*go-go*" has begun to significantly feel the inability to clearly control projects, understand the real amount of time spent on development and project approval, and the financial benefits of each project. Currently, there are more than 40 projects. Financial opportunities exist, but for some projects there is significant non-compliance with the implementation time. On the other hand, finances are available, but there is no clear understanding of the project's exact cost and its profits. Top-management began to feel the need for certain organizational changes.

This situation appears due to the "project" and "project approach" concepts' application but not understanding the deep essence of these concepts. The increase in the number of projects at earlier stages did not change the organizational structure and responsibilities of the team. The approach of the first projects did not change "in essence". That is, the work was performed as if there were only one or two projects and the others were absent. In addition, the introduction of the position of "project manager" has not changed the area of responsibility and subordination in the company. In fact, due to the number of projects, the company has had to reorganize the organizational structure into a project office, but it has not yet been reorganized to create separate teams for each project. That is, the rapid growth of the company in the number of orders "moved" it to a higher level of organization than it actually is. This was due to the lack of knowledge of the top-management of the fundamental differences between management "under the project" and others. After some online meetings with the business's top-management and employees, it became clear that the management fully understands and supports the need for change. The company's employees were also interested in it. Such trends are essential because, at least in the first steps, there is no need to overcome resistance at different levels.

The next step was to identify areas for change that needed to be improved. The results of the first meetings showed that the business has passed the levels of "initiation" and "defined" according to the maturity model and needs to move to "standardized". The identified areas for improvement are presented in Fig. 2. Some activities are planned to be implemented in the form of

"introductory" lectures, which allow top-management and employees to form a common understanding of terminology, concepts, and visions of change [21], [22]. Other areas require transformational actions directly.
During the meetings, it was decided to be based on the maturity model approaches in order to further certify the organization itself to increase the company's value in the market. In addition, this approach will systemize actions to prevent additional changes in the future.
The most important problems were the understanding of the real terms and budgets (from the point of view of profit) of projects and the staff time distribution to perform tasks within one or more projects. In addition, as a result of previous meetings, the issue of "project boundaries" and

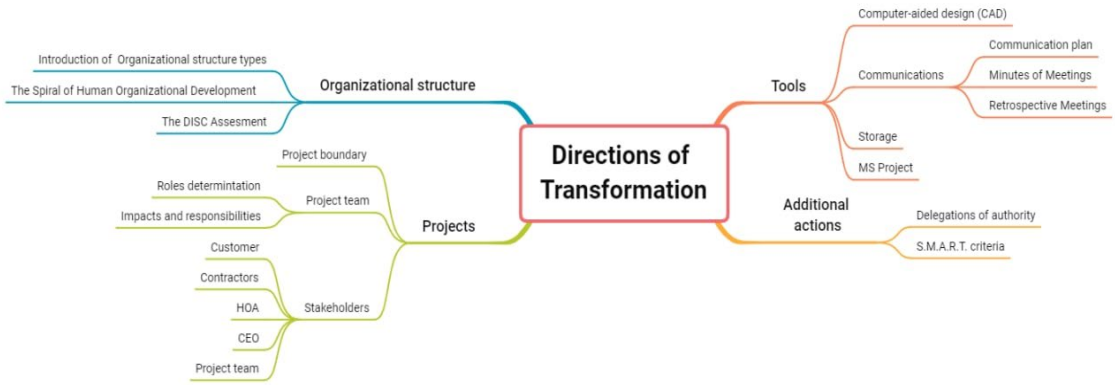

Fig. 2. Areas for improvement (own illustration)

the responsibility boundaries of each employee arose. The latter appeared after an in-depth interview with each employee to clarify communication, relationships, and responsibilities between employees of the company. The results of the in-depth interview are presented in Fig. 3.

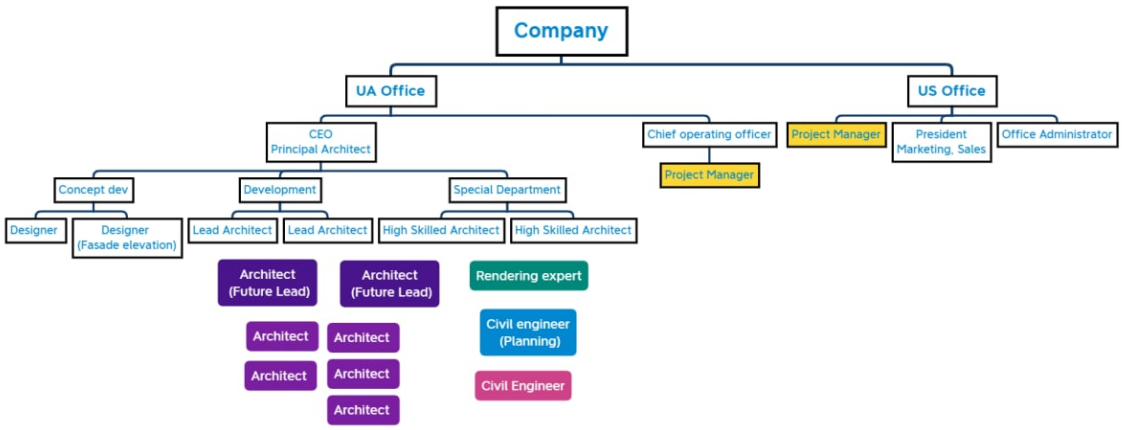

Fig. 3. The results of the in-depth interview (own illustration)

A Principal Architect is a "bottleneck". He is the person who prepares the first sketch of the project that is then finalized by other employees. It was found that the project manager is not actually part of the project implementation structure, and she doesn't control implementation and resource allocation. Employees listed in Fig. 3 as purple, navy blue, cyan, green, and pink are not included in any subordination at all, although they take an active part in the project implementation. The project manager from the US office is not formally (by structure) related to the Ukrainian office. However, he carries out all coordination work with the customer and the country's regulatory authorities (USA).

In addition, the MS Project software was applied incorrectly. The project did not have a WBS structure. So, by the end, the staff were not sure when the project started and finished. They had no idea what the entire set of works required to complete the project.
One of the first solutions was to subordinate the organizational structure to the project's needs so that the project manager could monitor the project's implementation. All employees had to be involved in the project. The results of such work are presented in Fig. 4.
The project manager's responsibilities have become the main focus. She will have to receive possibilities for project monitoring from the standpoint of resource attracting and project implementation deadlines.
It was decided to develop the project's WBS structure with the definition of needed resources. The first project after reorganization will be given priority status. It will be made to improve the actual terms' understanding and cost identification.

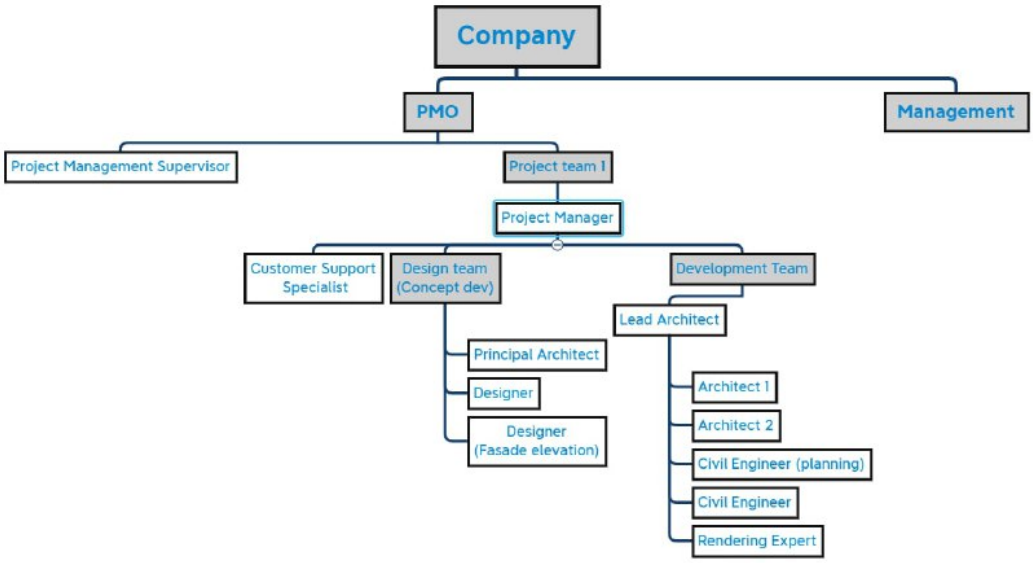

Fig. 4. Restructuring of the business's organization structure (own illustration)

It denotes prioritization in the completion of work. Agile elements will be introduced. It will be a daily short meeting to find out how much time the employee actually spent the day on the priority project and how much on other projects. This will allow us to more accurately determine the execution time of each work package, the effectiveness of each employee, and the correctness of previous estimates. All changes in the execution or non-execution of works and rescheduling of works will be recorded in special records to further conduct learning lessons and improve processes after the project close.

6. Conclusion

This paper presents the first steps using the study's results of the maturity model and organizational lifecycle used for the international private small business reorganization. The results of the stage are:

- according to the Adizes methodology, understanding the pool of changes is possible;
- formation of a project's unique mental space through the conducting of the introductory lectures;
- change of the business's organizational structure based on the IPMA Delta maturity model approaches;

- the development of communication approaches for the rational and effective organization of communication within the project, both among employees and with the project manager;
- defining the project's boundaries and each employee's and project manager's responsibilities;
- the control tool introduction for defining the actual deadlines of the work packages' implementation and funds used;
- employee assessment using the DISC methodology to make better use of personal traits in business operations.

Transformation and change processes are not easy for any company. This takes time and sometimes changes the paradigm of operation and the existence of the business. However, such changes lead to improved performance and the business's movement towards development. The main thing is to control such changes and not to increase part of the formalization by reducing or suppressing entrepreneurial energy.

Such a transformation is not always possible "from inside" the business, because the founders and employees are often so immersed in the work that they are unable (or do not understand) what and how it should be transformed. It is very useful to involve external experts who can look at the situation in the company with a "new look" and identify the needed changes to be made to improve.

Research and practical activities are ongoing and will be published in subsequent articles with a sufficient number of results.

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CONCEPTUALIZING OF SUSTAINABLE-ORIENTED CONSTRUCTION PROJECT MANAGEMENT METHODOLOGY

Tetiana Fesenko
Department of Electronic Computers, Kharkiv National University of Radio Electronics
Kharkiv, Ukraine,
ORCID 0000-0001-9636-9598

Abstract: *The integration of sustainability into construction project management is considered in correlation with the Sustainable Development Goals (SDGs). Conceptual guidelines for the development of a focused methodology for construction project management are outlined. It is taken into account that construction is a technologically specific activity carried out within the framework of industry norms, rules, and standards. On the other hand, the parameters of "sustainability" in the context of 17 SDGs and integration with economic, environmental, and social aspects are analyzed. A matrix of the integration of SDGs into ISO standards for sustainability in building construction, which allows identifying gaps and points in the development of sustainable-oriented construction project management methodology, is presented.*

Keywords: construction project management, sustainability, sustainable development

1. Introduction

Construction projects are increasingly faced with the need to act in accordance with the requirements of thrift economy use of non-renewable energy sources and even in turbulent conditions. This, in turn, puts on the agenda a methodological issue for the implementation of project actions at a higher level of sustainability. Many construction companies are already demonstrating the practice of implementing environmental technologies to create "green buildings". At the same time, investors / developers are looking for investments for facilities that not only meet environmental standards, but also other criteria for sustainable development. Compliance with the Sustainable Development Goals (SDGs) is not only the image of a socially responsible company, but also a crucial factor for business investment success [1]. At the same time, sustainable development is not limited to caring for the environment, but also to other areas. The "coordinate system" of sustainable development for 2016–2030 defined by the 17th SDGs.

There is a shift in the focus on achieving the results of the project with sustainability values in the project management methodology. Appropriate concepts for the integration of sustainability and its application in project management developed. The GPM Global P5 Standard for Sustainability in Project Management offers a kind of harmonization of the main results of the project (quality, cost, scope, time) with the factors of its environment (social, economic, environmental aspects), as well as processes, products and their relationships [2].

Incorporating sustainability in project management at three levels offered in [3]. At the project level, it envisaged to improve project management processes, increase the maturity of sustainable development integration processes. For the management level, it is necessary to acquire and improve sustainability competencies, develop a culture of sustainable development in the project team. The third level is the development of organizational maturity in sustainable project management. In [4] the authors consider the development of a conceptual platform for sustainable project management at the level of corporate policies and practices, resource management, life cycle orientation, stakeholder engagement, and organizational learning. The authors of [5] draw attention to the maturity of project management in the context of the ability to innovate and give an example of assessing the maturity of Chernobyl Nuclear Power Plant according to the IPMA

Delta model. In general, the transition to sustainable project management requires the development of relevant creative knowledge [6], the use of agile management [7], the development of soft skills [8].

It should be noted that the issues of integrating sustainability into construction project management require knowledge of the specifics of construction technology. After all, construction projects take place in different environmental conditions, and in remote high-altitude locations, and on the water and so on. Therefore, the context of sustainable management of construction projects is not limited to "Goal 9 – Industry, innovation and infrastructure" and "Goal 11 – Sustainable cities and communities" [9]. Humanitarianism, diversity and involvement of the client / beneficiary in decision-making are important for the management of construction projects in the parameters of sustainable development [10]. Research shows that the inclusion of people regardless of their gender, age, beliefs, orientation, race, nationality, level of physical preparation for project teams contributes to the adoption of better architectural and planning (for example, train stations [11], urban projects [12]), as well as organizational decisions. According to the content analysis of the interviews of project managers on construction engineering projects, the construction of sustainable project planning (SPP) should consist of three dimensions – management control, risk response and consensus in the work [13].

The "coordinate system" of SDGs allows us to apply the green logic system, which appreciates the quality of buildings and the comfort of their indoor environment, energy saving, energy efficiency, and participatory decision making. So far, there are no corresponding effective tools, despite the general interest of construction companies in applying sustainable-oriented approaches to management processes.

2. Concept Developing of the Methodological Basis for Sustainable Construction Project Management

The methodological basics for sustainable management of construction projects recognized by International Organization for Standardization (ISO). According to the ISO, "building project sustainability" defined as a construction project management system in which elements of the ecosystem and its functions integrated, which makes it possible to increase the service life of the facility for generations [14]. Integration of sustainability principles related to buildings and other construction works envisaged by following the general principles:

1) achieve objectives by making fair, responsible and transparent decisions;
2) constantly improvement the sustainability of construction throughout the life cycle;
3) search for a balance of environmental protection, economic efficiency and social needs;
4) assessment of the impact of local projects in the global perspective;
5) applying a holistic approach in assessing the sustainability of the construction project;
6) involvement of stakeholders for multifaceted formation of the context of a sustainable construction project;
7) assessment of the consequences of decisions in the short, medium and long term;
8) precaution and risk management and risk management (management of identified risks);
9) sustainability of construction project management is maintained at the institutional level;
10) accessibility and transparency of information in decision-making processes in the sustainability of construction project management.

The above principles are considered as a basis for developing a system of criteria for assessing the sustainability of construction project management. The matrix of characteristics for assessing the contribution of the construction object to sustainable development is presented in the areas of protection and aspects of a building that affect these areas [15]. The following areas have been identified: ecosystem, natural resources, health and well-being, social equity, cultural heritage,

economic prosperity, economic capital. The standard ISO [15] proposes such characteristics of a building object in terms of sustainability as emissions to air; use of non- renewable resources; fresh water consumption; waste generation; change of land use; access to services; accessibility; indoor conditions and air quality; adaptability; costs; maintainability; safety; serviceability; aesthetic quality.

ISO standards [14] – [16] correlate with the achievement of SDGs (Table I). The lack of connection with Goals 1, 2, 16 and 17 seems quite logical. Instead, the lack of a connection to Goals 4 and 5 is debatable. Sustainability in building requires special knowledge, and therefore special educational approaches. Thus, the relationship of SDGs with ISO standards (Table I) can be considered as a certain layer of methodology for sustainable management of construction projects. "Relationships that need to be established" can be the object of further research and development of standards and methodologies for sustainable construction project management.

TABLE I. Mapping the Integration of SDGs into ISO Standards for Sustainability in Building Construction

Sustainable Development Goals (SDGs)	**ISO/TR 15392** [14]	**ISO 21929-1** [15]	**ISO/TR 21932** [16]
Goal 1: No poverty (End poverty in all its forms everywhere)	–	–	–
Goal 2: Zero hunger (End hunger, achieve food security and improved nutrition and promote sustainable agriculture)	–	–	–
Goal 3: Good health and well-being (Ensure healthy lives and promote well-being for all at all ages)	**X**	x	**X**
Goal 4: Quality education (Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all)	x	x	x
Goal 5: Gender equality (Achieve gender equality and empower all women and girls)	x	x	x
Goal 6: Clean water and sanitation (Ensure availability and sustainable management of water and sanitation for all)	x	x	**X**
Goal 7: Affordable and clean energy (Ensure access to affordable, reliable, sustainable and modern energy for all)	x	x	**X**
Goal 8: Decent work and economic growth (Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all)	**X**	x	**X**
Goal 9: Industry, innovation and infrastructure (Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation)	**X**	**X**	x
Goal 10: Reduced inequalities (Reduce inequality within and among countries)	**X**	x	**X**
Goal 11: Sustainable cities and communities (Make cities and human settlements inclusive, safe, resilient and sustainable)	**X**	**X**	**X**
Goal 12: Responsible consumption and production (Ensure sustainable consumption and production patterns)	**X**	**X**	x
Goal 13: Climate action (Take urgent action to combat climate change and its impacts)	**X**	x	**X**

Sustainable Development Goals (SDGs)	ISO/TR 15392 [14]	ISO 21929-1 [15]	ISO/TR 21932 [16]
Goal 14: Life below water (Conserve and sustainably use the oceans, seas and marine resources for sustainable development)	**X**	**X**	**X**
Goal 15: Life on land (Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss).	**X**	x	**X**
Goal 16: Peace, justice and strong institutions (Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels)	–	–	–
Goal 17: Partnerships for the goals (Strengthen the means of implementation and revitalize the global partnership for sustainable development)	–	–	–

– *no correlation*
X – *correlation of ISO standard with SDG*
x – *requires correlation*

Sustainable construction project management is a crosscutting goal and it is based on core visions. The first measurement, construction is a technologically specific activity carried out within the regulatory framework (international, national, local). The use of cost-effective practices / technologies and Building Information Modeling (BIM) in construction projects is becoming a mandatory component. The second measure of sustainability includes economic, environmental, and social aspects. The relationship/combination of "technological specifics of construction" and "sustainability" regulated at the level of ISO standards [14] – [16]. "The GPM Global P5 Standard for Sustainability in Project Management" (GPM P5) proposes the integration of project management approaches for sustainable development [2]. In addition, elements of sustainable development are contained in project management standards such as "Projects in a Control Environment" (PRINCE2), "Managing Successful Programs" (MSP), "A Guidebook of Project and Program Management for Enterprise Innovation" (P2M), "A Guide to the Project Management Body of Knowledge" (PMBOK). However, only PMBOK offers an extension for construction projects – PMBOK Construction [17].

3. Conclusion

The considerations explained in this contribution indicate the need to develop a methodology of sustainable-oriented construction project management. The role and importance of integration of sustainable development parameters for construction project management are outlined. The correlations between 17 SDGs and ISO standards for sustainability building (ISO / TR 15392, ISO 21929-1, ISO / TR 21932) are presented. This approach allows identifying gaps and points in the development of sustainable-oriented construction project management methodology.

It is established that the existing studies of sustainable-oriented construction project management have not yet presented the development of methodological procedures for extrapolating project management processes (PMBOK Construction) on the context of GPM P5, ISO and SDGs.

The proposed focus on the conceptualization of sustainable-oriented construction project management methodology requires special in-depth scientific and practical understanding. The development of a model for assessing the sustainability of construction project management seems promising. The assessment tool can be presented in the form of a matrix of sustainability characteristics, which deepens the integration of SDGs in the "body of knowledge" PMBOK Construction. The mathematical model and methods of its application can be useful in decision-

making in construction projects for the reconstruction of Ukrainian cities destroyed by the Russian invasion. Infrastructure of Ukrainian cities needs to be rebuilt taking into account the new safety vision (with underground shelters), "green" technologies, as well as European standards of quality of life.

4. Acknowledgements

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APPLICATION OF THE ACATECH INDUSTRY 4.0 MATURITY INDEX AND SIX SIGMA METHODS TO IMPROVE PRODUCTION PROCESSES WITH A USE CASE DRIVEN APPROACH

Felix Ebberg [1], Daniel Strozyk [2], Henrik Ulitzka[3]
[1] Industry 4.0, Deutsche Nickel GmbH
[2,3] Quality Assurance, Deutsche Nickel GmbH
[1 2,3] Schwerte, Germany
[1] ebberg@deutsche-nickel.de, [2,] strozyk@deutsche-nickel.de, [3] ulitzka@deutsche-nickel.de

Abstract: *This paper describes the use case driven approach of applying the acatech Industry 4.0 Maturity Index and Six Sigma methods in the wire production department of Deutsche Nickel with the example of a pull-through furnace.*

Keywords: Industry 4.0, digital transformation, continuous process improvement, industrial internet of things

1. Introduction

Deutsche Nickel GmbH has been producing wires and bars since 1861 when founder Theodor Fleitmann invented forging of Nickel by adding magnesium to it. Because of its rich history, Deutsche Nickel GmbH has a grown number of production machines from different years. Newer ones bought in 2021 but also older machines that date back to the 1970s. The application of Industry 4.0 especially the connection of all machines is therefore extremely difficult, as there is no “one solution fits all” approach existent.
The management therefor decided to focus on one specific machine that consists out of multiple different machines with different age, to be able to scale the solution to the whole production environment. With the help of different sensors and PLCs (Programmable Logic Controller) and a software that is able to read data from any type of sensor, transparency of the machine was achieved. With the data being available to anyone in the company, six sigma methods were used to introduce continuous process improvement and statistical process control for the process parameters of the machine. The production department gained more visibility of their production process and took actions to improve the process and to reduce waste.

2. Use Case Driven Implementation of Industry 4.0 Capabilities

2.1 Goals and Initial Situation

The digital maturity level of Deutsche Nickel GmbH was analyzed with the help of the acatech Industry 4.0 Maturity Index. It identifies the areas that need to be improved to be able to compete in the digitalized world. The Maturity Index suggests that Deutsche Nickel GmbH should be aiming to achieve the third out of six levels of maturity [1]. One of the pain points identified, is the connection of the IT to the OT (Operational technology) and the availability of shopfloor data.

With the help of an inhouse workshop, the managers of Deutsche Nickel identified the needed parameters from the shopfloor that would be able to create a quick return on invest and enable the company to implement the most needed use cases. The use cases that have been identified are the implementation of a digital control chart, order-related traceability and reactive process surveillance.

The current status showed that there is no continuous process surveillance that could detect possible waste production. The analogue control charts that are being used can only show the status of the product and process parameters at a given time. Historical access to these parameters is as well a problem, as these analogue control charts, written on paper, have to be stored in physical folders. Access from a computer is therefore not possible. Additionally, the analogue control charts are extra work for the blue-collar workers. The IT systems of Deutsche Nickel GmbH include an ERP (Enterprise Resource Planning) system that is communicating with a MES (Manufacturing Execution System). A SCADA (Supervisory Control and Data Acquisition), as the ISA-95 suggests, is missing. Fig. 1 shows how the International Society of Automation thinks that IT Systems should be structured [2].

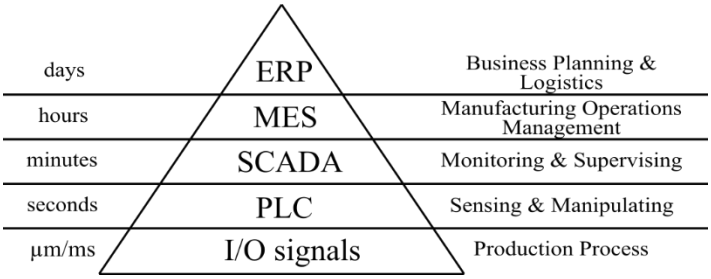

Fig. 1. ISA-95 Automation Pyramid [2]

2.2 Project Organization

The project was set-up in a hybrid agile way. Hybrid because there are two different parts in the project that could act with different velocity. One part concerns the retrofitting of machines with the help of additional sensors or add on technology that enables the machines to communicate via the industrial ethernet. This part is extremely dependent on availability of employees and delivery times of sensors and other add-on technology. Manufacturing and delivering times have been extremely prolonged due to the COVID-19 crisis. Careful planning of employee's availabilities and additional material that is needed for the installation of the add-on technology was needed. The other part of the project is the software development part. This part is dependent on requirements from the production and the quality assurance divisions. These requirements were gathered in user stories and mapped to the respective use cases which can then be developed by the software team. With more retrofitted machines, more data can be gathered and from this data new visualizations be created.

To be able to use the collected data in future applications, Deutsche Nickel GmbH decided to move to a time series database in which the sensor data can be collected. For communication purposes between the OT and the IT, a so-called manufacturing service bus, was introduced. Machines that are already available in the industrial network could then be connected to the bus to start reading data from them and storing it in the time series database [3]. This then helped to implement the mentioned use cases and to tackle the problem of the missing connection between OT and IT and the missing shopfloor data. To ensure that the data from the database can be displayed clearly and meaningfully for the user, they are transferred to a dashboard that displays a digital control chart.

2.3 Implementation of Digital Control Charts

To ensure that the requirements are met, and that continuous improvement is achievable, six steps have been defined to implement and roll out digital control charts for DN. Theses Six Steps are based on the IREB and Six Sigma DMAIC.

The DMAIC cycle is a Six Sigma tool for a structured and reproducible cycle of statistically supported process optimization. It consists of the five successive phases define, measure, analyse, improve, and control. In the define phase, the problem is described, the process is set up and the objective is defined. Furthermore, the process to be analysed is described in detail and the critical customer requirements are identified. In the measurement phase, the real problem is abstracted into a statistical problem by recording relevant process and product parameters based on the identified critical customer requirements. With the measurement data provided by a retrofit, sampling takes place. The abstracted problem is analysed in the analysis phase by performing process capability analysis and creating control charts. The goal of the statistical analysis is to evaluate the capability of the process and product parameters by determining key figures and deriving improvement measures based on the visualization of quantitative data. The improvement measures based on statistical data are subsequently transformed to the real problem in the improvement phase. Finally, the validation of the improvement measures and the documentation of the results take place in the control phase. In addition, an extended data acquisition concept is set up with the purpose of continuously monitoring the parameters by calculating control charts [4].

The IREB (International Requirements Engineering Board e.V.) define six steps to good requirements [5]. Theses six steps include the identification and analysis of stakeholders, goals setting, scenario description, requirements derivation and system modelling, and evaluation and documentation of the requirements.

The combination of IREB and Six Sigma DMAIC led us to our own definition of six steps which is described following. These six steps deal with the requirements through user-stories, the selection of important process parameters, the retrofitting of machines, the definition of process limits, the digital linking of process data and process limits, and an action plan. The execution of the steps has the goal of developing a digital control chart that not only monitors the process but allow to improve it. In addition, the developed system offers the possibility of assigning processes to products in terms of time, thus enabling the traceability of error causes even years later. These six steps are described in more detail below using the example of a continuous furnace for the heat treatment of wire materials.

Step 1. Requirements through user-stories

In the first step all the stakeholders that previously have been identified, had to define user stories. In these user stories, the needed data, and the goal of the implementation of the digital control charts for specific machines had to be described. The user stories enabled the following five steps.

Step 2. Selection of important process parameters

The determination of the most important parameters was carried out under aspects of economic efficiency and feasibility. For this purpose, the costs, and benefits of controlling a process parameter were estimated and prioritized. The costs result primarily from the costs for the procurement and connection of new measuring systems, the connection of existing measuring systems and the maintenance of the measuring systems. The benefit results from understanding of the influence of the process parameter on the product parameters and the importance of the affected product parameters for the quality of the product. Using the continuous furnace as an example, the temperature of the furnace chambers and the wire drawing speed were identified as important parameters, because they have a significant influence on the critical product parameter of strength. Since the measuring systems for speed and temperature were already available and only a connection of the corresponding measuring systems had to be carried out, the parameters were strongly prioritized. The diameter of the wire, which is not only a process parameter but often also the final dimension of the wire and thus a product parameter, was also given high

priority. High investments were required to monitor the diameter, as the digital measuring systems were not present, but the benefits here clearly exceeded the costs.

Step 3. Retrofitting

After the most important parameters were identified, the corresponding hardware had to be retrofitted. First, a measuring system is needed that can record the process parameter with a suitable resolutions and measurement uncertainty. This measuring system is then connected to a PLC if necessary. The hardware was also upgraded for the parameter „wire diameter “. For this purpose, diameter measuring devices from the company "Keyence" were integrated into the process. The sampling rate of the measuring system is up to 16 kHz and has a measuring accuracy of 5 µm. Thus, an accurate, almost continuous monitoring can be achieved, which would not be feasible with analog measuring methods.

Step 4. Definition of process limits

The fourth step deals with the definition of process limits. These can be separated into control and specification limits. If a process is within the control limits, the process runs stably. If the control limits are exceeded, this indicates that there is a disturbance in the process. Despite the disturbance, however, the limits of the product parameters are not endangered. If the malfunction is not corrected in time, the specification limits may also be exceeded. The quality of the product can then no longer be guaranteed, so that the manufactured material is withdrawn from the further process. Various approaches can be taken to ensure that the limits are selected sensibly. The specification limits must guarantee the quality of the product, so that it makes sense here to determine the influence of the process parameter on the product parameters. This influence can be carried out by a statistical design of experiments. Here, the process parameters are varied, and the values of the product parameters are determined. The influences of the individual process parameters on the product parameters can then be calculated using statistical software. Specification limits can then be formed based on the influences and the company's empirical values. Narrowing the tolerance range makes sense if the process parameter has a high process capability. Thus, the compliance with the product parameters can be further increased. Statistical process control (SPC) is used to determine the control limits. In SPC, the capability of the process is considered via the distribution and scatter of the process values and the control limits are determined mathematically from this. In addition, these values are compared with the empirical values in the company.

For the product parameter strength, concrete influences of the diameter of the wire, the drawing speed and the annealing temperature could be determined for different materials. Considering the standard deviation of the process values and an additional safety factor, the specification limits for the process values were derived. Due to the extremely high capability of the process parameter „annealing temperature “, the specification limit could be additionally reduced here.

Step 5. Linking of the data sources

So that the process values and the limits could be linked and visualized in a digital control chart, a manufacturing service bus was set up in the fifth step, which links the ERP, the MES the PLC data, to a dashboard and a time series database. Fig. 2 shows how the data flow should be organized. The product-dependent process (P) limits are entered into the ERP, the order data (O) comes from the MES, and the PLC provides the measurement and machine data (M). These are then linked together in the manufacturing service bus and visualized in a dashboard. The manufacturing service bus (M.S.B.) can then be accessed via a browser. This means that any employee with the necessary rights can access it from any location. In addition, the data is stored in a time series database (T.S.D.).

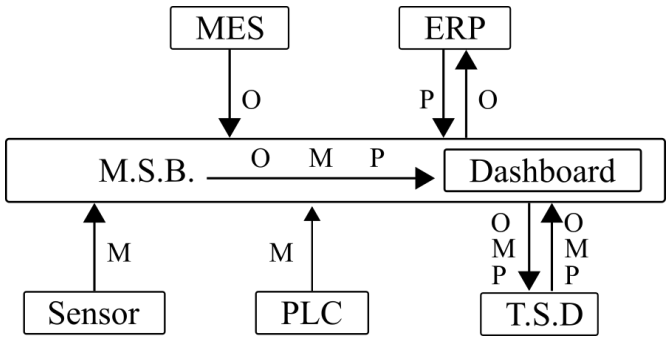

Fig. 2. Data acquisition and storage

Step 6. Catalog of measures (Countering measures)

Since pure observation of the process does not improve the process itself and therefore does not lead to an increase in efficiency or quality, a catalog of measures was also introduced. The catalog of measures contains instructions for action for specific events. An event represents the exceeding of a process limit. Action instructions are usually designed for the short term, so that the source of the disturbance is eliminated, and the process remains stable, but they can also be designed for the long term, so that measures are taken to prevent a disturbance. In the case of the product parameter „wire diameter “, various sources of error occurred. On the one hand, resistances built up during the process due to material accumulation in a die, which led to stretching in the wire. Secondly, external forces also caused stretching in the system. However, since this stretching occurred in a V-shape or U-shape, depending on the source, it was even possible to determine the origin of the defect by means of the exact representation. Fig. 3 shows a digital control chart with a U-shape stretch and the upper specification limit (USL), upper control limit (UCL), lower control limit (LCL) and lower specification limit (LSL). Fig. 3 shows a digital control chart with a V-shape stretch.

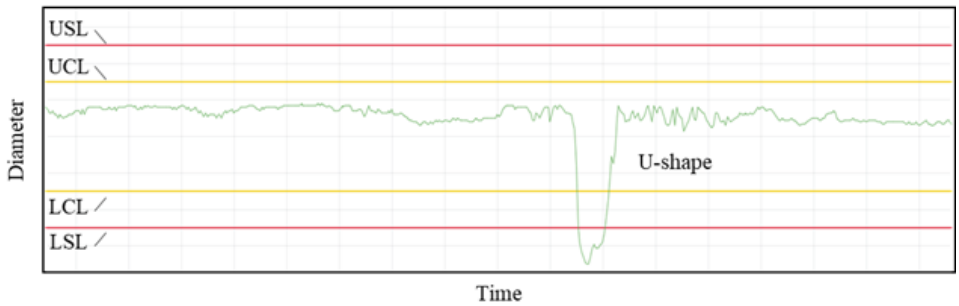

Fig. 3 Digital control chart with U-shape stretch

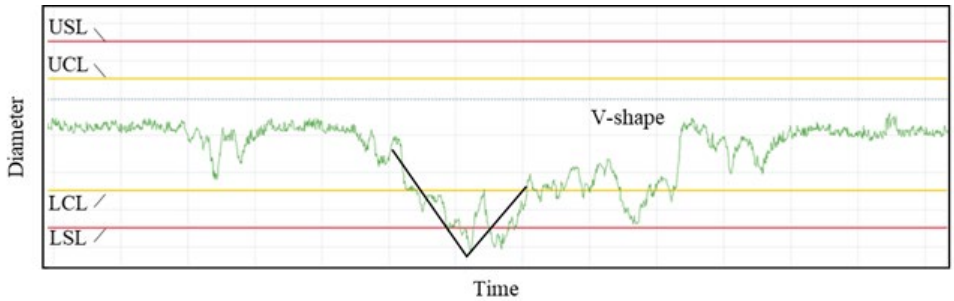

Fig. 4 Digital control chart with V-shape stretch

2.4 Use of a Digital Control Chart

The process and product data available through the connection of the machines to the manufacturing service bus are processed statistically and automatically transferred to digital control charts to enable both a short-term and long-term view of the processes based on the machine data.
Control charts are tools for collecting, analysing, and graphically visualizing sample data and are often used in SPC to examine a capable process for irregularities in terms of its level and variation. For this purpose, measurement data, the so-called process result, is aggregated into samples with a suitable size and interval and then statistical parameters such as the mean value, the range or the standard deviation of each sample are formed. The statistical parameters are in turn used for the calculation of control limits [6]. A manufacturing process is influenced by the 6M (manpower, method, machine, material, measurement, and mother-nature) and is always subject to certain fluctuations, so-called physical noise. Control limits can be used to assess whether the variations inherent in a process result are special or random causes of variation. By calculating and mapping control limits on the control chart, a kind of early warning system is created to help keep a process in a stable state by identifying and correcting systematic process variations. If the calculated control limits are exceeded by the statistical parameters, the process is regulated directly at the machine in a short-term control loop in order to avoid rejects and errors in production at an early stage. In this context, a catalogue of measures individually tailored to the process prescribes which measures are to be carried out in the event of disruptive events occurring [7]. Fig. 5 shows a schematic sequence of a SPC.

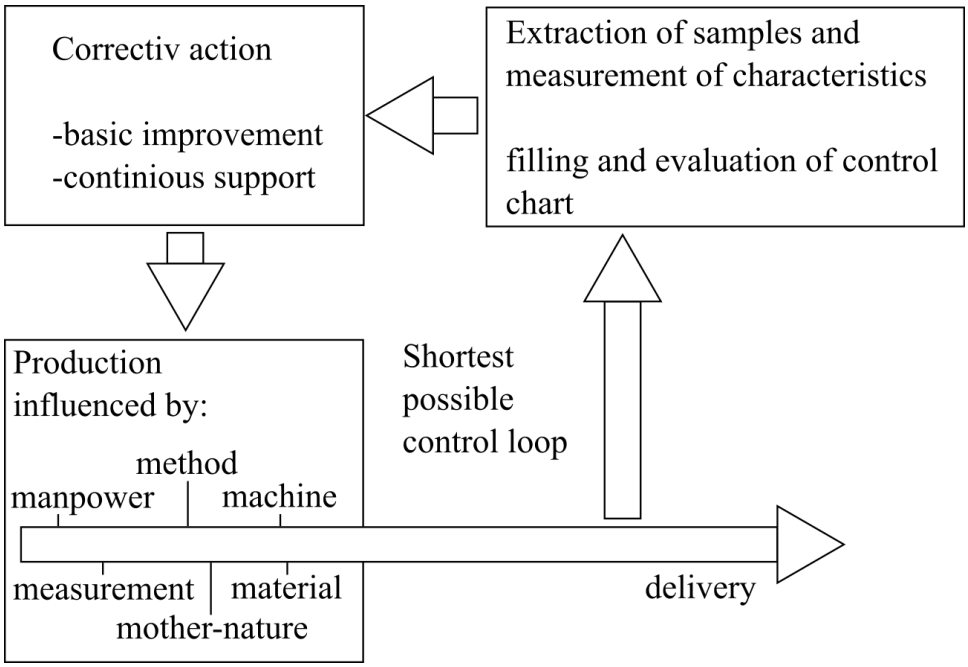

Fig. 5. Schematic sequence of a SPC according to [7]

Based on the collected samples from the control charts, the machine data are evaluated and analysed in a long-term control loop for maintaining stable and capable production processes. The stability and reproducibility of production processes is described by process capability, which is verified by using process capability analyses. The process capability is evaluated by calculating key figures defined as process capability indices *Cp* and *Cpk*. If the measurement data of the samples are subject to a normal distribution, the advantage is used here that the normal distribution is completely described based on the two parameters mean value and standard

deviation. Normally distributed measurement data of a process can thus also be described based on mean value and standard deviation and classified into specific area ranges, so-called sigma levels, by calculating the process capability indices. The process capability index *Cp* is calculated for normally distributed measured values based on the specified tolerance as well as six times the process variation in the form of the process standard deviation σ. The process capability index *Cp* only compares the process variation in relation to the present specified tolerance and does not provide any information about the process level. The actual mean value of a process can de cvviate from the expected level μ. Therefore, the minimum process capability index *Cpk* is additionally calculated, which describes the smallest distance of the process mean value in relation to the specification limits. If the *Cpk* value is above 1.0, the process is capable, which means that the process result is 99.73 % (three sigma levels) within specification and the potential process scrap is 0.27 %. Process capability can be increased through targeted process improvements. For example, increasing the *Cpk* value to 1.33 results in a scrap rate of only 0.006 % (four sigma levels), meaning that the process almost always meets customer requirements [8]. Fig. 6 shows the difference of the two process capability indices *Cp* and *Cpk.*

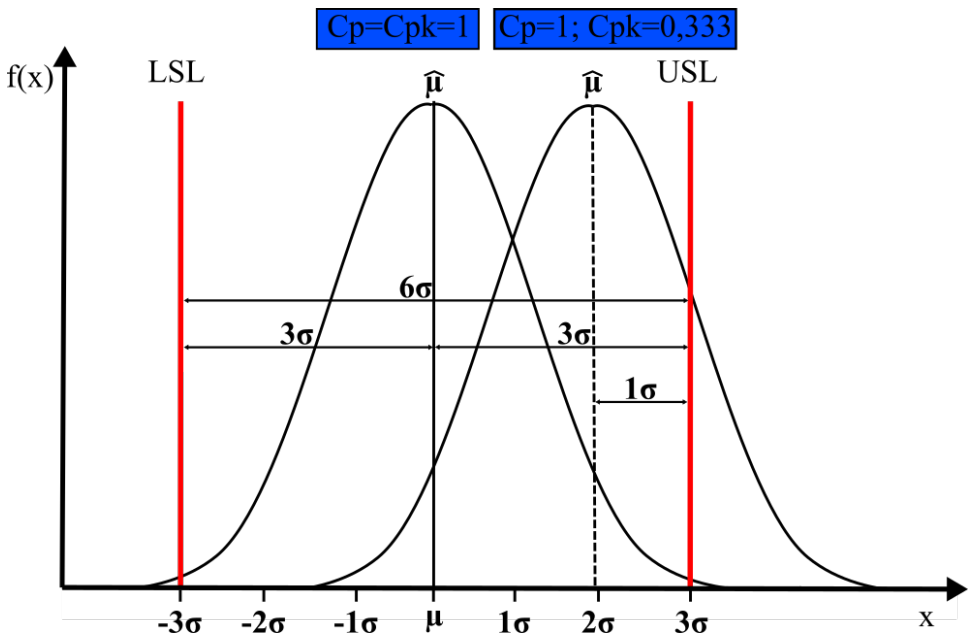

Fig. 6. Difference between *Cp* and *Cpk* according to [8]

With the help of the capability indices, cause-effect relationships are revealed, with which recurring disturbance influences can be declared and made recognizable by means of cause analyses. For a reproducible production process, it is necessary to evaluate the process behaviour regularly and to identify changes to already completed analyses. With subsequent correlation analyses and under the localization and elimination of previously unknown disturbing influences, the production processes are successively and continuously optimized and the product quality is improved.

Control charts are used both in SPC as a tool for process stabilization in the short-term control loop and as a proof of stability for determining the process capability of production processes in the long-term control loop.

2.5 Results

The implementation of the digital control chart and the catalog of measures had a direct impact on the processes in the company. The greatest benefits resulted from the automatic and continuous

recording, the digital access to current and historical data and the implementation of the catalog of measures. The automatic recording of process and individual product parameters reduces the measurement effort of the plant operators and reduces the susceptibility to errors and the operator influence of the measurement results. In addition, the continuous recording of data allows immediate reaction to the exceedance of process limits. On the one hand, this enables the implementation of the catalog of measures and, on the other hand, the immediate registration of exceeded tolerances. It is thus possible to directly determine the production of defective material and to clearly distinguish defective material from non-defective material. This minimizes scrap and thus saves materials, energy, production costs and capacity. The implementation of the catalog of measures also leads to the optimization of the process and thus to less scrap being produced, thus further saving resources. It also led to improvement of the machine to better be able to control the production process. The digital access to current and historical data makes it possible to make the determined data available to many people quickly, clearly and, if necessary, individualized, thus reducing misinterpretations and the search effort for paper files. This means that not only can process monitoring be carried out decentral, but order data can also be traced, which can be particularly helpful in classifying complaints.

The insights that could be generated through the implementation of the digital control chart led to understanding why the process proceeds in certain ways and which actions must be done to make it stable. Thus, the fourth maturity level, transparency, could be achieved.

Problems occurred during the implementation of the digital control chart in the retrofitting step. The retrofitting of the systems is very personnel- and time-intensive and significantly determines the duration of the implementation of the control chart. To greatly reduce the duration of the implementation, it was decided to carry out the project in a hybrid agile way.

3. Conclusion

The digitization of Deutsche Nickel GmbH, which has grown historically and therefore owns many machines from different decades, is challenging due to the different degrees of technologization of the machines. The goal of the digitization was the implementation of a digital control chart, which enables a current and continuous data acquisition and to achieve the third out of six levels of maturity, visibility. Through the implementation the fourth level, transparency, was achieved. Five steps were defined for the implementation of the control chart. These included the selection of important parameters and the corresponding retrofitting of the machines, the definition of process limits, the organization and connection of data sources, and the implementation of a catalog of measures. These steps were successfully carried out on the example of a pull-through furnace, so that all process parameters of the furnace and the upstream and downstream equipment can be monitored. The concept is being transferred to other areas of production.

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EDUBOTS AS ACADEMIC ADVISERS: A SPECULATIVE SOCIAL SCIENCE FICTION THOUGHT-EXPERIMENT

Jan Petrus Bosman[1,3], Wim van Petegem[1], Tinne de Laet[2], Nompilo Tshuma[3]

[1] Faculty of Engineering Technology, KU Leuven,
[2] Faculty of Engineering Science, KU Leuven,
[3] Faculty of Education, Stellenbosch University,
[1,2]Leuven, Belgium
[3]Stellenbosch, South Africa
[1,3] janpetrus.bosman@kuleuven.be/ jpbosman@sun.ac.za/ ORCID: 0000-0003-0324-4409

Abstract: *The current use of technology for academic advising is limited to supporting adviser-centric models of advising. In this model, academic advising systems are usually for the exclusive use of advisers and therefore it is impossible for all students to receive quality just in time academic advising support. Through speculative social science fiction, a digital twin of an academic advising EduBot is conceived that builds on the current experimental advances in predictive artificial intelligence learning analytics dashboards, the need for explainable artificial intelligence as well as humanising multi-agent chatbots that can support students, advisers, and institutions in their quest for student success. It is envisioned that an EduBot that is integrated into all the necessary data sources and systems, that can engage through natural language understanding models, that is aware of ethical and legal boundaries and that enables students to get help or a reference from a human adviser can indeed make a difference towards a more just and equitable educational support system, and therefore student success.*

Keywords: EduBots, academic advising, academic advising technology, artificial intelligence, explainable artificial intelligence, social science fiction

1. Introduction

"You cannot predict the future, but you can create it" [1]. Peter Drucker's famous quote is relevant to our excursion into the future of how technology (especially artificial intelligence (AI), educational conversational software robots (EduBots) and explainable artificial intelligence (XAI)) can support the process and practice of academic advising (AA) towards student success. Academic advising refers to:

> … the intentional interactions between representatives from institutions of higher education (advisors) and students (advisees), and the ways by which advisors provide guidance and support for students on issues relating to the students' personal growth, academic studies, career, and future aspirations (Her and Hutson in [2])

The use of technology in AA has been studied from the side of the emerging and developing AA field [3], as well as from Computer Science [4] (or related fields like IT, Information Systems, and Engineering).

From academic advising we see a call for a focus on intentional technology use that optimally enhances the desired outcome of academic advising**.** We also see the call for "front-line advising and student support staff" to become involved in the technology selection of AA systems [5] and to develop a more "humanizing" academic advising experience [6]. From Computer Science (and related) we see a focus on a variety of new systems and developments from data mining and classification [7]**,** chatbots to provide narrow-AI type learning support [8]**,** and different kinds of intelligent web-based applications to "improve the efficiency of the overall advising process" [9].

What we do see as a common theme among these perspectives is that advising technology – be it a bot, a mobile application, or an analytics dashboard – is always envisioned as used by a human advisor. Even experimental new work does not separate the role of the technology system from the human adviser (e.g. the AdviseMe [9] and UniBud [10] systems).

The question of artificial intelligence in higher education is a specimen example of how developments in machine learning can influence, enhance, or disrupt an "industry" like higher education. Without making a case that is too naïve, I think it is reasonable to think that higher education institutions will look towards AI (or all the other hyped-up concepts and promises of the 4IR – Fourth Industrial Revolution) to make the modern (neoliberal) university more effective. A well-accepted dictum in the growth of industry through technology is that that rule-based and repetitive tasks will be replaced by machine learning. In higher education teaching and academic advising we have relevant categories of possible automation. Even though one disagrees with humans being replaced by machines one should not be blind to the possible reality of massive change. Alternatively, one should also be open to understand the opportunities for more just and equitable educational systems that provides quality teaching and academic support to all students. This paper positions itself in the more hopeful latter option of better systems for helping more students to be academically successful.

The main problem that arises with academic advising in its current adviser-centric mode is that there are never enough well-trained advisers or enough time to provide quality services to *all students*. Flowing from this is that academic advising services are *limited to office hours* and that getting support is often a very *slow process*. In the process higher education institutions strain to improve student throughput while the number of students just mushrooms. This paper builds a speculative thought-experiment around the social science fiction idea that in future *EduBots can play an important role as academic advisers*.

To scientifically approach such an as-of-yet non-existing reality, we will use a methodology from social science fiction. This powerful critical tool can be used to analyse "our mutating, heterogeneous, and increasingly complex technoscientific world"[11]. This method has gained ground in technology in higher education studies recently as is succinctly stated by Suoranta et al.: "we need to release teachers' imaginations and invent new social imaginaries of digitalization in higher education with them. We need to switch from 'what is' to 'what is not yet', but 'what could be'"[1].

2. The Role of Technology in Academic Advising

Educational technology is an integral part of the AA process. Ever since the idea of AA 'as teaching' has emerged, the AA practice has borrowed ideas of technology use from the teaching and learning world [12]. This is of course still a contested terrain and just as technology enriched pedagogies are not fully part of all higher education teachers' practices, so the acceptance of new technologies to support AA for student success is also not fully dispersed through the field.

To demarcate the focus of the inquiry, we will use the mixed methodology framework of Kampen [13]. For scientific inquiry Kampen [13] extrapolates four (Johari Window like) positions namely: 1. Known-Knowns (Paradigms and saturated theories that we study through tests and replication); 2. Known-Unknowns (Aleatory uncertainty of random variations and chance outcomes that are usually addressed through statistics); 3. Unknown-Knowns (epistemic uncertainty studied through physical measurements, structured observations, content analysis or questionnaires) and; 4. Unknown-Unknowns ("Here be dragons" types of knowledge that is unearthed through qualitative interviews, focus groups and participatory observation). In terms of what we know about technology use in AA we could build the following classification (see Table I, built on the framework of Kampen [13]).

TABLE I. Technology Use in Academic Advising

	Knowns	**Unknowns**
Known	*Paradigms & saturated theories* - Communications Technologies - Learning technologies - Student Information Systems	*Aleatory uncertainty* - Descriptive LADAs - Administrative systems - AA helper EduBots: Single agents
Unknown	*Epistemic uncertainty* - Predictive LADAS with XAI - Assistant adviser EduBots: Multi-agents	*Hic sint dracones* - Adviser EduBots: Fully integrated and almost fully autonomous

In terms of the *Known-Knowns* technologies, there is already a good understanding and research base as to communications and learning technologies and the use of student information systems in AA. Communication technologies are used for virtual AA, and especially came to the fore during the Covid-19 lockdown [12]. Because AA is seen more and more as a form of teaching [14], learning technologies (like the institutional learning management system) are also being productively utilised. Student information systems (or similar institutional or national administrative systems) are a natural part of the AA technology ecosystem.

The *Known-Unknowns* technologies include systems that are already quite mature like learning analytics dashboards (LADAs), administrative systems, and single agent EduBots. LADAs in this classification are machine-learning enabled systems but stay in the descriptive range and the intended system user is usually the academic adviser in dialogue with the advisee student. We also have more complex administrative systems that students and advisers can use to schedule appointments, or document advising sessions. There are examples of EduBots in this space [10], but they are usually single-agent designs and can do a limited number of tasks well.

Coming to the more cutting-edge *Unknown-Knowns* we see experimental work with predictive LADAs [15]. When you venture into this domain of more complex machine learners the "black box" problem of non-transparency of machine learning processes arises [16]. To solve this problem explainable artificial intelligence (XAI) systems assist the users (advisers and in future potentially advisees) in understanding how the prediction was generated. Furthermore, there is already experimental work happening around using chatbots to serve as XAI mediators [17]. We also see movement in multi-agent EduBots [18] who can assist in more than one task and can so start being a kind of "assistant" adviser to students and address a growing number of needs of students (and in so-doing limit the number of students who must see an adviser for an in-person/ synchronous consultation).

The "*here are dragons*" *Unknown-Unknowns* classification belongs to the technologies that are intuitively sensed to be possible solutions, but that are not actively researched or experimented with. Although there could of course be many other emerging systems or technologies (like mobile apps, augmented or virtual reality systems, internet of things (IOT) solutions, or even holographic and digital human mirages on the technology horizon), the focus of this speculative social science fiction thought-experiment will be on EduBots that are fully integrated into AA systems. Such envisioned conversational agents will be able to fulfil the role of an academic adviser to a great extent – even being able to provide more "humanistic" interactive dialogic advising to students.

As we have seen in the introduction, there is of course an understandable rational(ised) reluctance to move in this direction of "automated" AA (and even for non-automated systems like Jones shows [19]) and all the fears and vulnerabilities it evokes. The point of this thought-experiment

is to dream into being our future AA technologies as powerful student success enabling systems before powerful market driven EdTech forces, or techno-determinist managerialism [1] creates the next potentially half-baked (or worse unethical or unjust) system on behalf of higher education. It is to this (speculative) social science fiction thought-experiment that we now turn.

3. Edubots as Academic Advisers: a Speculative Social Science Fiction Thought-Experiment

An EduBot is a chatbot that operates within an educational context. The definition of a chatbot is:

> "Chatbots are a relatively mature application of AI that are used in many domains. The AI aspects of chatbots include the ability to understand speech and the use of machine learning models to match the intention of the question to answers or actions." [20]

As with science fiction, social science fiction is built on the socio-technical insights at the time of "writing"/ envisioning [21]. It can be seen as a "thought-experiment that seeks to explore the forms of social life and social order that might result from impending technological conditions" [21]. In the recent literature around AA technology systems, we can find the seeds for the idea of EduBots as academic advisers. Khare et al [8] show, for example, how AI and chatbots could contribute to student success. The suggested academic adviser EduBot uses a bio-social mimicry type of approach where we learn from the way the current AA process works and what the knowledge, skills and attitudes of current academic advisers are. These insights become characteristics that can be used to design a "digital twin" EduBot that needs to function in a particular context.

Any piece of social science fiction can be seen as a thought-experiment that seeks to explore the forms of social life and social order that might result from impending technological conditions.

3.1 Characteristics of an Edubot as Academic Adviser: ETAACK Framework

The TPACK framework very well known in the technology enhanced teaching and learning world. Bachy [22] extends the model to include a personal epistemology angle which is very useful in understanding the way teachers can integrate their teaching and learning epistemology (E) with technological (T), pedagogic (P) and academic content (AC) knowledge (K). An adapted framework for AA, ETAACK, is suggested by us (building on the work of [23]): Academic advisers can understand how their AA epistemology (E) and Technological- (T), Advising- (A) and Advising Content (AC) Knowledge (K) integrate into building a well-equipped AA professional. Each aspect of the framework will now be unpacked.

Epistemology: the academic adviser's beliefs in terms of how AA functions to support students' academic success is critical. Four AA approaches can be identified that embody different epistemologies (how we "know" how AA for student success works): Developmental, prescriptive, intrusive [24] and advising as teaching. It is this last epistemological position that probably is the most productive for building an advising EduBot. The movement in teaching and learning has been to move away from a teacher-centred to a student- or even learning- or knowledge-centred approach. Similarly, although AA is still very strongly rooted in an adviser-centred paradigm, a pivot to an advisee-/student-centred paradigm can be a ground-breaking development for the AA practice. In both the student-centred T&L and AA world, the student takes responsibility for his or her own learning towards student success. In this scenario, the teacher as well as the adviser must relinquish pedagogic or advising control and trust students' abilities to find their own way in the curriculum, or academic success journey. Of course, the

teacher and adviser does not disappear, they become facilitators and guides in the higher education journey.

Technological knowledge: As we have already shown, there is a range of technologies that an academic adviser needs to understand and use in their practice. We can distinguish between 1. Personal and productivity technologies (e.g., synchronous communication systems, internet browsers, word processing, spreadsheet and presentation software); 2. Communication technologies (e.g., e-mail, mobile messaging platforms, social media, calendar); 3. Administrative systems (e.g. student information systems, programme registration systems, institutional and national programme and qualifications framework systems); 4. Learning Analytics systems (e.g., how to use descriptive and predictive learning analytics dashboards; how are AI/machine learning processes used in these systems work; why XAI processes are needed and more or less how they work); and 5. General digital skills (e.g. internet searching strategies, synchronous digital interaction skills, social media use insights, ethical and legal insights into the digital AA domain).

Advising knowledge: Here is meant the mental, social, and emotional skills that are needed for a meaningful AA interaction. Like pedagogy for teachers, academic advisers need a grounding in how the advising process works. Depending on the epistemology, an adviser might need skills similar to an administrator, a coach, a councillor or a teacher.

Advising content knowledge: Closely aligned to advising knowledge is the advising content knowledge, i.e., the knowledge about systems, processes, academic fields, student support opportunities etc. that an academic adviser needs to be able to successfully advise a student.

We can use this ETAACK "blue-print" of an academic adviser to "build" our digital twin academic advising EduBot.

3.2 A "Digital Twin" Academic Advising Edubot

As a software robot, an EduBot can "become" whatever the bot's digital access to data sources and AI models allows. Following the blueprint above it is clear that certain ETAACK skills are easier to programme into an advising EduBot. The *technological (T) and advising content knowledge* (AC) would be straightforward to design as the EduBot as a digital system could integrate into itself all the informational, administrative, learning analytical, content and student support systems available at a specific institution. The use of an extra XAI system to understand predictive LADAs would of course not be needed as this functionality could be integrated as a contributing system into the EduBot's repertoire, thereby increasing trust in the LADAs predictions and subsequent incorporation into the "advice" or suggested courses of possible action towards student success.

The *epistemological (E) and advising (A) knowledge* aspects are of course more "human" skills and would require careful programming and would probably be where the most development work would have to be done. Certain advising "epistemological" algorithms (such as "advising is like teaching", "students take responsibility for their academic success", or "advising means facilitating or guiding the process") could be built into the EduBot's structured and learned intents-response dialogical flows. Similarly responding and guiding a student advisee using the skills of a teacher, coach or counsellor can conceivably also be reached by learning an AI system which then develops (by self- or supervised learning) deeper and more human-like responses or skills as it engages more and more with student advisees.

For the general conversational interaction with the student advisee the EduBot would harness natural language understanding AI models to understand spoken and text requests and to respond meaningfully (using voice or text). It could also learn ethical, and legal nuances in its responses,

making sure it stays within the parameters of an institution's policies, thereby lowering the risks of the institution. When it comes to knowing when to refer (e.g., to a psychologist or social worker) the EduBot would be learned those intents and then use empathetic and supportive dialogue flows to "refer" the student to the appropriate help. It can even go so far as to offer to make an appointment on behalf of the student if the student chooses to do so (students in crisis can often not even keep it together to seek help themselves). And of course, a student is welcome at any time to "press" the button that says "I want to speak to a human adviser" or "emergency response" that would put the student in immediate contact with student support services.

4. Conclusion

EduBots can indeed play an important role in AA, if we as higher education advisers, researchers and teachers become involved in deciding what the EduBot should be or do (or not be and not do). In this we echo the powerful thoughts of [25]:

> We need to dream up what comes next and let our imaginations run wild, so that we begin to anticipate the various potentials of postdigital educational futures, rather than backing into them and hoping that we get it right.

To return to the main problems as stated in the introduction it can be social science fictionally stated that if EduBots can function as academic advisers as described in the digital twin design, then there is the potential that *all students* will be able to receive quality academic support. This support will potentially be available to them *just-in-time*, and the advice and support will potentially be extremely *quick and effective*. Just-in-time advising (or "being advised") interestingly connects to the familiar notion of "just-in-time learning" (see e.g., Baruah [26] for a critical discussion of this teaching and learning concept). In the process higher education institutions will improve effectiveness, more students will be successful, and academic advisers will be valued for the specialised and intensive advice and support they will be able to give to the at risk and under-served students who need extra (human) help and intervention.

Of course, this will only work if the context is receptive to the idea and reality. Advisers would need to change their beliefs from adviser-centric to student-centric epistemologies. Students will need to advance from passive receivers of advice to active self-regulated agents that take responsibility for their own learning advising process. We need to change our belief that only exclusive in-person advising with human advisers is valid. We also need to embrace the idea that students can seek the appropriate advice, support and help using powerful and appropriate systems (like advising EduBot systems). We also need to trust that a more dialogic understanding of learning or discovering is also a powerful mechanism that "allows" or "enables" technology systems like EduBots to make a real contribution in guiding a student's learning/advising process or facilitating a student's interaction with academic advising systems as the "generalised other" [27]. The EduBot becomes the "other" in the dialogue and as such does not have to be perfectly human, or (like towards a human) will be allowed some small errors. The last critical part of the thought-experiment is that ethical and legal boundaries should always be respected and that there should always be readily available alternative pathways to make contact with human advisers or socio-psychological support.

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ARTIFICIAL INTELLIGENCE AND THE THREAT TO REPLACE HUMAN OCCUPATIONS

Khushe Motemanikenari

Faculty of Computer Science, Dortmund University of Applied Sciences and Arts
Dortmund, Germany
khushe.motemanikenari001@stud.fh-dortmund.de

Abstract: *Artificial Intelligence (AI) is the ability of machines, computer programs, and systems to execute human cognitive and creative tasks, such as problem solving, drawing conclusions, and making decisions. Most Artificial Intelligence systems have the ability to learn, which allows humans to enhance their performance over time. AI tools, such as machine learning, deep learning, and predictive analysis, have aimed to improve planning, learning, reasoning, thinking, and action-taking abilities. But Artificial Intelligence, in addition to its benefits, has also led to negative effects, including employee replacement. Artificial Intelligence first replaces manpower for lower and easier intelligence tasks, then as soon as it is able to perform all job tasks, it replaces manpower completely. As a result, this literature review examines the capabilities of today's advanced AI as well as contemporary AI challenges. We also consider an important issue that is a fundamental threat that Artificial Intelligence poses to human employment.*

Keywords: artificial intelligence, machine learning, deep learning, human job replacement

1. Introduction

Artificial Intelligence (AI) has attracted a lot of attention in recent years and has created many opportunities in the various sectors. AI, which is represented by machines that indicate features of human intelligence (HI), is being more widely used in service and is now a significant source of innovation and creativity. For instance, Robots in homes, health care, hotels, and restaurants have automated many aspects of our life [1].

Many of the possibilities created by Artificial Intelligence led to cost savings and efficiency. Technology corporations such as Google, Facebook, IBM, and Microsoft are making significant investments in AI research and development. For example, Apple's Siri and Amazon's Echo with Alexa have gotten a lot of attention recently [2].

While Artificial Intelligence has many benefits, it also poses a danger to human service professions. When AI can do part of a job's functions better to satisfy a firm's strategic aim, such as profit, it replaces at least some human labor in a service. This strategy can start with "lower" (AI-friendly) activities like mechanical labor and work its way up to higher intelligence and more sophisticated professions. As we can see manufacturing jobs are being replaced at a rapid rate. When AI replaces humans, employees lose their careers, and customers lose the ability to obtain human assistance [1]. Now the question arises whether Artificial Intelligence is able to take over human jobs? It is for this reason that we are motivated to investigate the ways in which AI will transform service.
As a result, it's more important to define AI first before identifying and explaining AI application areas and associated issues with it.

This article first presents the definition of Artificial Intelligence (AI) and the most common approaches to AI. The concepts of automation, machine learning and deep learning are defined. Then the benefits and challenges of Artificial Intelligence will be explained. Finally, we answer the question of whether AI should be used to replace employees in business.

2. Definition of AI

In recent years, Artificial Intelligence has influenced various fields, including computer science, engineering, biology, psychology, mathematics, statistics, logic, philosophy, business, and linguistics. From Apple Siri to Amazon Go, and from self-driving cars to autonomous weapons, Artificial Intelligence can be found everywhere [3].
"Intelligence" is defined in some sources as the ability to engage, learn, adopt, and rely on information gained through experiences, as well as the ability to deal with uncertainty. In this context, "Artificial" refers to a human-created replica [3]. There are different definitions of Artificial Intelligence, but in general, AI can be defined as follows:
According to the definition of Nilsson (1998) “artificial intelligence is concerned with intelligent behavior in artifacts” [4]. AI tries to mimic human problem-solving techniques in order to come up with more efficient solutions. So, the ability of a computer system to exhibit humanlike intelligent behavior characterized by certain basic competencies, such as perception, comprehension, action, and learning, is referred to as AI [2].

Artificial Intelligence (AI) is divided into three types: Artificial Narrow Intelligence (ANI), Artificial General Intelligence (AGI), and Artificial Super Intelligence (ASI). ANI can usually only address one problem at a time and must be programmed by humans. AGI, on the other hand, can learn on its own and transfer its knowledge and skills to new tasks without the need for human help. ASI, in turn, signifies the advancement of software well beyond the capabilities of the human mind [2].

Artificial Intelligence can be classified into two groups in another category: weak AI and strong AI. Weak AI, also known as narrow AI, excels in a limited set of activities. The majority of AI achievements to date, such as Google Assistance and Alpha Go, can be characterized as weak AI. Strong AI (also known as human-level artificial general intelligence or artificial super intelligence) that is capable of handling several tasks. Strong AI can develop self-awareness and become intelligent in the same way as humans do [3].

AI as a field includes a wide range of techniques, from top-down knowledge representation to bottom-up machine learning. In recent years, three linked notions have become more famous: Artificial Intelligence (AI), Machine Learning (ML), and Deep Learning (DL). AI is the most fundamental notion, Machine Learning is a subfield of AI, and Deep Learning is a type of Machine Learning (Fig. 1). In the following, we describe these concepts [5].

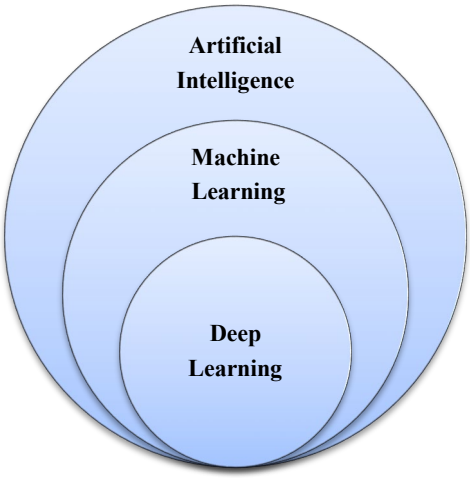

Fig. 1. Artificial Intelligence, Machine Learning, and Deep Learning [5]

3. The Most Common AI Approaches

1.3 Automation

The technology through which a process or procedure is done without human aid, states the definition of automation. Automation, in its most basic form, is a system or technology that automates formerly human-driven tasks. Although automation has been characterized in a variety of ways, the unifying factor is that it frees humans from time-consuming and repetitive duties, regardless of whether the tasks involve physical or cognitive functions. Automated assembly lines, dishwashers, and bar-code scanners are all instances of automation in operation [3].

2.3 Machine Learning

Machine Learning is an automated technique that allows machines to examine large amounts of data, discover patterns, and learn from the data in order to help with predictions and decision-making. One thing to remember about Machine Learning is that the inner workings of these self-learning machines are sometimes a black box and make it difficult to comprehend and explain. Because of this, sometimes it's hard to put trust in these machines.

Machine Learning is an AI subfield (see Fig. 1) that derives models from data using statistical approaches or numerical optimization techniques rather than directly programming every model parameter or computing step. Many Machine Learning models share one crucial feature: they employ probability to describe the uncertainty that arises in real-world problems. AlphaGo and self-driving cars are two examples of products of Machine Learning [6].

Also, Learning can be divided into three categories: supervised learning, unsupervised learning, and reinforcement learning (Fig. 2).

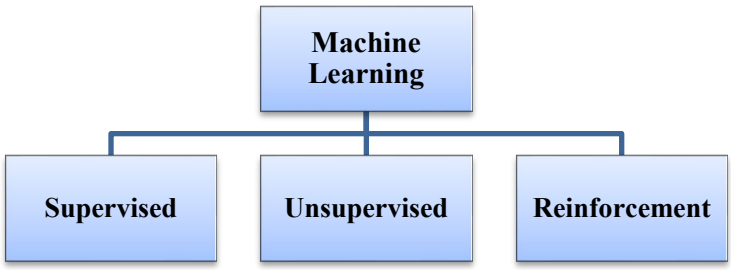

Fig. 2. Three categories of Learning [6]

Unsupervised learning examines unlabeled data to uncover patterns, whereas supervised learning uses labeled data to train a computational model. Reinforcement learning does not require labeled data, but it does require action-based feedback, such as rewards or penalties, to aid in the development of a computer model [7].
There are several ways to classify Machine Learning tasks. Tasks like classification, clustering, and prediction can be identified based on their goals. The purpose of classification is to categorize a target into a sector, such as a land parcel into a Commercial or Agricultural category. The purpose of clustering is to identify clusters in data, such as detecting vehicle clusters based on their positions to detect traffic congestion. The purpose of prediction is to anticipate unknown values, such as estimating the average temperatures of multiple sites in the near future using a regression model based on their historical temperatures and other characteristics. Regression, random forest, decision tree, support vector machine (SVM), naïve Bayesian classifier, density-

based clustering, hidden markov model (HMM), artificial neural network (ANN), and many other machine learning methods have been developed [5].

3.3 Deep Learning

Deep Learning is a subset of Machine Learning that focuses on the development and utilization of deep neural networks (DNN) to machine learning tasks. DNN is a sort of artificial neural network that comprises numerous layers between the input and output layers (also known as hidden layers). Each layer is made up of a group of computing units known as neurons that accept the input from the previous layer and produce a non-linear output for the next layer. Deep Learning, like other machine learning models, can be used to fulfill tasks such as classification, clustering, prediction, and so on [7].

Convolutional neural networks (CNN) and recurrent neural networks (RNN) are two types of DNN that have gotten a lot of attention. CNN is particularly well suited to image processing since it extracts and represents abstract features using a cascade of neuron layers and convolutional filters. By memorizing parts of the prior states and establishing linkages between the current and previous states, RNN is well suited for analyzing sequence data, such as movement trajectories [7].

4. Artificial Intelligence (AI) Benefits

AI, when used in concert with other technologies, has the potential to answer some of society's most crucial issues. AI has great potential in a variety of fields, including business, industry, healthcare, education, military and many more. AI-based technology has been used to generate a variety of advances, including facial recognition and self-driving cars. These applications necessitate AI systems that can interact with the actual world and make decisions on their own [3]. Therefore, the use of Artificial Intelligence in various sectors and fields has many advantages, some of which are described below.

4.1 Artificial Intelligence in Human Resources

AI helps in simplifying human resource procedures in a variety of ways. AI programs can sift through thousands of applications more quickly and effectively. For example, by recognizing the characteristics of successful personnel, AI can boost the likelihood of a firm choosing the most suitable applicants, resulting in higher productivity and retention rates. It can also relieve humans of repetitive paperwork and provide solutions to frequent action [6].

4.2 Intelligence in Cybersecurity

Cyber security analytics intelligence can aid in the detection of a potential attack before it occurs. The use of Artificial Intelligence (AI) and Machine Learning to detect and respond to threats might make cyber employees feel less anxious. In addition, AI can speed up the detection of risks, minimize the time it takes to respond to situations, and alert users to unusual activity in real time. Artificial Intelligence is already being used in every aspect of cybersecurity, including cyber intruder detection, prevention, threat detection, and risk analysis. This allows for the redirection of human efforts to more vital tasks [8].

4.3 Artificial Intelligence at Home

The way we live in our houses is also changing as a result of AI. When a connected home is combined with AI-driven home automation, it can handle practically all of the daily tasks that

humans do, such as turning off lights, closing doors, monitoring temperature, playing music, and cleaning the floors [9]. Furthermore, by controlling smart thermostats, lighting sensors, and smart plugs, AI-powered home automation can reduce energy consumption. Also, Face recognition algorithms can be used to identify break-ins and call emergency services, obviating the requirement for human monitoring [9].

4.4. Artificial Intelligence in Healthcare

Patients' and elders' health and quality of life can be improved with AI-based solutions. Monitoring medicine, managing chronic illness, identifying disorders, and assisting with surgery are some of the most common uses of AI in health care. AI can also assist in forecasting and identifying individuals who require medical treatment on a more urgent basis. Algorithms based on AI have made headlines for their accuracy and speed in everything from symptom diagnosis to clinical decision support [10].

4.5 Artificial Intelligence in Drones and Self-driving Cars

Self-driving vehicles are predicted to reduce traffic accidents and deaths as a result of self-driving technology. Unmanned drones have also been made possible by self-driving technology. Drones have grown popular in a variety of businesses and government organizations, particularly in situations where humans find it impossible to reach or perform efficiently, such as scanning an inaccessible military base and making speedy deliveries during rush hour [11].

4.6 Artificial Intelligence in Education

People who are unable to read or write, as well as those who are unable to utilize computers, would benefit from AI's natural language processing capabilities. Teachers can use AI to free themselves from everyday activities like grading, allowing them to focus more on their professional work. AI tools can also assist in making global classrooms accessible to all students, including those who are unable to attend school [12].

4.7 Artificial Intelligence in Manufacturing

The manufacturing industry has gained many benefits from AI, including real-time equipment maintenance and virtual design. The software can analyze all possible variations of a solution, quickly create design alternatives, and allow testing of their practicality when the designer inputs design goals. Thus, the key to future manufacturing growth is Artificial Intelligence (AI) [3].

4.8 Artificial Intelligence in Finance

In terms of accuracy and completeness, the AI-based system has been demonstrated to be more effective in detecting financial malfeasance. Credit card fraud, anti-money laundering, and synthetic identity theft are all examples of financial crimes that AI can deal with them and detect. FinTech (Financial Technology) is quickly becoming a revolutionary and strategic initiative for the financial industry [13].

4.9 Artificial Intelligence in Military

AI has numerous advantages for the defense industry. Combining AI autonomy with computer vision, for example, might have a positive impact on the defense industry by improving military decision-making and efficiency. AI can distinguish a thermal image of a person's face acquired

in low-light situations for facial identification. This development may aid soldiers who conduct covert operations at night [3].

4.10 Artificial Intelligence and Hazardous Environment

As intelligent machines and systems are trustworthy and practical, the use of AI in hazardous environments is increasing. They are more capable of performing dangerous and difficult activities than humans. In areas like nuclear energy, deep mining, and deep-sea operations, AI and robotics are designed and employed to provide safer working environments. Human laborers can be relieved from hard and dangerous conditions such as extremely high and extremely low temperatures, extreme humidity, chemical hazards, and radioactive radiation with the help of robotics [14].

5. Artificial Intelligence (AI) Challenges

Although AI offers a lot of potential as a cutting-edge technology, it also has a lot of drawbacks for users and society. Privacy concerns, data security, explicitly, and transparency of algorithms, job replacement, trust and adoption, and ethical and governance challenges are the key sources of risk (Fig. 3) [3].

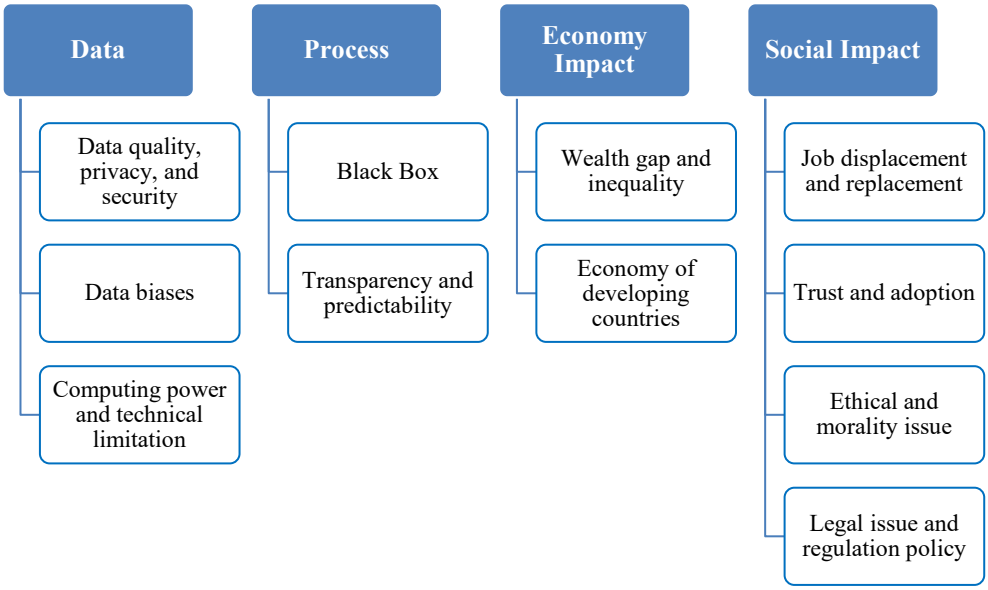

Fig. 3. Artificial Intelligence challenges [3]

In addition to the AI safety, security and quality of the system/data, financial feasibility as well as expertise are the main problems associated with the major problem in developing Artificial Intelligence technology. AI safety relates to ensuring AI's safe and reliable operation and impact. This includes not only issues of information security, but also issues of security in general. This also includes complex and safety-critical issues originating from conditions where AI learns undesirable behavior from its environment or misunderstands its surroundings.

Because the AI system is only as smart as the data from which it learns, and data is regarded as the basic driver of current AI systems, system/data quality and integration is critical [2]. As a result, collecting, aggregating, storing, and using unbiased and relevant data is required for successful AI implementation in each sector, as inaccurate or bad data can lead to failures.

Financial feasibility is also important when it comes to integrating AI technology, and a lack of resources is one of the most significant obstacles that businesses encounter when launching AI

initiatives. As a result, before creating and deploying an AI application, the overall cost and expected revenues must be assessed ahead of time in order to determine whether an AI solution is financially sustainable in the long run [2].
Another crucial facet of using AI technology is specialization and experience. The rapid development of AI necessitates the hiring of specialists and experts with essential abilities to help support and promote its advancement. As a result, the global demand for AI professionals has skyrocketed in recent years. Aside from the unique difficulty of workforce substitution, AI's complementation of many tasks will change their need profiles, causing humans' duties to shift toward a more supervisory function, requiring AI-specific abilities. The advancement of AI also results in the birth of whole new job profiles, such as data scientists or machine learning engineers, which require professionals with AI-specific abilities, which are now scarce [2].
However, AI systems are typically meant to mimic or recreate human behavior and make judgments for people with the goal of maximizing effectiveness and efficiency while decreasing errors in order to make the best or most appropriate decision for them.

6. Should AI be Used to Replace Employees in Businesses?

The decision should be made at the task level, which means that a company should consider a job's task portfolio and optimize the division of labor between humans and AI. A company can examine the following factors [1]:

- **Type of tasks:** The first tasks that should be replaced are those requiring a lower level of intelligence. As Artificial Intelligence replaces more tasks, less manpower will be needed [1].

- **Type of service:** Replacing services that require a higher level of human interaction or touch will be more challenging for AI [1].

- **Strategic emphasis of firms:** Given that AI applications are typically implemented for cost savings, companies that pursue a cost leadership strategy would replace more human labor with AI, whereas companies that pursue a quality leadership strategy will use more human labor and less AI [1].

At the same time, the threat of human job replacement remains, creating ethical questions about the deployment of AI technology in a public sector. For example, the issue of liability and duty in the event of AI technology making defective or incorrect conclusions has yet to be resolved. As a result, Artificial Intelligence is a two-edged sword: on the one hand, AI applications can be used to enhance public affairs and improve the efficiency of internal procedures. On the other hand, threats imply that AI may raise unemployment and that some applications and machines may eventually replace humans. As work activities and jobs become increasingly subject to automation, there is growing concern that further advancement and adoption of AI will lead to unemployment [2].

7. Conclusion

In recent years, Artificial Intelligence (AI) has attracted the attention of many academics, industry and the general public. Therefore, Artificial Intelligence (AI) plays an important role in today's digital environment and is included in our daily lives. Artificial Intelligence has many benefits today, but there are some issues that have been merged by it. One of the most important issues is the replacement of employees.
Many jobs are at risk of being replaced by AI and AI-based automation technology due to significant advancements in Artificial Intelligence (AI), machine learning, automation, and robots. However, besides the many benefits of Artificial Intelligence, job substitution is not a new

phenomenon and "Technological unemployment" refers to the losing of jobs caused by technological change. However, just because a job has the technical ability to be automated does not ensure it will happen. A range of economic, political, legislative, and organizational factors could influence AI's ability to replace human jobs. On the other hand, AI and associated technologies will also promote economic growth, resulting in one of many job vacancies. AI systems and robotics, in particular, will increase productivity, lower costs, and improve the quality and diversity of products that companies can manufacture.

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ARTIFICIAL INTELLIGENCE IN THE FIELD OF HEALTH CARE: ADVANCEMENTS, CHALLENGES AND RISK

Shahida Banu Shaik Abdul Khader
Faculty of Computer Science, University of Applied Sciences and Arts
Dortmund, Germany
shahida.shaikabdulkhader003@stud.fh-dortmund.de

Abstract: *In recent years, artificial intelligence in healthcare has made significant development in the field of Digital Transformation. In terms of advantageous, precise, and early diagnostic and therapeutic interventions, artificial intelligence has a lot of potential. However, most of this growth appears disjointed, without a unified framework for the astute observer. Meanwhile, there is a growing awareness of the possible hazards and risks that unchecked artificial intelligence breakthroughs may create. Around the world, guiding principles are being created to promote the trustworthy development and implementation of artificial intelligence systems. These principles can help developers and regulatory bodies make judgments about how to employ artificial intelligence. It is widely believed that artificial intelligence has the ability to drastically modify the function of the doctor and revolutionize medical practice. People must begin to understand that medical professionals would be assisted, and possibly replaced by AI and sophisticated robotics systems in the future.*

Keywords: artificial intelligence, healthcare, medicine

1. Introduction

Artificial intelligence (AI) is a broad term that refers to the use of a computer to replicate intelligent behavior with little or no human interaction. The creation of robots is often regarded as the beginning of AI [1]. According to McCarthy, *"Artificial intelligence is the science and engineering of making intelligent machines, especially intelligent computer programs"* [2, p. 2]. AI is rapidly taking over the healthcare industry. It converts the manual health system into an automated one, in which humans do routine tasks in medical practice to manage patients and medical resources [3]. Concurrent advancements in information technology infrastructure and mobile computing capacity have prompted optimism that AI may potentially bring chances to solve health issues. These issues, which include acute health personnel shortages and poor public health surveillance systems, impede global progress toward reaching the health-related sustainable development goals (SDGs) [4].

Positive economic effect is a critical decision element in deciding whether to invest in an AI solution in the health care business. It is primarily significant to the healthcare provider and insurance industries, as well as the pharmaceutical drug and medical technology sectors [5]. The term "Medical Technology" refers to a variety of tools that can help health professionals provide a healthier quality of care for patients and society by performing timely detection, minimizing side effects and improving treatment. AI has transformed Medical Technology and is usually considered as a branch of computer science capable of dealing with difficult issues with numerous applications in fields with massive amounts of data but very little theory [6].

AI has the ability to significantly enhance patient care while also lowering health-care expenditures. The growing population is likely to increase demand for health-care services. The health-care sector needs creative ways to become more productive and efficient without incurring exorbitant costs. The use of AI and robots in health care is rapidly evolving. It allows them to accomplish tasks that people do more efficiently, simply, and at a lower cost. Some hazards and

obstacles emerge, such as the risk of patient damage from system faults, the risk of patient privacy and designing of AI systems, the technological limitations of digitizing health care system [3].

Because there are both advantages and disadvantages in the deployment of AI, which are discussed in detail in the later session, the future of AI in health care is not entirely clear. Problems arise regarding AI's ability to exercise physicians' rights and duties, as well as preserve privacy issues, and the applicable legislation is not entirely equipped to deal with this advancement [3].

In this paper, we are trying to present a brief history of the evolution of AI in Healthcare in section 2. In section 3, we are trying to the evaluate the advancements in the field. Then, in section 4, we go over the challenges that AI can create and the advantages of using AI. This paper will help the readers to get a deeper understanding of the current happening around AI in healthcare and also summarizes previous research on AI in healthcare and analyses current strengths and flaws, as well as difficulties, associated with this new technology. The review's goal is to offer a high-level update on recent AI advancement in health so that health professionals are aware of how swiftly AI is moving in health and can lead the change necessary for its acceptance by the health system.

2. Evolution of Artificial Intelligence in Healthcare

AI was initially defined in 1950; nevertheless, significant shortcomings in early models hindered recognition and implementation to medicine industry [7]. According to authors Hamet and Tremblay, "*The term derives from the Czech word robota, meaning biosynthetic machines used as forced labor*" [8, p. 36]. AI, which is defined as the science and engineering of creating intelligent machines, was created in 1956. The phrase refers to a wide range of medical goods, including robots, medical diagnostics, medical statistics, and human biology [8]. Medicine was thought to be one of the growing applications of AI. Since the mid-twentieth century, researchers started created support systems. Rule-based techniques were a tremendous success in 1970, and were used to interpret ECGs, choose the best therapy, diagnose illness, and even aid clinicians. These rule-based systems are expensive since they necessitate the regular insertion of rules and modifications. It was also tough to encode the various knowledges received from various specialists [1]. In the following session, we will take a closer look at the evolution of AI over the years. Fig. 1 depicts a detailed chronology of developments in the different eras.

2.1 First AI Era - Winter Mid

When computers were available in the mid-1950s, numerous scientists instinctively understood that computer systems that could control numbers could also control symbols, and that the modification of symbols may symbolize the core of human mind. This created a new method of addressing "thinking machines" [7]. At the Dartmouth Workshop in 1956, McCarthy introduced the term "Artificial Intelligence" and the study of AI as an academic domain began [9], [10]. Programs produced during this time period relied on reasoning and investigation, and even the finest computers of the time, which were constructed at tremendous expense, could only solve problems in a limited number of ways. They were, nevertheless, "astounding" to others at the time. However, in the 1970s, AI was met with criticism and reduced funding. One explanation was that the AI researchers did not correctly appraise the difficulties of the task they were confronted with. The results were expected to be excessively optimistic and high; nevertheless, the results failed to fulfill the expectations, and funding for AI research has essentially dried up [7], [11].

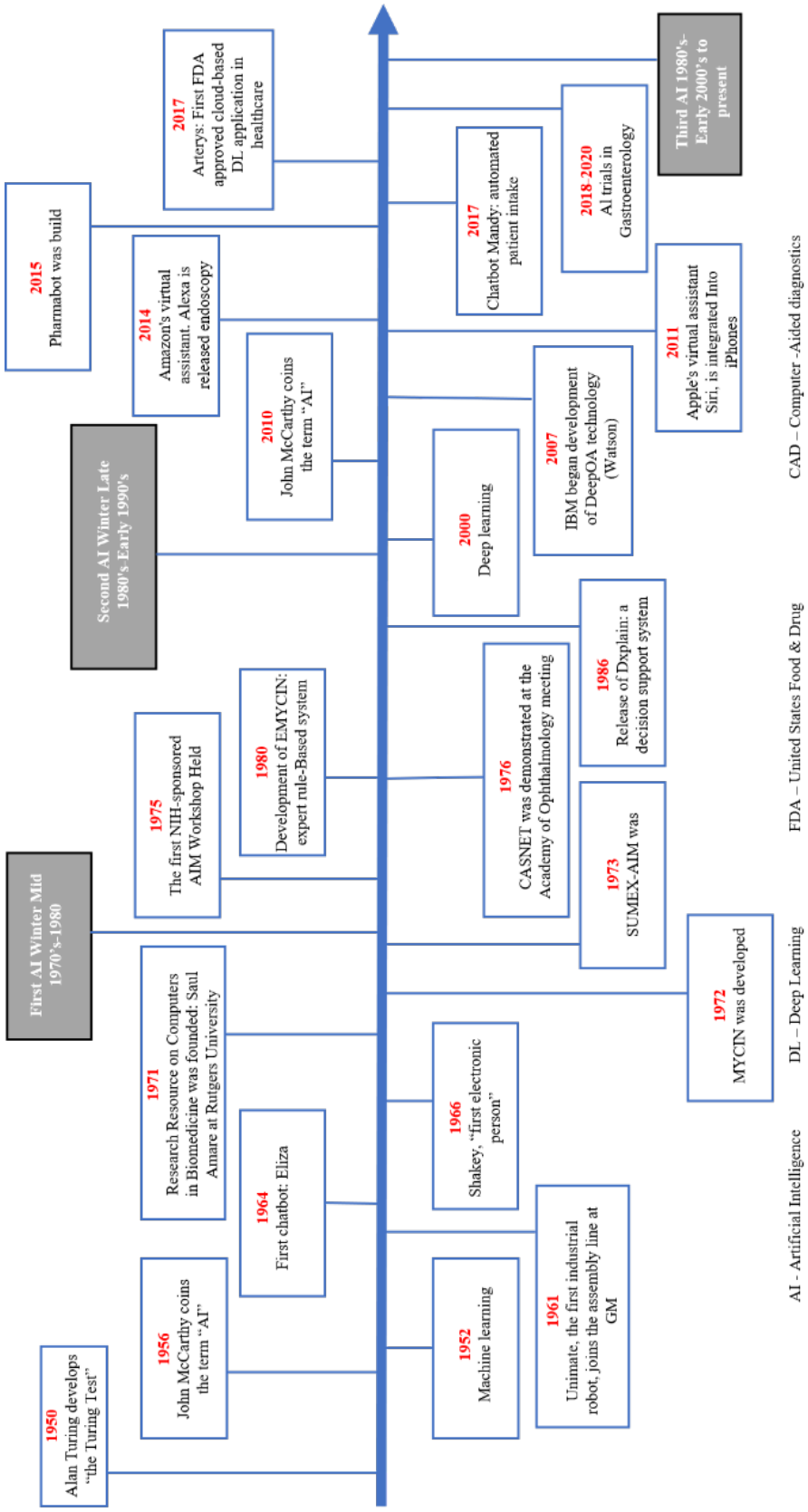

Fig. 1. Timeline of the evolution and use of Artificial Intelligence in medicine, adapted from [7]

2.2 Second AI Era - Winter Late

As "expert systems" a type of AI software, were implemented by organizations throughout the world in the 1990s, explicit knowledge had become a priority of AI research. An expert system is a program that employs logical principles drawn from expert knowledge to answer questions and solve problems in a certain domain of knowledge [7]. The use of AI in medicine was divided into two categories: virtual and physical. The virtual branch encompasses informatics technologies ranging from deep learning information management to physician control over treatment choices. Robots employed to aid the elderly patient or the accompanying surgeon best reflect the physical branch. This branch also critical examination nanorobots, a novel innovative drug delivery technology [8].

Earlier example includes deep learning, Amazon virtual assistance, Apple virtual assistance, etc. The rise in interest in AI in the 1990s was fleeting and followed the normal practice of the bubble economy. In the end, expert systems were only useful in very specific situations, and AI research faced another funding crisis in the late 1990s. The second era's technology fell well short of these great expectations, resulting in a time of acute disappointment [7], [10] - [12].

2.3 Third Era of AI

We are currently living in the third era. The second period was based on new and exciting technologies, as well as the promise that computers will soon solve all of our problems. In the present third era of AI, where computer systems approach human-level capacity and can execute human activities, defining risk based on the extent of human supervision necessary over an algorithm may be significantly more relevant. These advancements illustrate the most significant difference between traditional AI and modern AI that we have learnt in the past [11].

3. Advancements of Artificial Intelligence in Health care

AI has now been proved to be as successful as humans in the diagnosis of numerous medical diseases. Recent study suggests that AI outperforms humans in predicting suicide attempts. AI's present strength is its capacity to learn from vast datasets and recognize patterns that may be used to detect illnesses, placing it in direct rivalry with medical professions involved in pattern recognition diagnostic procedures, such as pathology and radiology. Legal responsibility and attribution of negligence when errors occur, as well as ethical difficulties linked to patient decisions, are among the current challenges in AI [13].

Since the development of Machine Learning and Deep Learning, personalized treatment has been possible. In the future, predictive models might be utilized for illness diagnosis, treatment prediction, and perhaps preventative medicine [14], [15]. With all the recent advancements, AI has been divided into several subfields as explained in Fig. 2. as, Machine Learning (ML), Deep Learning (DL), Natural Language Processing (NLP) and Computer Vision (CV).

i. ML is a pattern recognition and analysis; machines may learn from specified data sets and improve over time.
ii. DL is made up of multi-layer neural networks which allow machines to understand how to make decisions on their own.
iii. NLP is the process by which computers extract knowledge about the human language and make decisions based on that data.
iv. CV is the process through which a computer learns and understands from a sequence of photos or movies [7], [14].

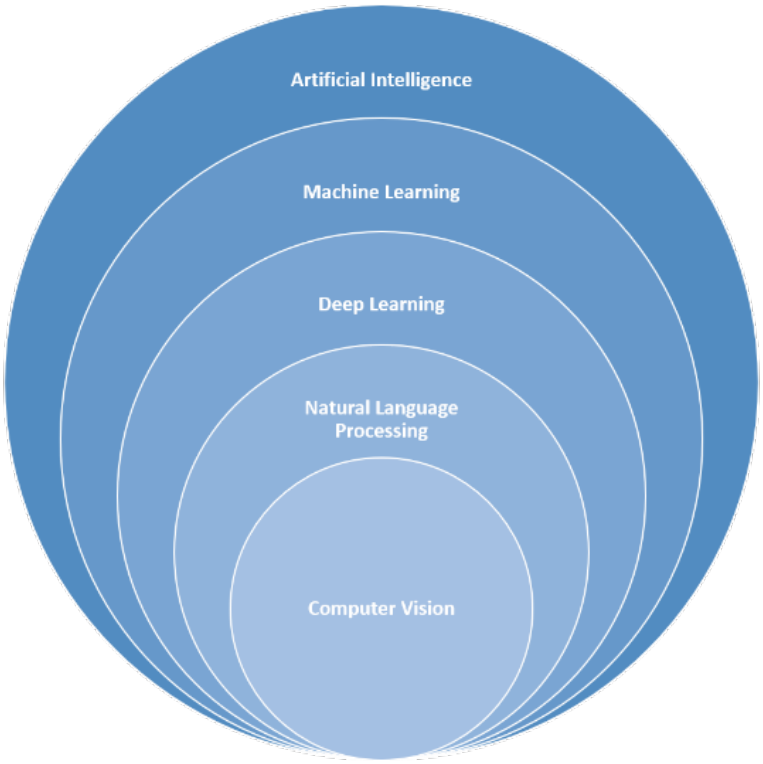

Fig. 2. Subfields of Artificial Intelligence, adapted from [7], [14]

ML is also the application of specific features to uncover patterns that may be utilized to analyze a scenario. The machine may then "learn" from this knowledge and apply it to future comparable instances. AI may increase diagnostic accuracy, provider workflow and clinical operations efficiency, disease and treatment monitoring, procedure accuracy, and overall patient outcomes [7], [14]. Table I lists the many forms of AI used in health research in Low and middle - income. Machine learning, signal processing, or both were employed in most AI-driven health treatments. Machine learning was frequently used in conjunction with other AI techniques. Furthermore, we could see a variety of machine learning algorithms were regularly combined [4], [7], [14].

TABLE I. Artificial Intelligence's Functions in Public Health and Related AI Types, adapted from [4], [7]

Function	***Types of AI***	***Example***
Diagnosis	Machine learning, natural language processing, signal processing, expert system	To detect and screen for diabetic. Retinopathy, nonmelanoma & melanoma skin cancers, TB and drug-resistant tuberculosis and to estimate perinatal risk factors researchers used machine learning [4], [7]
Risk assessment for mortality and morbidity	Signal processing, data mining, machine learning	Researchers used machine learning algorithms on administrative records from a hospital to evaluate the probability of dengue fever severity [4]
Prediction and tracking of disease outbreaks	Signal processing; data mining, machine learning, natural language processing	Globally, remote sensing data and machine learning techniques were employed to characterize and forecast Zika virus transmission patterns and to find the progression of Alzheimer's disease[4], [7]. It was also used to improve surveillance of HIV in Chine [4]
Health planning and policy	Machine learning, expert planning	Machine learning algorithms were used to predict duration of stay among in employment of health-care in underprivileged communities using administrative data from South Africa [4]

Table II outlines recent advancements in AI in medicine and provide key use-cases where AI-powered medical solutions are currently being employed in clinical practice.

TABLE II. Artificial Intelligence's Advancement in the Field of Healthcare, adapted from [6], [7], [13], [14], [16]

Medicine Field	***Advancement***
Nephrology	Prediction of glomerular filtration rate reduction in polycystic kidney disease patients, as well as determining the likelihood of progressive IgA nephropathy[6]
Gastroenterology	A recent randomized controlled study used the device to monitor real-time withdrawal speed and colonoscopy withdrawal time and demonstrated significant improvement in adenoma detection[6] and to identifying and distinguishing between benign and malignant colon polyps[7]
Endocrinology	Gives information on rate of change of blood glucose levels in real-time using interstitial glucose monitoring system [6]
Cardiology	AI has been shown to be more accurate than traditional assessments in predicting the cardiovascular risk, such as acute coronary syndrome and heart failure[6]
Neurology	identify generalized epilepsy seizures and report them to close family or physician about the patient's whereabouts. also used to evaluate tremor in patients with sclerosis and Parkinson's disease [6]
Cancer	AI is well-established in the diagnosis and identification of pre-malignant lesions and early malignancies. It is also used in early detection of recurrence of cancer [14]
Endoscopy	ENDOANGEL (Wuhan Endo Angel Medical Technology Company, Wuhan, China) is a CNN-based system that can offer a 91.89 percent accurate evaluation of surgical intervention every 30 seconds during the withdrawal period of a colonoscopy [7]
COVID-19	AI outperformed humans in diagnosis, prognosis appraisal, epidemic prediction, and medication development. AI has the ability to greatly improve present medical and healthcare system efficiency [16]
Pulmonary Medicine	In the instance of analyzing pulmonary function test results, AI-based software delivers more precise evaluation as a decision-support tool [6]
Psychiatry	A predictive model using whole-brain functional magnetic resonance imaging (fMRI) in identifying patients with more symptoms of schizophrenia [13]

According to authors Lee and Yoon, Chief Medical Officer of Watson Health at IBM, reported at the 2019 Annual Meeting of the American Society of Clinical Oncology (ASCO) in Chicago that AI would help scientists make more informed decisions based on scientific evidence and increase patient satisfaction by giving a thorough view of treatment options [17].

4. Challenges and Risk of Implementing AI in Healthcare

The employment of AI in health care can bring both challenges and opportunities. The use of technology in healthcare provides apparent benefits, such as improved patient management options and results, as well as possible secondary benefits including fewer referrals, lower costs, and time savings. It can also help rural health care institutions and improve rural recruitment and retention. In the end, this can contribute to a more equitable global health care system, with the challenges of facilitating early adoption and sustainable implementation in the health system, a lack of consideration for the user's perspective, and technology that cannot be used optimally, but the need for AI adoption in the public health sector [3]. Major issues with the use of AI in health care are listed below

i) Data & Algorithm: The AI model requires a large amount of data, such as health data or other types of data, to be trained. When too little is used to train AI models, there may be incomplete data due to social marginalization or very small samples. A further challenge is with the algorithms, algorithms can only be as effective as the data that they are trained on. When training data is partial or incomplete, or only represents a subset of a particular population, the resultant

model is only relevant to the community of persons represented in the dataset. This highlights the problem of data provenance and reflects the decision-making capacity of algorithms [3], [18].

ii) Personal Privacy: Because AI-based technologies and systems rely on massive datasets, privacy concerns arise in terms of data gathering and sharing. Health Service Data are the most sensitive information about another person that may be possessed by an individual. Respecting an individual's privacy is a crucial ethical concept in health care since privacy is tied by patient autonomy or self-government, personal identity, and well-being. Respecting patient confidentiality and ensuring sufficient protocols for gaining correct permission are thus morally crucial [3], [17].

iii) Job loss and transformations to the change: AI-related technologies will generate many repetitious tasks redundant. Many people feel that radiography will become obsolete in the future because AI will be able to assess diagnostic medical pictures more correctly than humans. While some jobs may be lost, it is important to recognize that many new ones will be created to support the adoption of AI-based systems [17].

iv) The ethical double-effects concept: Science is considered to be a sword; certain results will inevitably cause harm. In AI, this is ideal for particular boundaries. As a result, when using AI in areas like stem cell research and gene editing, the rules must be carefully examined to establish strict guidelines to find when it is ethically appropriate to do an act in favor of a desirable objective while fully aware that the activity may result in negative consequences [3].

v) Ethical dilemma in research and biomedical medicine: Biomedical ethical principles, like other new scientific approaches, must be followed by AI in smart healthcare. Autonomy, profit, non-crime, and justice are the four pillars of these ethics. Authorization, confidentiality, and security, as well as voluntary involvement and autonomous decision-making, are examples of values that should be addressed and applied in any implementation [3]. With the addition of digital technologies to this evolving environment, it is becoming increasingly unclear who is participating in a fiduciary compact, even if physicians continue to provide treatment. Medical ethics will have to improved and employed [19].

According to authors Bare, Miyata-Sturm and Henden, it is recommended that the ethics and robustness of AI rather than just the legal challenges, based on a basic rights approach to ethical advice for trustworthy AI. The framework is shaped by four principles founded in these fundamental rights, which are translated into more concrete requirements:

(i) respect for human autonomy;
(ii) harm prevention;
(iii) fairness;
(iv) explicability (the study emphasizes that this list is not necessarily complete) [20].

These requirements can be translated into a customized list that can be used to evaluate certain AI solutions as shown in Fig. 3.

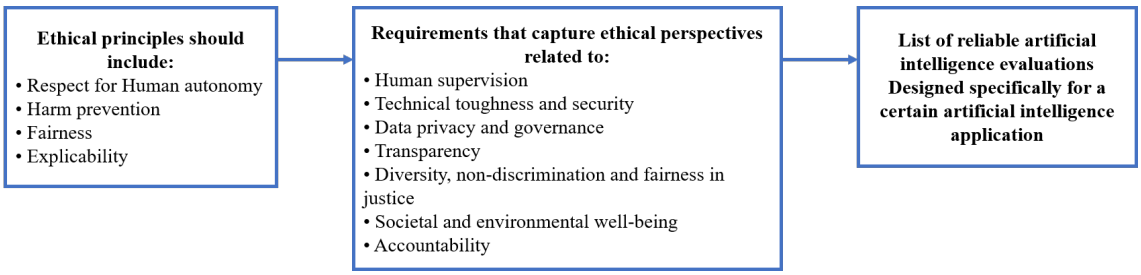

Fig. 3. Trustworthy artificial intelligence framework, adapted from [20]

5. Limitations in the Growth of AI

As the use of AI in healthcare grows, various limitations arise as well. One of the major limitations is the problem of legal responsibility. Who is responsible if a medical error occurs? Because a robot surgeon is not a legal person, should the patient sue the company, developer, manufacture, or others? Could an AI ever face criminal charges? [13]. With all this limitation sin hand, AI is unlikely to replace physicians. However, comparisons between AI solutions and physicians are regularly made, as if the two equivalents were in competition. Future research should compare physicians utilizing AI; only then will AI be regarded as a supplement to physicians [6].

6. Conclusion

In today's fast-paced digital world, innovation is critical. The primary tools for adopting and integrating new creative ideas are with the emerging technology [17]. The use of AI in medical care is rapidly growing alongside other modern disciplines. While scientific research into new ways to improve modern healthcare, it will continue to be rigorous and transparent, health policy should focus more on tackling the ethical and financial difficulties associated with the supports of medical evolution. Healthcare professionals and people are now in a position to welcome digital innovation and be the primary drivers of change, while a fundamental redesign of medical education is required to educate future leaders with the necessary competencies for the future. As a result, the use of AI and associated technologies is no longer a choice, but rather a trend that enterprises must accept and use for competitive advantage.

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STORAGE AND DATABASES ON CLOUD

Rodrigo Castro Godinez
Master of Digital Transformation, Dortmund University of Applied Sciences and Arts
Dortmund, Germany
rodrigo.castrogodinez002@stud.fh-dortmund.de

Abstract**:** *Cloud computing has gained a lot of popularity because of the benefits that users and organizations can adopt while utilizing this model. For most organizations, the proper management of information can play a huge role in the success of the business. This paper introduces the cloud concept, the cloud storage and delivery models utilized in recent stages of technology. It was compared two of the most important cloud vendors on the market, Amazon Web Services and Google Cloud.*

Keywords: cloud storage, cloud databases, Azure, AWS, postgreSQL, cloud native

1. Introduction

Research conducted in 2018 [1] indicated that 90% of the world's data was created in the last two years and as society we were generating 2.5 quintillion bytes per day. The amount of data that is being created, processed and stored is growing at an exponential rhythm. Nowadays data is being captured in different formats from structured and unstructured data within IT infrastructures [1]. Another report found that databases in cloud environments are growing at a rate of 68%, showing that there is a major change and evolution on how the data is stored nowadays [2].

It is important to first look into the definition of cloud, the NIST provide the following definition for the term cloud, or more formally called cloud computing: "*Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources [..] that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models*" [3]. Another definition of cloud, described by Reznik, Dobson and Gienow [2], is the definition of cloud as a demand model that grant infrastructure, storage, databases and any other categories services over the internet. There are a lot of providers such as Amazon Web Services, Google Cloud, Microsoft Azure, that offer cloud services where the client pays just for the services that they utilize. Both authors [3][2] agreed that the cloud provide an on-demand model that leverage the use of computing resources. In the following literature review it is explored the which properties a cloud service should have, the different categories a user can adopt while storing information, the benefits of a storing information on the cloud and a comparison between the two biggest cloud vendors nowadays in the context of the features they provide regarding PostgreSQL.

2. Cloud Properties

There are properties that are fundamental to describe cloud computing. On-demand self-service, broad network access, measured services, resource pooling and rapid elasticity [4].

- The on-demand self-service state that the user can, in an independent way, reserve and release IT resources according to their needs. The independent way can be done without the need of a human interaction of the cloud provider.
- The broad network access, provide services over the network that can be reached by client platforms.

- The measured service characteristic enables the use of the computation capabilities and storage to be measured to have a transparency for the customer and cloud provider. This allows to the customer to pay only what it is being used, with a monitored, controlled and reported data. This characteristic provides a benefit for parts, given that the customer can scale based on their needs, and the cloud provider, with their pool model, can serve other customers
- Resource pooling, this characteristic allows the cloud provider to have a resource pool that is shared across multiple users. This enhances an easy way to assign resources to multiple users, depending on the needs of each of them. All these resources can include storage, processing, memory and other computational capabilities. With the previous characteristic, an on-demand self-service, customer can reduce or increase the resources without in an easy way.
- The rapid elasticity characteristic is a result of the economy of scales that cloud provider use. Given that providers give shared cloud service to a great number of customers this is translated into a reduction of costs of each customer, on the provider behalf. And this also provide an elastic benefit when one of the customers need more resources, because the provider can allocate more resources from another client that at that time does not require that number of resources [4].

3. Cloud Storage Categories

Regarding the databases on cloud there are two main categories: self-managed databases and managed databases. On the self-managed category there is a freedom to perform administrative tasks about the installation of the database engine, choose the operative system of the VM and managing the updates for the networking. The cloud provider grants hardware, and hypervisor to run the VM and some other tools to help in the deployment of the database. In contrast in the managed database scenario, the provider supplies a more robust solution including the database engine, the hardware and all the software a user needs to operate the database. Using a managed database also provides the benefit that the cloud provider handles all the updates, configuration of the database, backups, among other administrative tasks. There is a freedom to choose some parameters such as which releases should be installed, how much time the backups should be retained, and how to run the database. The security is also handled by the cloud vendor, but they provide the ability to choose some specific security decisions such as the users that can access the database, which IPs are allowed to modify data. The security administrative tasks like the auditing access must be done by the user. There is a main disadvantage on the managed database category, since the cloud vendor already have prebuilt solutions, in some cases it is hard to ask for a specific database engine since it is not supported by the vendor. However, nowadays cloud vendors support most of the open source's databases and, they offer their own database solutions. In most cases, a user should choose the managed database, since it requires less administrative work, and a database administrator can focus on more important decisions [5].

The most used options, managed databases, can be branched into two main groups: Traditional and cloud native. On the first group there are popular options like Oracle, SQL Server, MySQL between many. When an organization is working with an on-premises database, it is more likely that the organization choose the traditional managed database giving that the migration to a cloud approach can be easier. On the other hand, the cloud native approach are all the solutions that vendors have designed and created. Because these solutions are created specifically for the cloud and designed by the own vendors, there database performance on this category can provide a better performance, more and easy scalability and it can be more cost-efficient than the traditional

approach.
On the managed database, there are several types of databases that can be traditional and cloud native and these types are: Relational databases, data warehouses and nonrelational databases. On the relational database a user can find popular options like MariaDB, MySQL, Oracle, PostgreSQL and SQL Server. Cloud vendors have also created cloud native solutions for relational databases, for example AWS offers Amazon Aurora, Azure propose Azure Cosmos DB and Google Cloud Spanner [5].

The relational database, these offering stores information in a way the data can have relations between them and provide a query language to get the information in an effective way. In this model similar data elements are stored in tables, and the data inside a table can have a certain dependency with data from another table. This tables contain columns that represent an attribute of data element, the columns provide a well-defined structure for all the elements inside that table. The data can also have an attribute that makes that data element unique, this identifier is called a key attribute. To describe the relation between two tables, in each of the tables that are related it should be a foreign key. The well-defined schema on the tables and the relations, provide on this offering data consistency on the data elements. The write, delete, create operations on a particular table are validated against the schema and the relations. There a popular data base management system that enhance this offering like MySQL Oracle or Microsoft SQL Server. On the context of cloud storage, Amazon Database Service or Microsoft SQL Azure [4].

A data warehouse type can be used on scenarios when there is a need to store handle greats amounts of data without sacrificing the speed for ingesting and extracting value from it. The main difference between a relational database and data warehouse, is the way data is stored. For relational databases, the system stores for a single row all the columns, so the database engine can easily find specific data from a table. On the contrary, a data warehouse, data is stored in a columnar, this makes it easier to derive knowledge of aggregated information [5].

The nonrelational databases, this type of database englobes a data type that cannot be structured in a particular way, such as the columns on relational databases. There are a variety of storage approaches for this type. The key/value database provide a fast operation for handling the data. The document base, where database can store documents such as JSONs with a schema that can be easily modified [4]. This type of storage, provide an alternative to support semi-structured or unstructured data with the restriction on querying support, but with characteristics such as high-performance, availability and flexibility. This offering comes useful when the data that the system is handling does not follow a defined database schema and they will exist a horizontal scale. On this offering, information is stored on a pair of identifiers, also known as the key and an associated data, called value. The difference with the relation database, is the lack of a well-defined schema, this can be perceived on the reduction on the expressiveness of the queries but gaining a more scalable approach and with more configurations. Data can be scaled out by adding more resources to handle the operations and the configurability is facilitated by the few fields that data elements contain. On the context of a domain model that does not have many dependencies between their data elements, a key value storage can be a better approach. There is a well-known implementation of this offering: like Apache Cassandra, Couch DB or mongo DB. On the context of cloud storage Amazon simple DB, Amazon Dynamo, Google Big Table, between others [5].

The graph database stores the relations between data elements, so it provides the advantages of running algorithms to find paths between data. The time series databases, as the name implies, it provides a way to store events and have the capability to perform time related tasks [5].

Regarding the storage on cloud there are two popular options: The block storage provides a way to store data in a block, with the particularity that the system itself store in fixed sized chunks. Then when the system needs to retrieve data, the system first needs to localize the data from the different blocks, consolidate each part and finally retrieve them. This storage offering works well in scenarios when there should be a high availability and fault tolerance so if one of the servers fails, the data can still be retrieved [4]. The blob storage on the other hand, provide a way to store large files that can be pictures, videos, audios or any other format. Given that the use a table-based storage would provide a bad performance, this storage offering provide a way to handle these large data elements. The way it works is that elements are stored centrally and in hierarchical folders. Each of these elements has its own unique name inside the context of the folders that are stored, and the folders also have a unique, so a folder hierarchy can be followed to retrieve a specific file. This kind an offering storage can be found in traditional web servers and FTP servers, where files are stored in folders, and they can be accessed through the HTTP with the domain name, folder name and file name [4].

4. Storage Cloud Delivery Models

The cloud storage can be hosted in different manners, and there are three main deployments models that vary each other depending how the users access the storage [6].

The public storage cloud model provides an approach to store information on the cloud that can be accessed through the internet. The service provider must manage all the administrative tasks related to the storage. In this model a user pays for the consumption, and the cloud vendors takes the advantage of economies of scales to provide an inexpensive cost to users. Regarding some aspects like the security of the data each business must choose what is aligned with the business requirements [6]. In the context of an organization relying on the hardware management to a public cloud can be beneficial, especially when they take care of installing, supervising and maintaining their own hardware and this process does not take part of the core business. Relying these operations to public cloud provider like Amazon, Microsoft, Google can benefit the enterprise the sense that these vendors will provide a fully automated, scalable, resilient infrastructure and the organization will pay only for the resources that will be uses [2].

A private storage cloud model allow access to the information inside the client's intranet, and it is stored on cloud storage service. The client can build their own infrastructure to achieve or to outsource it. This provides a more custom solution, and it can be providing more layers of security than the public cloud model, using different security methods [6]. In a local private storage cloud, data is stored on the client's own premises and accessed through the intranet. The storage space is not shared with other organizations, so the storage solution can be made exactly as the business needs. [6]. In the context of a company that is part of a highly regulated industry, this type of cloud can be very suitable, given that the services are provisioned through private infrastructure, and this will be typically managed by internal resources. The use of private cloud can bring benefits such as the IT team can prepare the infrastructure on their own and a provide faster delivery times, and the advantage of a full control over the platform. However, using this model is usually associated with huge cost of ownership and over the years has becoming outdated approach [2].

The community storage cloud allows users to access to the cloud infrastructure if they are part of one the organization that belong to the community. This can be the case for universities, hospitals or enterprises that share a common concern and have shared requirements. The organizations in the community share the infrastructure costs and adopt the pay as you go model [6]. The community cloud holds the common data and functionalities that the organizations within the

community need. This is usually achieved by using a private data center that is controlled by the organizations. A data center of a third party can also be used, in this case the community cloud may be referred to as, outsourced community cloud, this is especially suitable when within the community there is no organization reliable to maintain the data center. It can be hosted also in an isolated portion of a public cloud, in this case referred to a virtual community cloud and it is generally the easiest approach to establish the infrastructure of the community [4].

5. Benefits

A cloud storage implementation offers advantages for organizations who utilize it. The business units within an organization can become more agile and dynamic, providing a better response to changes and planning. The costs of storing data can be reduced, given that the implementation of a pay per use model can provide an easy way to monitories the way the money is spent on data storage. An organization can also use the economy of scales, to provide a single storage infrastructure for multiple business units, giving the power to control the peaks of operations over data. The data resource pooling allows an organization to provide more storage depending on the needs of the business in an efficient way. Organizations can take advantages of the elasticity that a cloud approach provides. The demand of storage and computation power to perform over data can be provisioned in an elastic way considering the behavior of the demand. This takes place in scenarios where a business unit demands more resources for a specific task and after this task is completed, the associated storage and computing power can be released to the virtual storage pool or to give it another business area. Another advantage is the rapid provisioning, with this there is a holistic way to the resources and an automated process to provision the storage. With this rapid provisioning, teams become more agile given that there is not a delay on the infrastructure provisioning. This also bring a benefit of reducing the time on the way resources provisioning is handled, therefore providing more time to focus on core competencies of each business units. In the context of an organization, this implies a faster time to launch services and products on the market [6].

Organization also requires a database platform that supports different features and a database in the cloud can provide an enhance for these elements.

A secured database environment is required to prevent data theft, provide integrity and confidentiality or to avoid unauthorized users. A database on the cloud can provide encryption, which is a key feature for maintaining a secure database, for instance the SSL communication and protocol can help to implement an encrypted storage.

Achieving a fast performance on a database is critical for business nowadays, a cloud solution can provide a fast performance database by tunning some parameters to accomplish this. There are some algorithms that vendors utilize to automatically tune the parameters, that are based on benchmarks and the analysis of other instances. For example, PostgreSQL requires setting several parameters to achieve a good performance, when using this instance on a cloud storage solution, business doesn't need to set these parameters. Vendors also provide multiple options to enhance performance, like the type of disk where the instances are running.

The reliability feature is key for any organizations, in on-premises solutions there is the possibility that the hardware where the instance is deployed fail. This can have a huge impact on operations of the business, given that database could become inaccessible or could have an impact on the performance. With a cloud solutions approach, the vendors take care of the hardware, eradicating the need to constantly monitoring the hardware instances or having a possible impact on the business operations. Another important feature that clouds provides, is the ability to create

redundant and durable databases. This is achieved by vendors providing effective ways to create replicas and backups for databases deployed on cloud, given the possibility to the business to recover from failures or disasters.

The scalation of database instance is a factor that must be considered in an organization environment, infrastructure that is designed to scale vertical is outdated. The modern techniques used by the cloud vendors involve the possibility of scaling in a horizontal way, meaning that data is across multiples machines to scale out efficiently. In a context where users are accessing information from different regions of the world, having a geographically distributed infrastructure can create a huge impact on the performance of the platform. A database cloud instance allows users to perform deployments of the databases in different regions, given that most of the providers are distributed across the world.

Having a high availability system is crucial for the operations of organizations and most infrastructures in on-premises model have a single point of failure. A single point failure refers to a component inside the infrastructure that can take down the whole application or cause a downtime, for example a router, a database server, a hard disk, among others. Cloud vendors provide environments that mitigates this, by providing redundancy and backups tools. These tools provide a high availability of the services that the organization is utilizing, by giving several means to control and configure the availability of the databases.

A cloud database can enhance the teamwork to collaborate efficiently. Given the context of a business with employees across different regions, it is crucial that the team members can collaborate in a smooth way. For example, a group of developers that have the need to develop the product in an incremental way usually need snapshots of the database. This snapshot will help to deploy changes, test them and revert them. A cloud solution can provide the tool to easily create snapshots of databases [7].

6. AWS

Amazon has an established cloud hosting platform known as Amazon Web Services (AWS), which offers a set of cloud-based services including computer, storage, databases, applications, among others. The growth of AWS in the last years make it nowadays the most popular platform for managing and deploying applications and databases on the cloud and is the largest platform regarding cloud computing on the industry. AWS has presence in sixteen regions and 44 zones with plans to expand to five more in the future. A peculiarity of this platform is that customer have the freedom to choose different zones when deploying and hosting a cloud application [7].

Amazon RDS is service that allow the user to create and manage a database in the cloud, using the model database as a service. It supports several relational databases such as MySQL, MariaDB, PostgreSQL, Oracle and SQL Server. These solutions provide the capabilities to scale databases depending on the workload, with a faster and easy setup and deployment on different environments. Amazon RDS can be deployed to different zones for high availability [8]. The AWS RDS console provides the user different features, such as: Provisioning the database, an easy way to upgrade software, an easy process to replicate data on different databases, an economical way to resize the capacity adjusting to the demand of the application and a visual tool to make diagnostic of data of the instance that is being utilized [7].

The Amazon portal [9] states that with the use Amazon RDS the launching, operation and scale of PostgreSQL can be done with ease, supporting the versions from 9.6, 10 –14. Given the flexibility to scale and resize the hardware capacity of the instance in a few clicks and managing the complexity of the administrate tasks like software installations and updates, replication and

backups. The benefits of this cloud solutions are: An easy way to manage the deployments, using the AWS Console a user can run a pre-configured instance and utilize a granular control to manage the database. It provides a new storage hardware (SSD) for the PostgreSQL database, providing a good relation between the cost and effectiveness regarding the workloads. RDS also provide an automated backup enabling the recovery of the database until the user explicitly deletes it. The feature Amazon RDS Multi-AZ deployment creates a way to replicate data into different available zones improving the durability and increasing the availability. Another important feature is the Amazon CloudWatch feature, that provides a way to monitor and manage the metrics regarding the CPU, memory, file systems, among other compute/storage capacities. Regarding the security, RDS provide a high level of security with an Amazon Virtual Private Cloud and encryption using SSL.

7. Azure

Microsoft introduced Azure in October 2008, which is a cloud platform that nowadays is one of the competitors of AWS. It offers a variety of services, like compute, storage, networking and storage. Azure has presence in 36 zones, competing with AWS. Among different services, this cloud platform provides a cloud service called Azure Database for PostgreSQL, which is a DBaaS for PostgreSQL. For this service Azure offers different features like a multi-factor authentication, encryption of data, protocols like SSL/TLS, a key vault service to protect keys and passwords and an access management. The PostgreSQL instance on azure provide an entirely managed database service that users can deploy with ease. It is a service that provides a high availability, with a plenty of extra features and replication at no additional cost [7].

The Microsoft Azure portal [10] states that the Azure Database for PostgreSQL provide a solution with a fully managed PostgreSQL database, where the user can focus on the innovation and not in the managerial tasks that a database requires, supporting the versions from 10 –14. It provides three deployment modes, single server, flexible server and hyperscale. The PostgreSQL solution using Azure provide the following features: Support PostgreSQL extensions to extend the functionality of the data base this includes support for geospatial data, rich indexing, among other features, a flexible server with high performance and horizontal scaling that provide a solution with heavy workloads given the chance to the user to control in a more granular way the functions and a feature that offers quoting from the Azure portal [10] “best-in-industry protection against intellectual property (IP) risks”. They also offer a high availability, fully managed and intelligent performance PostgreSQL solution.

8. Conclusion

Cloud computing has gained a lot of popularity on recent years and given the amounts of data that we are generating, the use of databases and storage on cloud has captured a lot of interest. There are a lot of benefits that a cloud-based solution provides to organizations and users in various domains. In the context of a storage and databases, a cloud model can improve various areas within a business. Cloud vendors provide various ways to storage data, from nonrelational databases to more complex solutions like data warehouses. Amazon Web Services and Microsoft Azure provide different cloud database solutions, and both provide very robust solutions with different features that adapt to the user needs. There is no doubt that in the future, we will generate even more data, giving new opportunities to cloud vendors to come up with new solutions.

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SMARTER THINGS – A QUICK OVERVIEW OF ARTIFICIAL INTELLIGENCE IN THE INTERNET OF THINGS

Marek Polak
Faculty of Computer Science, Dortmund University of Applied Sciences and Arts
Dortmund, Germany
marek.polak003@stud.fh-dortmund.de

Abstract: *The Internet of Things has multiple definitions that can be summed up as devices exchanging and acting on data. Data Science and Artificial Intelligence (with a special focus on Machine Learning) serve as means to better analyze data. This literature review examines some select recent combinations of those topics in the spheres of transit, healthcare, industry, and habitation.*

Keywords: internet of things, artificial intelligence, digital transformation

1. Introduction

It would seem that we are surrounded by 'smart' things. Phones in our pockets are smart. Watches try to measure our sleep quality [1]. Cars are trying to drive themselves [2]. But how can all those things come together to make themselves even more intelligent? This review was born out of simple curiosity: how pervasive has the 'smartness' of devices become throughout a modern human's life? The paper's purpose is to consolidate the context in which AI-enhanced IoT solutions are used.
The article is organized as follows: Chapter 2 shortly explains the base concepts of the Internet of Things, data science, and Artificial Intelligence. Chapter 3 presents some selected literature sources showing the combination of those two concepts, or 'smarter' things, in four major spheres of our civilization relevant to everyday life: transit, healthcare, industry, and habitation. It also contains a short discussion on the matter. Chapter 4 is a summary.

2. Base Concepts
2.1. Internet of Things

Internet of Things, henceforth called IoT in this paper, has multiple definitions focusing on the concept's different aspects [3]. They can be summed up as a paradigm in which devices of various capabilities and purposes ("things") exchange data over a network without ever-present human intervention [4]. Interest in IoT is growing rapidly, with an expected global value of up to $12.6 trillion by 2030 [5].
Things at the core of IoT can be divided into two major categories: sensors and actuators. *Sensors* are devices acting as data collectors, providing some output value representative of the measured phenomenon, e. g. temperature or pressure. IEEE 1451.2 defines several different types of sensors based on their modes of operation, such as buffered sensors or event sequence sensors. *Actuators*, on the other hand, are devices that accept an input signal and perform a physical action as a result. Sensors and actuators adhering to IEEE 1451 can describe themselves to the network, making automatic configuration easier [6].
Applications typically associated with IoT are e. g. *home automation*, *smart healthcare, agriculture,* and *manufacturing* [7]–[10].

2.2. Data Science and AI

Data science is an interdisciplinary field at the intersection of statistics and computer science. It aims to better process and analyze data through the application of modern computing power and algorithms to statistical methods [11]. IBM defines the data science lifecycle as the following sequence: a) Capture the data, b) Prepare and maintain, c) Process, d) Analyze, and e) Communicate [12]. The data-scientific approach seems like a natural fit for massive streams of data generated by IoT solutions, though some things might need attention when adjusting from a human-driven process [13].
Artificial Intelligence, or AI, is a broad term describing the "science and engineering of making intelligent machines" [14]. A particular subset of AI called *machine learning* (ML) is of great interest. ML is a study of algorithms that improve through experience, mimicking the process of learning [15]. Three main areas of ML shown in Fig. 1., divided by the general principle behind the algorithms, are *supervised learning*, *unsupervised learning,* and *reinforcement learning*. Supervised learning methods aim to find an optimal hypothesis for a provided training data set, with the idea that the fit can be generalized onto unknown data. Unsupervised learning algorithms are not provided with labeled data sets for their training and are used e. g. for detecting clusters within data. Reinforcement learning focuses on defining rewards and punishments, with the algorithm trying to find the optimal behavior by maximizing its score [16].

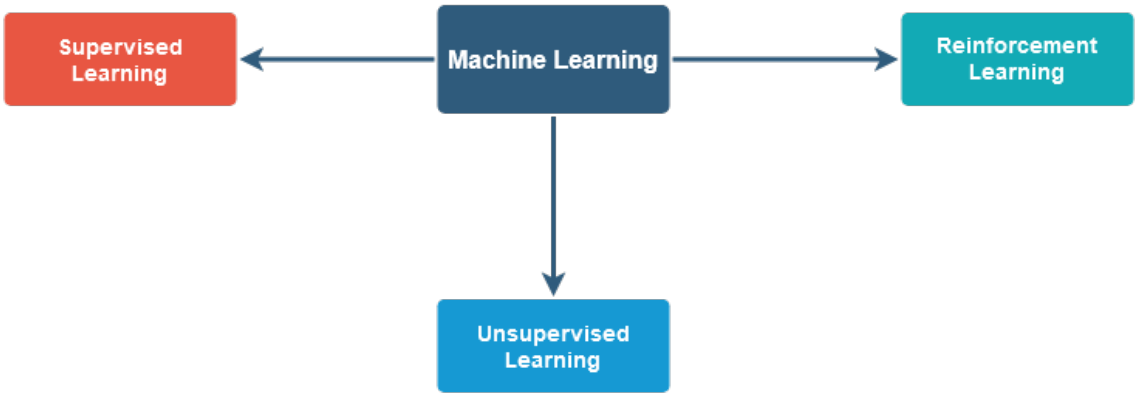

Fig. 1. Basic division of machine learning methods, source: own, based on [16]

3. Selected Literature Review

3.1. Transit

Abdellaoui Alaoui and Koumetio Tekouabou [17] describe a smart system for bike sharing management. Their proposed framework uses smart city IoT solutions to collect data relevant to the bike sharing system and an ensemble machine learning method to predict the available number of bike shares. Simulations of the system were performed on historical data from London's bike sharing system in years 2015 through 2017, with 5-fold cross validation. The variables included in the ML model included e. g. real and perceived temperature, wind speed and (categorized) weather type and season. Pawłowicz, Salach and Trybus [18] propose a system for traffic monitoring within smart cities. It would utilize 5G cellular network and RFID tags as data providers and a Cloud-based ML model to predict traffic jams and would work in conjunction with navigation applications and autonomous vehicles to redistribute traffic. They proceed to point out relevant ISO/IEC standards and describe possible implementation through

MQTT protocol and Azure Cloud Services. Their solution was only tested in laboratory conditions with limited data input, but with the used technologies' good scalability they remain convinced of the system's performance. Mohseni, Pitale, Singh and Wang [19] review possible ML strategies for AI safety aspects in autonomous vehicles. They present algorithms that could find use in two AV safety strategies, Safe Fail and Safety Margin.

3.2. Healthcare

Healthcare is a high criticality area that has potential to greatly benefit from AI-enriched IoT solutions. Ed-daoudy and Maalmi [20] proposed a system architecture utilizing IoT devices in conjunction with Apache Kafka as well as Spark data analytics suite. The system would receive a steady stream of real-time big data from a patient's wearables, medical data feeds, social media activity etc. to actively predict health crises and send alerts to relevant emergency services. In the authors' implementation they utilized Spark's decision tree ML model. They have performed tests of their system against scenarios of heart disease and diabetes, with datasets taken from Heart Disease database (processed.cleveland.data set) and Kaggle respectively. Their dataset split was 70%-30% for training and testing. The two simulated data providers were sending "approximately 270000 events per second per node", which were consequently split into topics by Kafka and forwarded to Spark streaming. Farahani, Barzegari and Aliee [21] propose a Collaborative Intelligence concept in their case study on arrythmia detection. They utilized a lightweight shallow neural network as an on-chip ML model present on the Edge devices for making individual predictions and Cloud-based convolutional neural network for conducting heavy tasks like net training. Those authors' idea was to define a healthcare system that would shift from hospital-centric to patient-centric view. Farrokhi, Farahbakhsh, Rezazadeh and Minerva [22] reviewed applications of IoT and AI in *"smart fitness"*. They divided IoT devices used there into wearables (e. g. gloves or smartwatches) or non-wearables (e. g. smart gym equipment), with AI element of the system being movement analysis. They also reviewed social aspects of IoT-powered fitness, noting resulting topics of user profiling and recommendation systems. Furthermore, they reviewed specific applications of supervised, unsupervised, reinforcement and deep learning in this field. Their conclusion was that unsupervised learning's main use is to preprocess the data for other ML methods and that reinforcement learning performs best at motivating a system's users.

3.3. Industry

Hansen and Bøgh [23] examined usage of IoT and AI in the context of manufacturing small and medium enterprises. They found in their review that most of the academic work there focused on cloud aspects of IoT solutions and that necessary technical expertise can discourage use of AI and IoT, let alone their combination, in smaller companies. However, they have also found that the entry level for the application of those technologies has been lowered with introduction of relevant services on platforms like Microsoft Azure. Wan, Yang, Wang and Hua [24] presented an AI-enhanced four-tier architecture concept for a cloud-assisted smart factory (CaSF). They described the four layers of a CaSF (*smart device layer, network layer, cloud layer, application layer)* and proceeded to suggest AI algorithms to improve various elements of those layers. Amongst their suggestions were e. g. the use of convolutional neural networks and deep learning in predictive maintenance and application of reinforcement learning for autonomous cloud resource distribution. Ayvaz and Alpay [25] proposed a predictive maintenance system utilizing IoT sensor data and AI methods in real-time. Devices on the assembly line would collect the sensor data and stream it in real time to storage and analytics

suite. The suite would train an ML model, which would then proceed to continuously analyze the data stream from the IoT devices and notify of upcoming failures. Their architecture bears a resemblance to Ed-daoudy and Maalmi's system mentioned earlier in Chapter 3.2 [20]. Indeed, it would seem that the two systems are an application of a similar thought process on different domains. Perhaps designing a generalization of such an architecture could be an interesting and useful topic for future work.

3.4. Habitation

Jaiar, Lingayat, Vijiaybhai, Venkatesh and Upla [26] described a proof-of-concept experimental setup integrating ML with small scale IoT. They trained a Support Vector Machine model to recognize a limited selection of basic emotions from user's facial features and e. g. turn on a fan when the user is angry. The idea behind that study was to show the potential of combining ML and automation systems. Chen, Lin, Kung, Chung and Yen [27] described and implemented a smart energy management system for smart homes extensively utilizing AI. Their system included edge computing with an embedded Artificial Neural Network.

3.5. Discussion

It can be seen that enhanced data analytics provided by the application of AI is used to improve many important spheres of modern civilization, with examples given in healthcare, transit, industry and habitation. Machine learning methods operate on digital datasets, the bigger the better, especially in the case of supervised learning methods. Internet of Things serves as a bridge between the digital and the physical, extending the direct reach of AI into the real world and providing it with its own senses and means of autonomous data collection and action execution. The next possible logical step could be integration of all those spheres into one big ecosystem, creating a symbiosis between the user and the platform. An example might be designing smart cities as faux-living entities composed of multiple cooperating IoT-AI solutions looking after their citizens.

4. Conclusion

This work has presented examples of AI-enhanced IoT architectures in four major spheres of human life. It also attempted to consolidate those contexts into one bigger idea and propose a research project in the form of a smart city as one overarching solution composed of directly cooperating subsystems.

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COVID 19 AND WORK 4.0 - EMERGING CHANGES AND THE FUTURE COMPETENCIES: A LITERATURE REVIEW

Md Nafis Istiak [1], Shahida Banu Shaik Abdul Khader [2], Sara Azmin[3], Alketa Alia[4], Jurgen Shaba[5], Dzmitry Hryshyn[6]

[1] Faculty of Business Studies, Dortmund University of Applied Sciences and Arts
[2,3,4,5,6] Faculty of Computer Science, Dortmund University of Applied Sciences and Arts
Dortmund, Germany
[1] md.istiak001@stud.fh-dortmund.de, [2] shahida.shaikabdulkhader003@stud.fh-dortmund.de,
[3] sara.azmin001@stud.fh-dortmund.de, [4] alketa.alia003@stud.fh-dortmund.de,
[5]jurgen.shaba001@stud.fh-dortmund.de, [6] dzmitry.hryshyn001@stud.fh-dortmund.de

Abstract: *COVID-19 has had a huge influence on employees all around the world. This comprehensive overview of past research focused on the changes that took place during the pandemic in the work environment and its development to work 4.0, aims to make sense of the consequences for employees and teams. The focus of this study and preview of this literature is on (a) emerging changes in work practices and employees, (b) new work 4.0, and (c) new skills and competence required by workers. This broad-scope analysis offers a holistic approach to understanding COVID-19's implications for work and employees, as well as providing the groundwork for future study.*

Keywords: COVID-19, employees, work from home, teamwork, work 4.0, skills and competencies

1. Introduction

The world constantly changes and fosters companies and employees to follow the change just to stay in the same place. Thus, some skills required yesterday could be totally useless today or tomorrow. That happens because of changing work environment. Starting from the 18th century till now we have a long road from Work 1.0 to Work 4.0. And the pace of change is constantly accelerating [1], [2]. To fit the market needs personal skills should be adopted to satisfy current or near-future requirements for workers. Each era requires specific skills and their combination to successfully do the job. Many studies and research, especially for Work 4.0, were conducted to classify and specify the skills and competencies required for the jobs [3], [4]. Aside from the industry innovations the other events of human life could significantly change how people work. COVID-19 in 2020 was such an event. It forced people to start working from home (WFH), foster virtual teamwork and distributed team's communications and collaborations. The employees and employers faced unique challenges to solve on the quite long period in the uncertain environment [5], [6]. The paper will review changes and events that happened last couple of years and how and why it has changed the way people and what does the industry is looking for in future employees.

2. Literature Review

2.1. The 2020 COVID-19 Pandemic Lockdowns and Remote Work

The coronavirus was initially discovered in China in December of 2019, and it quickly spread over the world, resulting in a global pandemic (World Health Organization [WHO], 2020). To stop the spread of Covid-19, most nations enforced lockdowns. Lockdown includes the shutdown of various facilities and limits on leaving home for non-essential work, depending on the country. Organizations needed to find strategies to keep their company solvent while keeping their employees productive, which resulted in a significant shift to work-from-home practices. According to Isometrics and GWA's global survey (2020), 88 percent of respondents worked from

home on a regular basis in 2020. Employees in most nations were still obliged or encouraged to work from home, if practicable, by early 2021 [7].

2.2. Covid-19 and the Workplace

COVID-19 is a worldwide health emergency as well as a global financial threat. Employees and employers have faced a variety of unique difficulties as a result of the company and industry shutdowns that were established and mandated around the world to stop the virus from spreading. Individual communities of lockdown employees were overnight turned into (a) "work from home" (WFH) workers, (b) "essential" or "life-sustaining" workers (e.g., emergency room medical personnel and supermarket employees), or (c) employees who have been furloughed or laid off and are looking for the equivalent of unemployment compensation in their home country. Organizationally, the economic shutdowns and policy changes are likely to (a) fundamentally alter some industries, (b) accelerate trends already underway in others, and (c) create possibilities for new industries to emerge, as is customary in the past [5].

2.3. Emergent Changes in Work Practices

At the same time as COVID-19 threw typical work routines into disorder, it accelerated previously established trends concerning the migration of work to online or virtual environments. However, whereas WFH used to be very responsive to employee wishes, COVID-19 compelled many employees to work from home, making it impossible to apply previous findings [5].

3. Research Questions

During the COVID-19 pandemic a lot of areas in everyone's life were affected, with one of them being the work environment. But what are the impacts that the pandemic had on the work environment and what issues did individuals face during this period of change? These two topics will be covered in section 4.1 and 4.2 of this paper. In section 5.1 and 5.2 the question of how the work environment developed to work 4.0 will be analysed. With big changes come also big challenges, which require new skills and competencies to be acquired for everyone. These important topics will be further examined in this paper, specifically in section 5.3 and 6.

4. Emerging Changes - Impacts and Issues Faced

COVID-19 has had a huge influence on employees and workplaces across the world. The consequences for people, teams, and work organizations are examined in earlier studies are covered in Section 2. Emergent changes in work practices and the impacts caused for employees and organizations are the subjects of this section.

4.1. Emergent Changes in Work Practices

In this part, we are going to concentrate on two vast changes faced by employees because of covid, i.e., work from home and virtual teamwork.

4.1.1. Work from Home

COVID-19 disrupted regular work patterns while simultaneously accelerating trends in the movement of work to online or virtual settings. However, although WFH was previously typically responsive to employee wishes, COVID-19 pushed many into Mandatory Work from Home [5]. Before the outbreak started, the majority of employees had little or no experience with work from home, and many had never worked at home before the lockdown. As a result, many found themselves in a completely different working situation that came unexpectedly and abruptly. [6].

So, we can state that COVID-19, has initiated a global workplace shift. Previously, organizations could only theorize about new forms of work; now, the COVID-19 emergency has pushed them to act, such as switching to wholly new modes of working and even reimagining new kinds of work to meet the new pandemic conditions. According to Ancillo et al., the future workplace will not be the same as it is today, as this is generally viewed as a transition time, nor will it be the same as it was previously before pre-COVID-19 conditions. However, it will definitely become more inclusive, mature, and unique, taking into account both employee and corporate demands and striking a healthy balance between them. As a result, businesses must identify the most critical processes inside their company for re-evaluation by both management and staff [8].

Employees frequently find it difficult to draw a line between work and nonwork activities. The forced confinement of employees during the COVID-19 outbreak has compounded the situation even further [5]. Kniffin et al.'s [5] research also present evidence that such remote and computerized monitoring can lead to reduced creativity among individuals at a micro level.

4.1.2. Virtual Teamwork

In the pre-COVID workplace, environmental capabilities supported a wide range of professional and personal interactions. The speed of change associated with working outside of co-located contexts was increased dramatically by COVID-19 and thus organizations have adopted virtual communication practices [9]. Multiple obstacles hampered the team's capacity to coordinate, communicate, and work together to achieve common goals [10].

To communicate with other employees, they must first book an appointment using video-conferencing platforms, and they must also specify a topic for the discussion. As a result, talks become much more purposeful and focused, increasing efficiency. While lowering ad-hoc gatherings reduces physical interruptions, it also makes information transfer and spontaneous cooperation more difficult. On the other hand, removal of a casual gathering has a significant impact on new worker's confidence in asking inquiries regarding their job tasks, since they can no longer readily stroll over to a colleague [9]. According to the authors Lajčin and Porubčanová [11], Virtual teamwork has also shown decreased productivity, more demanding communication between teams, and subjugation of originality among team members [11].

Job and workplaces are continually rebuilt, reformed, and reconstructed, resulting in changes in the people who do the work, the arrangements around the work, the technology employed in the execution of the work, and even the purpose of the work [12]. Many teams have started daily stand-ups (formal meetings) as a result of the forced removal of pre-COVID formal gatherings, which improved communication and coordination between team members [9]. That team collaboration is particularly vulnerable to the effects of a pandemic because it frequently entails face-to-face connection and coordination across people, time, and location, making social distance and virtual work a significant departure from traditional teamwork environments.

4.1.3. Team Management

COVID- 19 crisis is unique in terms of rapid spread and the rate with which the virus swept across countries, wreaking havoc on the global economy. In terms of knowledge, resources, and abilities, not all businesses are prepared to deal with the pandemic situation when it started and are still struggling to handle business smoothly. Managers and human resource professionals must devise inventive strategies to keep operations running while protecting the safety of their personnel [5, 13]. In the crucible of a crisis, the role of leaders was to determine the organizational outcomes that have a broad influence on personnel at all levels [5]. COVID-19 has created a difficult position for organizations all around the world.

4.2. Emergent Changes for Employees

Aside from the immediate effect of COVID-19, individuals are expected to face a wide range of social-psychological, health-related, and economic expenses as a result of the pandemic, particularly those whose employment is virtual or distant. While the previous part of this work focused on people whose jobs were virtualized, this section is relevant to everyone who has been touched by COVID-19.

4.2.1. Stress, Health and Well-Being

Workers who were obliged to WFH and those who were laid off during COVID are likely to be badly impacted by the loss of social connections. While we noticed that virtual contacts are lacking in-depth, a further severe consequence of online communications is that misunderstandings due to the lack of nonverbal indicators are likely to heighten employee's fears of interpersonal rejection, adding to loneliness. Handshakes are also proven to be beneficial for establishing social connections [11].

Employee's loneliness can also be a result of virtual working owing to a lack of engagement between employees, a lack of peer guidance, and a lack of one-on-one communication, all of which will be a source of stress that can harm employee's mental health [13]. Employee's emotional commitment, affiliative behaviors, and performance have all been proven to be negatively impacted by workplace loneliness [5]. In their attempts to aid employees and their businesses in this challenging and stressful moment, employees find themselves exposed to job loss or further stress [14]. To address this, companies and their leaders could consider offering employee assistance programs, such as counseling, therapy, and training, as well as psychological resources such as feedback, support, and motivation through frequent video chats with their staff [5].

4.2.2. Unemployment

COVID-19 forced the closure of whole businesses including travel, hospitality, sports, and entertainment, resulting in the loss of millions of jobs worldwide in early 2020. Individuals who are jobless may endure a variety of stress-related repercussions, including despair, anxiety, and physical problems, in addition to losing money. As the pandemic continues, the data on rising jobless numbers and relative gains and losses changes [14]. There are negative effects for those who stay employed, the fear of losing their job, in addition to the implications of unemployment for people [5].

Furthermore, employment insecurity following COVID-19 is likely to induce increased risk-taking and presentism among low-paid workers. Finally, if economic and social inequality rises as a result of COVID-19, civilizations may face social discontent and political instability. As a result, more organizational efforts to reduce inequality should be taken help to prevent the negative spiraling [5].

5. Work 4.0

With the progression of technology and usage of digitalization, the work environment has already changed significantly and continues to change over time. This transforming world of work can be described with the term work 4.0.

5.1. Evolution of Work 4.0

It all started back in the late 18th century, with the invention of steam engines. This is Work 1.0 where the revolution began with new organizations and factories. After nearly 100 years, lately, in the 19th century, motorcars were innovated and mass production was first introduced. Powering engines and machines in the factories were made possible with electricity and other resources, not just steam. This is the second revolution of work, Work 2.0, where industries witnessed evolution with the usage of electricity. As the factories expanded, so did the quantity of employees and work pressures. Which caused many social problems to arise in the workplace. The German Reich substantiated the first social insurance system at this stage. The third revolution Work 3.0 took place with the increase of using computers and several possibilities of automation in companies. Work 3.0 was introduced with the social market economy. With this, the employees finally gained many rights as well as a high level of social security at this point. This phase can be noted as the beginning of digitalization. For the expansion in technology utilization, the need for servicing surged as well. Consequently, national boundaries have become less essential, while market globalization has expanded. In the 1990s, the faster expansion of computers and Internet connectivity indicated the era of the fourth industrial revolution. It is still going on today [1], [2].

5.2. Work 4.0 - A New World of Work

Work 4.0 outlines all these uncountable possibilities and opportunities for the development of a future work environment. It reflects how automation is renovating the workplace, how it is influencing the work quality and work relations as well. Work 4.0 takes into account the speedy increase in computer-controlled technology in the working world and the corresponding change in how people deal with increasing automation and digitization for the time being of big data. The idea of Work 4.0 comes from Industry 4.0 that is known as fourth industrial revolution and purely focuses on the industrial branch alone. Whereas Work 4.0 emphasizes the work-life of all areas [3].

Digital transformation happens to be one of the principal features of the 4.0 world of work. Most of the processes are digitally authorized or fully automated, employees may work at any time and from any location, and the entire economy is connected internationally. Currently, very well-known scenarios work from home, working from distance in a virtual team across multiple locations, and virtualized cooperation of the entire company, which represent a common corporate identity and service portfolio to the customer and are commissioned as a virtual unit are all examples of workplace flexibility. The Internet and new technologies have a huge impact on the economy as well as the society, and the fast expansion of information and communication technology is a high-priority aspect in an organization's potential to compete and develop [15], [16].

5.3 Challenges of Work 4.0

The transformation of the work world from 1.0 to 4.0 has revealed that work is getting more and more pleasurable, but also more complicated. Companies face significant challenges subsequently for the increasing needs of today's working world. In order to be fit for the future workplace, employers must prepare themselves and their staff for what is coming. Amidst the upgrading of technology, the companies confront obstacles like resources accessibility and experienced expertise to cope with the trends ongoing. Not just big companies, even medium and small companies go through this situation. For instance, Trendy topics at present like big data as well as cloud computing are considered both complicated and expensive for most the medium and small size companies [17], [18].

As a fact known to many, the greatest number of populations in Germany are elderly person and this is a reason of shrinking German society. As the number of the young age group is not sufficient, it is getting difficult day by day to get skilled young employees in the companies. Many businesses' growth is slowed by a shortage of employees. In addition, less skilled employees are likely to lose their jobs as they are replaced by new highly skilled employees. The digital world today has requirements that frequently changes from one day to the next based on users' need. Agile project methodologies have been designed in order to be able to respond to quick changes. Such solutions need not just technically understanding, but also a new way of thinking and, in certain cases, a shift in company culture. Companies must foster this transformation. The employees have to be trained further to adopt the changes in the workplace. To summarize, likewise every previous revolution, Work 4.0 contains its own benefits and challenges. Aiming to make the best use of the workplace benefits, the challenges must be overcome gradually [17], [19].

6. Skills and Competencies of Work 4.0

Numerous studies and research have been carried out in recent years on the required competencies of work 4.0. Based on the studies and analysis, the key competencies and skills of work 4.0 can be classified into various categories. In this paper, we have figured out and classified these competencies mainly on technical aspects, intrapersonal aspects, interpersonal aspects, and ICT-related aspects [3], [4]. Apart from this, a few other sides have also been mentioned here.

6.1. Technical Competencies

Several studies are showing the importance of knowledge and skills in Big data in recent years. It is a means by which a larger volume of data sets is collected and investigated. Secondly, individuals should possess adequate knowledge on Digital transformation based on which new information and communication can be carried out vastly. Another key aspect of technical competencies is Industry 4.0 or the fourth industrial revolution. It's a process by which automation and interconnection are established in production and supply chain sectors by an efficient and flexible production system. Last but not the least, skills and competencies on crowd working, by which works are done in digital platforms by distributing the task to crowd workers and splitting the tasks into smaller parts [3].

6.2. Intrapersonal and Interpersonal Competencies

Several studies have found that, soft skills and people skills that are most crucial for an organization to cope up with the issues and challenges. The main tasks of humans will be to accomplish non iterative, mental, and physical works based on their superior knowledge, experience and skills in workplaces [4]. For this purpose, humans should have the intrapersonal and interpersonal skills and competencies.

6.2.1. Intrapersonal Competencies

Intrapersonal competencies refer to the lifelong learning of any person from the time being. It is the internal ability that helps to face challenges, cope with empathy and give self-confidence. Such intrapersonal competencies can be:

i. **Critical thinking:** It is about using logic, hypothesis, common sense in decision making and finding the strength and weakness of any solutions.
ii. **Sense making:** It is about understanding the in depth meaning of any visual, written and spoken terms.
iii. **Adaptive thinking:** It describes the skills of thinking out of the box and provides solutions.

iv. **Self-direction:** It helps to instruct, coordinate, command individuals in learning, performing, operating issues, challenges, and tasks [4].

6.2.2. Interpersonal Competencies

Interpersonal competencies are the soft skills that help to interact, cooperate and connect people with each other. It is a must-have social skill. Various types of interpersonal competencies that individuals must possess are:

i. **Communication:** It is the skills with which people can share information, solve conflicts, and listen effectively to others.
ii. **Collaboration:** With the 88help of this competence, an individual can work efficiently, become a good team player, and support onshore or offshore teams.
iii. **Intercultural competency:** It's a great competency that helps any individual to learn and respect different cultures, norms and interact with diversified people [4].

6.3. ICT - Related Competencies

Recent studies have intensified the importance of ICT and ICT-correspondent skills for each individual. It emphasizes the ability to deal with online sources and modern technologies such as mobile, computer, and various online platforms. In the future, digital skills will be an elemental aspect of an individual's competencies baseline [16]. ICT-related competencies are first of all, ICT fluency which helps to use any technology, taking advantage of modern technology. Secondly, social media literacy that helps to develop content for better communication through social media. And lastly, consciousness about information security that helps to take decisions on which information can be shared on social platforms and helps to protect personal information from being misused [4].

6.4. T-Shaped Skills Framework

A study has emphasized the importance of skills development and suggested one framework of skills. It is called a T-shaped framework of skills. The horizontal bar of the T shape represents the competencies, core literacies, and mindset & talent. The vertical bar of the T shape represents the collaboration of a cross-functional team with expertise [4].

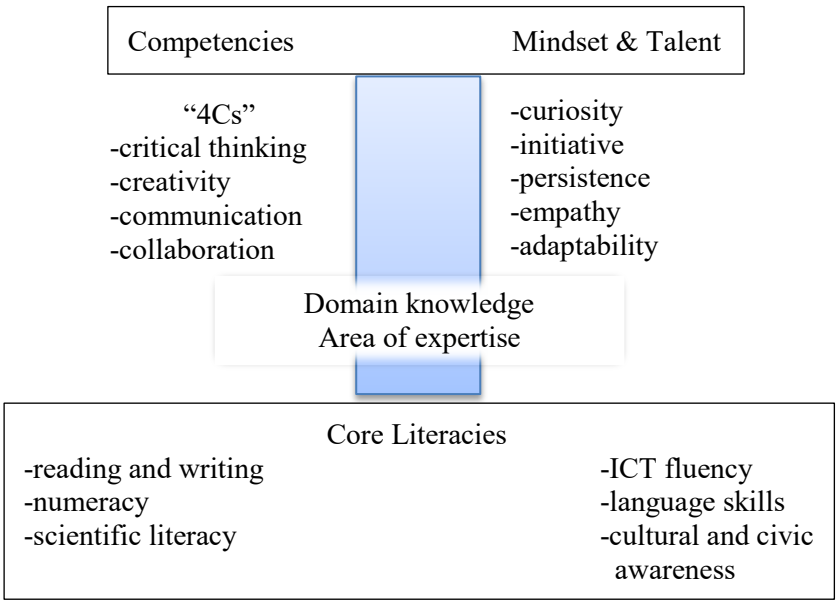

Fig. 1. T-shaped skills framework [4]

Alongside these above-mentioned competencies, individuals should have the capability of flexible working time and location. It is a competence that allows an individual to balance work and personal life. Even though working time and location will be flexible, they should be maintained in an organized way so that there is no adverse effect of it on physical and mental health. It is also essential that individual gain the trust of works and executes the tasks within the boundary of time [16].

Another significant skill, competency, and knowledge that an individual should possess is agility. In the modern Work 4.0 environment, agility is a prerequisite potentiality. Agility refers to the knowledge of agile methodology. An individual needs to have insight into the agile process, user story, DoD, sprints, as well as agile management tools such as Jira, Trello, Confluence. They should also have proficiency in MS Office, MS team so that virtual team operation can be performed efficiently [20].

7. Limitations and Future Scope

Although Work 4.0 talks about worktime flexibility and working virtually from anywhere of the world. Implementation of these is yet not possible in current world of work in many sectors. Many still have to attend their workplace physically to do their jobs. For instance, in a grocery delivering company, the employees of the IT team can work virtually but their employees for the purpose of delivering must be present physically. The same scenarios can be seen in any manufacturing industry as well where many people are working in the same line and same floor. Several of such similar scenarios we have witnessed and still witnessing in the time of COVID-19.

Another concern regarding the limitation of Work 4.0 would be the privacy of data and information. Due to excessive use of Big Data, Crowd Working and social media there will raise the risk of data security and people's privacy. Another concern would be intrapersonal and interpersonal competencies. The individual has to be proactive, determined, and confident in developing their intrapersonal and interpersonal skills to be able to better match with the diverse environment and people. Without these skills and competencies, it will not be possible to cope with the modern work environment.

In spite of having these limitations, Work 4.0 paves a new way for revolutions. In future, individuals will get more scope to broaden their knowledge and skills on technology centric environments. They will be more habituated working with new technologies for remote works. Meeting platforms like MS team, Zoom, WebEx will provide a better features and security. Managing, monitoring and controlling work from home will be more uncomplicated by using various DNSS server, Trello, Miro, Yammer [4], [14].

8. Conclusion

The paper provided an overview of recent industry changes and future trends with explanations of their nature and reasons. The main topics were covered Work 4.0, skills and competences now and in near future, COVID-19 challenges and outcomes. Digitalization and globalization are main features of Work 4.0. The transformation from Work 3.0 to 4.0 is forced by companies and employees must adopt changed work environment and master skills needed by companies. Structure and classification of skills and competences was developed greatly last years. Intrapersonal and Interpersonal competences, ICT and T-shape models were introduced and become an orienting for the companies and workers. Emergent changes in work practices were called by COVID-19. The concepts of Work from Home, Virtual Teamwork and Work-Life balance become well known for companies and employees. The challenges and outcomes of COVID-19 were reflected by management of companies and governments.

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TEACHING THE KAZAKH LANGUAGE IS THE BASIS OF LEARNING THE TURKIC LANGUAGES

Akmarzhan Akyzhanova [1]***, Saniya Kabdrgalinova*** [2]
[1, 2] *Languages department, International Information Technology University*
[1, 2] *Almaty, Kazakhstan*
[1] takmarzhan@mail.ru, [2] ksaniyabah@gmail.com

Abstract: *The main idea of this article is to substantiate and justify the benefits of knowing the Kazakh language as a foreign language in order to freely enter the world educational space, to justify its consideration as a dialect of a common language among the Turkic languages. Today the trend of holding world-class events is gaining momentum in all countries. At international forums, conferences and gatherings, we see the special role of interpreters in translating from one language to another. There is no doubt that the demand for journalists who speak their native language and a foreign language will increase day by day. In this regard, it is time to pay more attention to the training of translators who have a deep knowledge of simultaneous translation techniques. Teaching Kazakh as the basis of all Turkic languages in educational institutions will undoubtedly help to solve this problem. From time immemorial, it has been known that there are two main differences in their ethnic identity. The first and most important indicator is that their language is scientifically proven, the languages of Turkic-speaking peoples are studied and classified by linguists, and the second is the historical-ethnological, folklore and ancient Turkic heritage. Everyone knew that it was in the monuments. The similarity of their spiritual and cultural treasures along with their languages has always shown that they have the same roots. Therefore, today's situation provides a great opportunity to conduct large-scale research beyond the narrow framework of yesterday's overly politicized scientific knowledge. Given this opportunity, in the post-Soviet space, including Kazakhstan, Turkic studies has entered a new stage of development. Kazakhstan's independence opens a wide way for a deeper study of Turkic written monuments, other ancient traditions and concepts, which are the source of its spiritual and historical culture. Along with this opportunity, in the process of globalization, rapidly developing international relations are interested in the presence of multilingual (polylingual) translators and aspiring ordinary citizens. This article can be a motivation to achieve this interest.*

Keywords: educational and scientific space, education system, simultaneous translation, linguistic image of the universe, national identity, national ideology, Turkic-speaking countries, classification of languages, distribution of Turkic languages, number of speakers, dialects of one language, the place of the Kazakh language among world languages

1. Introduction

It is known that in order to freely enter the world educational space, the need to know a foreign language does not require proof. After all, language has become not only a means of communication, but also a great bridge of friendship, conveying international social, economic, cultural, historical and educational information. If we want to raise Kazakhstan's education system to the world level and act in accordance with international standards, we need to make many changes in the qualification requirements for specialists who speak world languages.

Currently, the process of holding world-class events is gaining momentum in all countries. At international forums, conferences and gatherings, we see the special role of interpreters in the translation from Kazakh into a foreign language, from a foreign language into Kazakh. There is no doubt that the demand for journalists who speak their native language and a foreign language

will increase day by day. In this regard, it is time to pay more attention to the training of translators who have a deep knowledge of simultaneous translation techniques [1].

2. Teaching the Kazakh Language is the Basis of Learning the Turkic Languages

One of the most memorable features of linguistics in the late twentieth and early twenty-first centuries is the transition from the internal system analysis of language to anthropocentric analysis, as in the study of linguistic phenomena, linguistic composition and grammatical approach. Modern linguistic research is aimed at studying the highest form of ideal representation of objective reality inherent in man, which is closely linked with his mind, consciousness, thinking, spiritual inner world. Scientist B. Tleuberdiev in his work "Linguocognitive aspects of Kazakh onomastics" mentions that ‘the issue of 'man and language' is very relevant, because the study of language is possible only when it goes beyond language and refers to a group of people living in a particular environment in nature and society.’ Yes, it is in the sense of each name, the history, culture, customs, traditions, beliefs, etc. of our people. We see that this reflects the cognitive thinking, worldview and essence of the Kazakh people in creating a ‘linguistic image of the universe.’ Of course, the linguistic image of the universe, the national identity of each ethnic group will vary depending on the experience and knowledge of that ethnic group. This is because the marking function of a language symbol is not only in connection with the outside world, but also is the basis of knowledge that a person sees and knows in life. Its linguistic image, national spiritual nature varies from nation to nation. Through the comparative analysis of the image of the universe, the differences and intersecting channels of the national culture of the ethnos (people), the national worldview are recognized [2].

Prior to Kazakhstan's independence, the Kazakh language gained state status and expanded its use. It is not easy for a language to have official status. This is because the language must be in the interests of the state-owned population and be able to meet the demand in all areas.

In this regard, the teaching of the Kazakh language to foreigners as a unifying language of Turkic languages will be of great international importance and practical benefits.

Russian orientalist, ethnographer V.V. Radlov said: “I consider among the world's greatest languages such as French, Russian, KAZAKH is one of the greatest languages among the Turkic languages. However, Kazakhs do not know that their native language is one of the richest. The dictionary of the state language is larger than Russian, Estonian and Flemish”.

According to Gerold Belger, an ethnic German, Russian, German and Kazakh linguist, the largest 17-volume academic dictionary of Russian literature contains 120,488 words, while Dahl's 4-volume dictionary contains 200,000 proverbs and commentaries. According to him, the 10-volume explanatory dictionary of the Kazakh language contains 2,550,000 words.

Many Turkic-speaking peoples live in Turkey, Iran, Afghanistan, China, the Mongolian People's Republic, and etc. The Kazakh language is the native language of Kazakhs living not only in Kazakhstan, but also in other fraternal republics, as well as abroad (China, Afghanistan, Mongolia and etc.). Since the Turkic languages are related to each other, they have much in common. The closest to the Kazakh language are Nogai, Karakalpak, Karachay-Balkarian, Kyrgyz, Tatar, Bashkir and Kumyk. The relationship of the Turkic languages is reflected in their lexical composition, phonetic (sound) and grammatical structure. Many words are common to Turkic languages. This can be seen from the data given below (Table I).

TABLE I. Common Words in Turkic Languages (not all Included)

Language	**Words**			
English	**Teeth**	**Hands**	**Thirty**	**Sit**
Kazakh	Тістер	Қолдар	Отыз	Отыр
Nogai	Тислер	Қоллар	Отыз	Олтыр
Karakalpak	Тислер	Қоллар	Отыз	Отыр
Kumyk	Тишлер	Кьоллар	Отуз	Олтур
Tatar	Тешләр	Куллар	Утыз	Олтур
Bashkir	Тештәр	Кулдар	Утыз	Утыр
Uzbek	Тишлар	Қўллар	Ўттыз	Ултыр
Uyghur	Тишләр	Қоллар	Оттуз	Утир
Khakas	Тістер	Холлар	Отыс	Одыр
Turkish	Дишлер	Коллар	Отуз	Отур
Azerbaijan	Дишләр	Голпар	Отуз	Отур
Kyrgyz	Тыштер	Қолдар	Отуз	Отур

There are similarities in words relating to changes in case, conjugation, singular and plural forms, possessiveness, and etc. It is also important to know the differences between the Turkic languages.

The following features of the Kazakh language can be observed:

- the sound ‘й’ that typically appears at the beginning of the word in some *Turkic languages* in the Kazakh language is changed and the sound ‘ж’ that is pronounced instead: ***йаш - жас, йол — жол, йаңа –жаңа, йыл – жыл, йаз — жаз, йоқ — жоқ,*** and etc.;
- The sound ‘ш’ typical of other *Turkic languages* in Kazakh language is replaced by the sound ‘с’, e.g.: ***аш — ас, таш — тас:*** and the sound ‘ч’ is replaced by the sound ‘ш’, e.g.: ***ич — іш, қуч — күш***, and etc.
- According to the law of progressive influence of sound consonance which could be named ‘the rule of sound harmony’, several types of applications in the Kazakh language, beginning with so called hard sounds, sonorants, voiced consonants, do not exist in other Turkic languages.
- For example: In the Kazakh language, the endings added to the root of the word as in the following cases: ***ат-тар, қыз-дар, жас-тың, қыз-дың, бала-лар, бала-ның, көш-тер, кеш-тің*** in other Turkic languages they are mainly used as follows: ***ат-лар, йаш-ниң, қыз-ниң, бала-лар, бала-ниң, көч-лер***, and etc.

The Kazakh language ranks 70th in the world in terms of distribution and number of speakers. However, according to the latest statistics, the Kazakh language has risen to 40th place, with 16,197,000 speakers. The Altai language family, which is predominantly Turkic, is in third place. ‘Currently, there are about 200 million people in the Turkic world who speak about 40 languages (some researchers say 25, others say 49). According to statistical data of the scientist Prof. Dandai Iskakuly, ‘to see the linguistic picture of the Turkic world, one must first talk

about numbers. Of those 200 million, about 40 percent speak one language, about 70 percent speak six languages, and 30 percent speak 34 languages. In the top ten there are 80 million Turks, 35 million Azerbaijanis, 30 million Uzbeks, 12 million Kazakhs, 9 million Uighurs, 7 million Turkmen, 6.5 million Tatars, 4.5 million Kyrgyz, 2.2 million Bashkirs, 1.5 million Qashqai languages'. Thus, Turkic languages are the 6th largest in the world in terms of the number of speakers after Chinese, Spanish, English, Hindi, Arabic languages, and the 5th largest in the world as an international language (English, Chinese, Spanish, Arabic, Turkic). The number of Turkic speakers could be 800 million. The Turkish community inhabits a very large area: Babur invaded India, Kutuz and Beybars conquered Egypt, and Gagauz conquered Persia. Within three millennia, the Turkic community was able to build 16 major powers and empires. However, the Turkic people were rapidly assimilated, so they could not maintain their unity in the conquered lands. However, the above figure did not become today's figure.

If we look at all the world's languagesthat are Spanish, English, French, and Chinese, all of them have large and small dialects and several variants. For example, the most geographically widespread Spanish language has more than 40 dialects, and Spanish in Spain and Spanish in Latin America are considered to be two languages. Even in Spain, Castilian and Basque, which are forms of Spanish, were 'incompatible' for centuries, and eventually Castilian became the "mother tongue" of modern Spain. Spanish is not understood by the inhabitants of one country in every Latin American country: Mexicans by Argentines, Cubans by Peruvians, or Guatemalans by Chileans. But they are all Spanish. The same can be said about the English language. Chinese also consists of 5 main dialects, which are simple and convenient. Chinese and English dialects are very far apart and do not understand each other. Russians themselves consider Ukrainian to be a dialect of the Russian language. All modern European languages are descended from different dialects of ancient Latin.

This means that Turkic languages can be considered as several dialects of one language (there are those who do!). If we look at the dialectical characteristics of the above languages, we can see that the Turkic languages are dialects of a single, native language. Since the Turkic community was so vast, it was only natural that there should be differences in their languages, as the language itself is depended on space and boundaries. The languages of such nations as Kazakh, Kyrgyz, Tatar, Bashkir, Karakalpak, Nogai, Kumyk (these peoples are bordering on each other, so there is no significant difference in their languages) are understood without any translator, i.e. these languages are 95% similar. Although the language of other Turkic peoples is not immediately understood in the spoken language, it is possible to understand it immediately in writing. That is why we need a common alphabet system.

When Atatürk came to power, the Ottomans called themselves Turks, saying, "We are from Central Asia, we are from Asia, we are Turks". For example, in Turkish linguistics, the history of the literary language of the Turkic language is divided into historical and cultural periods: Turkmen Turkish, Uzbek Turkish, Azerbaijani Turkish, Kazakh Turkish, Tatar Turkish, Uyghur Turkish, Yakut Turkish, Shuvash Turkish and Turkish Turkish. The reason for this division is that the change of the Turkic language in each period was similar to these languages (Kazakh, Nogai, Azerbaijani, Karakalpak, Tatar), so the process of literary language of modern Turkish Turkic shows the true dialectical character by considering the evolution of this formula.

If the Turkic Union is to be formed tomorrow, there is a lot of talk about the need for a common language. By saying that there is no leadership in this union, there is no need for a common language, because these brotherly states, which can understand each other, do not need to apply the principle of the European Union. The European Union is an integration zone, and it is not a nation of kinship, but a distant one, and it is united in the union. And the peculiarity of the Turkic Union is that it is formed spiritually. Even in the European Union, where there is no spiritual relationship, a common language is synthesized, a common language of Germanic and

Romance languages. This was necessary because the languages of 23 countries would be difficult to work with. On the one hand, this linguistic process also forms a common language under the influence of the impulse of mutual integration, since the European Union is a homogeneous cultural region. But the Turkic Union does not need such a process, the Turkic languages are different dialects of the same language and can freely understand each other, and at the same time, new technologies for understanding the language appear in the modern space.

If we consider the Turkic languages as a large number of dialects, then the Turkic languages are in the 5th place in the world, then the Kazakh language is also a 4th or 5th language in the world after being a part of the Turkic languages, not the 70th language. Here we can consider the Kazakh language as the mother tongue of all Turkic languages, as everyone recognizes, and it is scientifically proven that in order to understand the ancient Turkic language, it is necessary to be the first to know the Kazakh language. During the 'Alash' period, the Tatars also recognized the common language of the Turks - the Kazakh language and decided to adopt a common script, written by the founder of the first Kazakh alphabet and national newspaper, poet, translator and enlightener, Akhmed Baitursynov. The Turks themselves say that "true Turkish is Kazakh Turkish" [3].

It is important to keep in mind that defending your native language is much more important than protecting your homeland. You believe that sooner or later your homeland will be conquered by the enemy. And if your mother tongue is defeated, then everything is over. The spread of so-called dreamers, cosmopolitans who have forgotten their native language is very dangerous not only for the language, but also for the Fatherland. A marginal phenomenon that has begun to occur in our society, like the first heralds of a dark cloud threatens a nation blindly obedient to everything foreign.

Every nation first of all seeks to preserve its language, and if it fails to do so, it has to say goodbye to both its nation and its statehood, which was created to protect and preserve that nation. It should always be remembered that the Kazakh language cannot be independent without Kazakhstan.

Many of the world's political figures and spiritual stars, who led the development of society, grew up in the national school, in the national spirit, in all the noble qualities of the nation. The fact that most of the Nobel Prize-winning scientists come from this national school also means a lot.

In the case of Kazakhstan, the lack of scientific-based consistency in the conduct of state language policy, ignorance, campaigning, etc., have led to many scandals in our spiritual life. Improper language policy in society can lead to irreparable gaps and social contradictions.

In Kazakhstan, which is a sovereign state, the national interests of the Kazakh people are not protected, the roots of the national spirit and national culture are being eroded and foreign expansion is taking place.

The spirit is mainly national, and as the well-known Kazakh public and political figure and ideologist of the Turkestan autonomy Mustafa Shokai said, 'the basis of the national spirit is the national language'. It is an axiom that the language cannot be corrected, the spirit cannot be corrected, the nation cannot be corrected without the correction of the spirit, in turn, the society cannot be renewed, life cannot be established and prosper.

Today's Kazakhstan, despite the various threats from the west, the east, the south and the north, lives in the heart of Eurasia. The western market seems to be a country with a very weak national identity, unable to embark on the path of national development.

If Kazakhstan is the common socio-political home of all Kazakhstanis, the state language is the Kazakh language, which serves to ensure the spiritual unity, spiritual integrity and spiritual life of the people in that house.

The Kazakh language is the lifeblood of the Kazakh spirit. Just as there is no blood in the body, its life ceases, just as there is no blood in the Kazakh spirit through the Kazakh language, both the Kazakh nation and the state of Kazakhstan, which forms that nation, will be destroyed.
Without language, society will not improve. The future of both the state and the nation remains bleak. Therefore, it is time to take the national language policy more boldly and intensively in the social and spiritual life of the country.

Atatürk said, 'we must always give priority to national ideals and national interests. International politics, the international situation must be below the national ideals and national interests'.

3. Conclusion

Today's Kazakhstan is a world-renowned sovereign state living in the heart of Eurasia, despite the various threats from the West, the East, the South and the North. By teaching the Kazakh language in other countries, it is possible to train a citizen, a specialist who understands 9 languages of the Kipchak group of Turkic languages without an interpreter. And a person who speaks these nine languages has a great opportunity to quickly learn other languages of this family.

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COMPETENCE PROFILE DEVELOPMENT FOR DIGITAL TRANSFORMATION

Afrida Islam
Dortmund University of Applied Sciences and Arts
Dortmund, Germany
afrida.islam@fh-dortmund.de

Abstract: *Digital revolution is accelerating day by day which is also affecting every element of our society. Core competence and competence profile have become increasingly popular in recent years as well. Competencies had also frequently been established and deployed as a framework for concentrating individuals' behavior on the most important aspects of an organization. The digital business model is a way of creating value by employing people with the right skill sets to deliver consumer advantages using digital technologies. With their competence profile, expertise, internal and external skills, and beliefs, individuals are now helping to bridge the gap between organizational digital transitional changes and technology. But this competence profile cannot be fully based on academic or professional knowledge, but rather be considered persistent learning. Evolving a competence profile has become a demand of time to contend with digital transformation. The literature deliberates on this notion of competence profile and its adaptivity*

Keywords: competence, competence profile, digital transformation, stages of competence

1. Introduction

"The best way to predict the future is to create it" this saying from Abraham Lincoln [1] has certainly revolutionized the way of thinking and conducting business. Nevertheless, digital transformation is having a vital role in improvising the future. The globalized world is now transforming into a technological era and businesses thus organizations are focusing on employee's competencies to keep pace with this digital change. Competencies are becoming more common not only in the labor market as well as in other fields like social, economic, commercial, and so on. In a nutshell, the competency concept seeks to move the emphasis away from knowledge and toward skilled applications. In addition to our personal life, digital transformation has a big impact on different sectors of industries. Companies are changing, and the question is no more "what if", but "when". After everything, the number of potential uses of digital systems and software, as well as their connections with users, is so large that most of them require professionals with the necessary digital abilities hence competence profile.

It is unquestionable, that the competence profile is having a prominent role in this digitally transforming world. It is an essential part of an individual so that he/she can actively participate in the job market as well as in society. Yet these terms are often confusing as the domain is quite wide. Eventually, a translucent concept about this competence, competence profile, the importance of it, and a way to develop it lining up with digital transformation necessitates in the long run.

This article covers the concept of competence profile and the development of competence profile aligning with digital transformation which is the foundation of lifelong learning and crucially significant for any company. The major goal is to crystalize the broad array of ideas on competence profile and how it is impacting an individual's career path in this digitalized world. The literature drives through some basic clarification on competence and competence profile following digital transformation. Afterward, the significance of competency profile development is discussed along with a basic conviction of developing that. Eventually, the study concentrated on orienting competence profile development with digital transformation. In light of this, the

study's major goal is to promote digital transformation by identifying relevant acquire adequate to reassess strategic planning with varied skillsets and responsibilities in addition to supporting information technology (IT) acquisition and its use.

2. Literature Review

With an in-depth review of the existing literature on digital transformation and competence management, it is undeniable that organizational practices are increasingly stressing innovation and technology. Considering that an individual's competence profile is playing a vital role for any organization. The article [2] extensively elaborates on this competence. Whereas papers [3], and [4] discuss the need and process of developing competencies based upon digital transformation along with some more details about digital maturity level, and competency models. The authors of the article [5] have shown an assessment model developed on the review of selected literature sources. The concept of Industry 4.0 has evolved into a shift in employee competencies. This has become the principal strategy for improving the competitiveness of both small and medium-sized businesses as well as larger firms that are not confined to a single industry. How this is being adapted and maintained and the dominance of these competencies in the various sector is covered in [6] – [9].

People should learn to manage the digital transformation to adapt to changes and cope with the problems and opportunities produced by the digital era. The question then becomes: what are the competencies that an individual should pursue to manage the digital transformation? But then there's the subject of what we know about schooling and other forms of competency profile development for employees in businesses and other organizations. Despite the high expectations for efforts to improve competence and the huge amounts of resources allocated to it, empirically research on competence development in firms and other organizations is severely lacking. The literature referencing [10] – [12] details the connection of competence profile with employability and the workplace.

Furthermore, there are various perspectives on competency, phases, and development processes. Personnel core competence cannot be established by default. If we merely analyze the evolution of competency profiles formed on academic learning, according to the article [13], we can accept certain changes in the content of higher-level degrees (master's programs). These competence profile development processes, on the other hand, are dependent on an individual's skill set, which is developed over time rather than learned academically. Organizational training and education for their personnel, as well as workshops and sessions for improving professional and global capabilities, can be considered, which is noted in the literature [14] and [15]. The literature in [16] focuses on some skills and competencies for CIOs, CTOs, CMOs, COOs, CFOs, and CEOs required for the team members to do digital transformation.

The entire topic is a vast realm to cover, hence the focus of this literature is mostly on providing a clear picture of competence and competence profile in the context of digital transformation.

3. Definitions

A competence profile denotes a detailed list of the individual competencies required to perform optimally in a particular job or job category. Whereas competence comprises knowledge, skills, qualities, and attitudes. Depending on the human management situation, competency profiles can be developed through selecting, placing, assessing, and growing an individual in an organization [2].

Additionally, competencies can be classified if technical competencies, professional competencies, and global competencies. Professional competence is focused on achieving

outcomes with other project or program teams and stakeholders. Technical competencies include digital literacy. And the global consists of the intercultural and international skills which are needed to manage a project's environmental impact [3].

However, because three basic phrases are used interchangeably, digital transformation might be a bit confusing. "Digitization" refers to the process of transforming analog to digital (data, technical procedure), whereas "Digitalization" refers to the conversion process, and "Digital Transformation" refers to anything that goes beyond the two categories. It might concentrate on the impact of business process reengineering on a firm and the societal changes brought about by digital technology adoption [4].

Different opinions and definitions exist for the term "digital transformation." Most definitions emphasize value creation and business model modification to raise the organization's competitive level. The speed of change is determined by the type of transformation: whether the organization is being forced to change or transforming on its initiative [5].

To dig more, digital transformation is a complicated technology-driven process that has an impact on culture, politics, and the economy, resulting in market shifts that need strategic responses from enterprises to remain competitive. To realize their goals of making digital technology an intrinsic element of value generation, businesses must make structural and organizational adjustments [6].

4. Importance of Competence Profile

Continuous learning is always changing, owing to a bunch of reasons such as the employment market, regulatory frameworks, and economic concerns. In the context of professionalization, valid talents must be demonstrated across the engineering education area to ensure quality assurance, systematic development, competitiveness, and employability for tomorrow's engineers. Transdisciplinary efforts are required to build standard competency profiles. As a result, education is successful when students have acquired all of the necessary workplace information and abilities [7].

The problem of the connection between learned education and the job market is very certain to affect employers, educational institutions, and of course recently graduated students. With the help of competence profiles, those involved in curriculum development in secondary and higher professional education, as well as post-secondary professional education, attempt to bridge this difference. This enables them to clearly describe requests for the content of training programs and change them as needed [2].

Every educational system has the adjust to changing circumstances. Given that a university's major purpose is to establish a robust, future-proof knowledge foundation, one of the most essential roles for these institutions is to manage their latent potential, which isn't always apparent. A variation in knowledge areas has different levels of knowledge expiration. As an outcome, several optimal amounts of latent capacity exist. Because of fast-expanding technology, education institutions and regulators, as well as businesses, employees, and society, are confronted with new difficulties [8].

The world's growing economies are likewise pushed to innovate. Countries like India and China are increasingly integrating innovation into their national strategic plans. Their innovation performance is strengthening because of a combination of methodologies and practices aimed at addressing broader socio-economic issues while also posing new competitive forces in well-established markets [9].

5. Concept of Developing Competence Profile

Competencies are abilities that emerge from a specific achievement in a specific situation; they are not openly or outwardly visible. As a result, looking at an individual's accomplishments is the only way to establish their competency level. Initiative, assertiveness, and empathy, for example, are impossible to assess without seeing someone display them in real-life or simulated situations. Completing tasks, solving problems, and, more broadly, effectively functioning in a specific profession, organization, position, or role requires integrated performance-oriented capabilities, which include subsets of knowledge structures as well as intellectual, interactive, effective, and, when appropriate, cognitive capabilities, as well as attitudes and values [2].

A competence profile is a comprehensive summary of the skills and abilities that are needed to succeed in a particular job category or even a career. The term "competence profile development" refers to a broad description of the various metrics that can be used to influence the level of competence in persons, groups of personnel, or the entire workforce. As a result, competency profile development might refer to any of these elements. These activities may be planned, but unintended or unanticipated outcomes should be considered. It's essential to know that "competence development" can also relate to individual learning processes that result in competence development. Therefore, the organizational and individual meanings of "competence development" can be identified [10]. Before getting into the concept, it's critical to understand the competency stage.

The four stages of competence shown in Fig. 1, also known as the four stages of the learning hypothesis are based on the idea that before beginning a learning experience, people are unaware of what they know or how much they know (unconscious incompetence), and that as they learn, they go through four psychological states until they attain unconscious competence. Martin M. Broadwell first originated the four stages of competency theory in 1969. Noel Burch of Gordon Training International widens on this theory in the 1970s, coining the phrase "the four phases for learning new skills."[11].

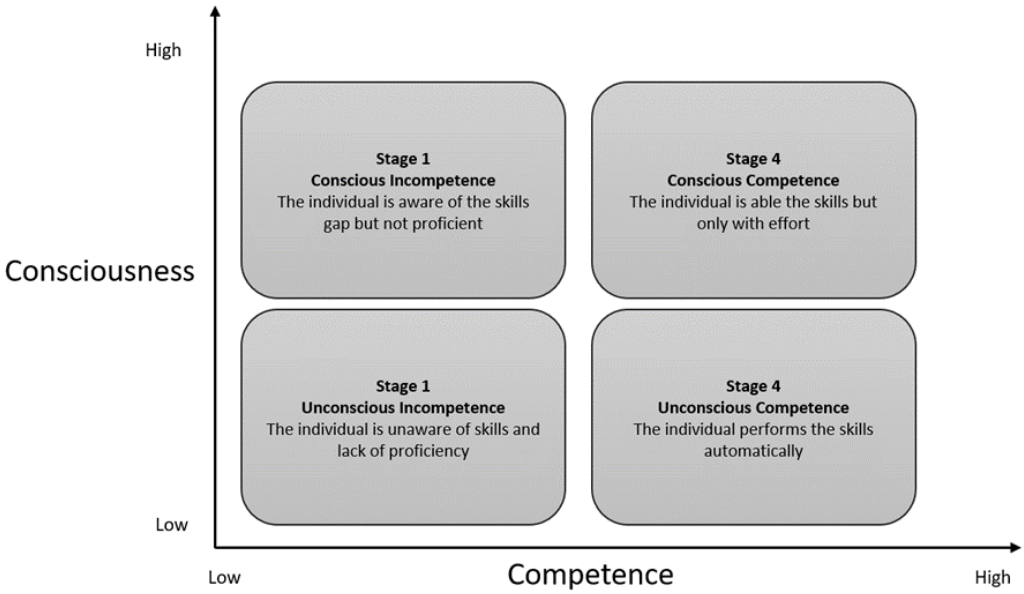

Fig 1. Stages of competence [11]

The four stages of competence are at the center of adaptive learning algorithms. An adaptive learning platform can select content on a topic that will help the individual go to the next stage by knowing where they are in the learning process for that certain skill. It can also employ tests

to show an individual that they have skill gaps, allowing them to go from one stage to another [11].

However, skill gaps later sum up into competence gaps while performing a job in a certain role. The term competence gap denotes the gap between individual competence and job competence. If the competence gap is little, an individual can perfectly fit a certain role [3].

It is easier to work on establishing a competence profile once an individual has determined their competence stage. This is necessary for fulfilling the goals of entrepreneurship, the organization, the job, or the profession, which also include boosting employees' performance. It also helps for contributing to their future employability and flexibility, which can be initiated and guided by both the employee and the organization [12].

Competence can be acquired by means of education or training. This can be considered mainly a lifetime learning phase. Continuous learning involves all learning processes that contribute to the development of knowledge, credentials, and competencies on a personal, civil, social, or professional level. Lifelong learning is an education and training that is mainly vocational and is not limited to educational facilities such as schools or universities. These processes encompass a wide range of learning activities, including work-integrated, casual, and/or non-formal work-related educational processes, as well as leisure-time learning [7].

In education and training, on the other hand, learnable competencies are extremely significant. Activities that might not have the primary purpose of competence development later. These activities may have an additional impact of implying a rise in the individual's competence and thus be classified as educating/developing. Another interesting note is that different competence development methodologies and approaches can be combined. It cannot be denied and is probably true in practice. It may also be argued that to facilitate competent on-the-job learning, one should strive for the methodologies (Table I) listed [10].

TABLE I. Conceptual Model of Strategies of Workplace Learning [10]

Dimension	**Individual**	**Organization**
Curriculum-based	School model	In-service training Continuing education
Practice-based	On-the-job training (informal learning in work)	Organizational learning & development

The conceptual model emphasizes the importance of formal and informal learning, as well as individual and social learning, as fundamental and necessary components of learning. To create consistent competency profiles, cross-disciplinary initiatives are required. The emphasis on participant orientation indicates that current programs must be realigned to the individuals' interests, skills, and capacities. Successful education cannot be attained without the participation of participants in the teaching and learning processes. The activities that help the participants with learning, efforts, and personal devotion might be considered examples of success elements in this regard [7].

The development of a framework of measures aimed at improving employability is largely responsible for the proper usage of individual skills. The primary goal of any firm is to discover and implement potential growth reserves while maintaining employment. The ability to achieve socially beneficial improvements in work activity indicators illustrates the social value of improving an employee's competence profile. The development of the personal and professional capabilities of an employee gives the organization, an individual who has a certain degree of

freedom and independence. This includes the ability to make decisions, select the methodology of tasks, the intensity of activities, and so on; and maintain a favorable socio-psychological climate within the organization [12].

6. Aligning with Digital Transformation

Organizations that lead digital change must envisage how to alter their firm for the digital age. When readjusted to a company's level, these three pillars, shown in Fig. 2 can serve as strategic digital transformation goals. Digital transformation can be defined as a collection of actions that include streamlining operations, changing products, services, processes, and methodologies, and empowering workers [13].

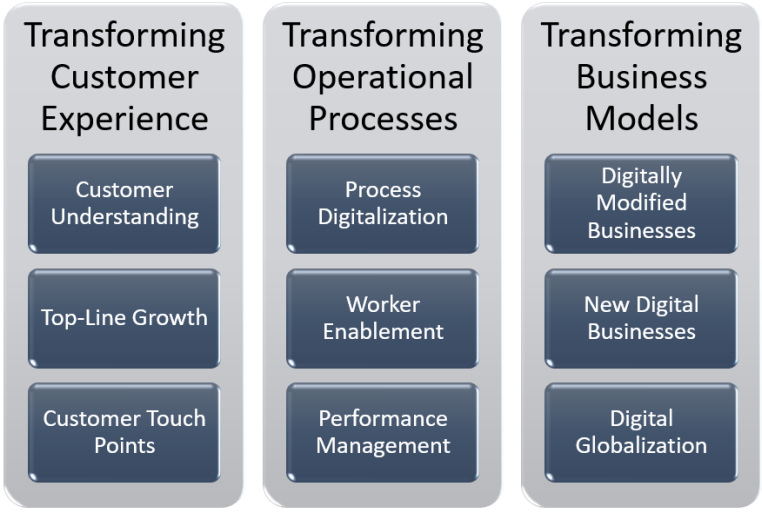

Fig 2. Key elements of Digital Transformation [13]

When businesses recognize the benefits of social learning in the delivery of information, problem-solving, knowledge sharing, and user-generated content, they are said to be undergoing digital transformation. In consideration of this background, the main objective of this section is to contribute to digital transformation by defining the competencies required to rethink organizational tactics with various sets of skills and roles to ease information technology adoption and use [14].

The five top competencies identified are compatible with the European Digital Competence Framework competency area dimensions: information and data literacy and communication and collaboration, respectively. These important digital competencies are: "(1) evaluating data, information, and digital content; (2) browsing, searching, and filtering data, information, and digital content; (3) interacting through digital technologies; (4) managing data, information, and digital content; and (5) collaborating through digital technologies" [15].

The EU Digital Education Action Plan identifies three major areas for digital transformation competencies: “(1) utilization of digital technology for teaching and learning, (2) development of applicable digital competencies and skills, and (3) improvement of education through better data analysis” [3].

It is undoubtful that, improving the digital competence of an individual will provide the business with the necessary knowledge, skills, and attitudes to succeed. Yet to align with digital

transformation some special sets of skills are required in an individual's competency profile. These may include knowledge of business process modeling, knowledge of developing technologies that have the prospective to disrupt specific industries, and firms' business norms, processes, and models. It's believed that you know a lot about disruptive technology adoption and have a lot of experience with it. This also comprises, managing competitive vendors, and internal and external communication skills. In terms of project management tools, techniques, and best practices for project and program management as well as knowledge of and experience with project and program management of small and large-scale technology initiatives also encompasses with it. This also involves the capacity for managing projects and programs not only efficiently but also within task-defined timescales, and from a distance. It also relies on the assumption of flexibility [16].

Digital competence profile is becoming one of the most critical factors of service quality and client satisfaction. Technology-enabled learning is quickly becoming a vital tool for developing digital competence since it allows employees to receive training while also tracking and managing their progress toward obtaining more sophisticated skills. As a result, many people are worried about developing a digital-first competency framework over a combined digital-analog approach. The promise of competency monetarization is a result of this digital transformation of competence management. In the end, these skills are dominant. [4].

Teams with the appropriate competence profile are essential for any organization to support digital transformation. There can be vast competencies listed in this regard but some of them which are worth enough to mention can be shown in Fig. 3 below:

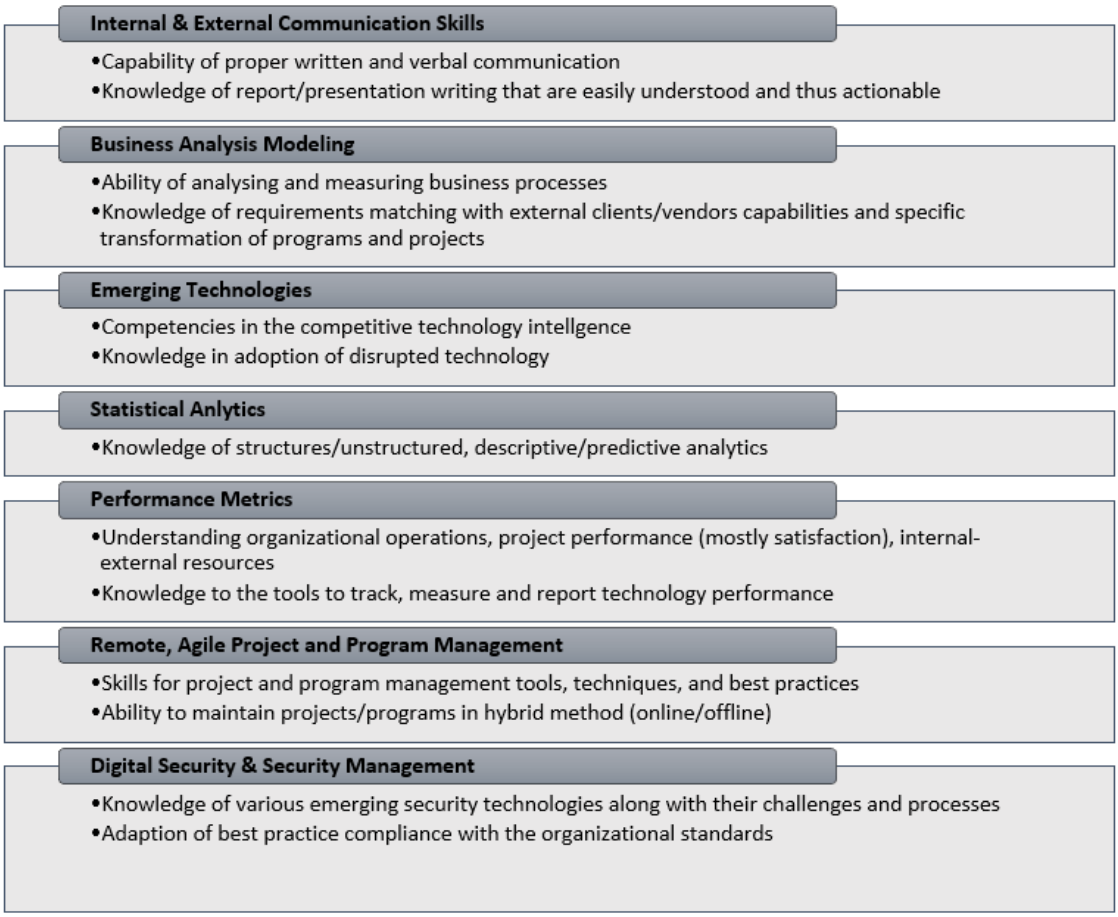

Fig 3. Some competencies for Digital Transformation [16]

These skills developed in a competence profile can be evaluated for a business-technology team's objective workforce assessment in consideration of digital transformation [16].

7. Conclusion

In consolidation, it is visible that competence profiling increases transparency between the individual and organization. Although it may be claimed that competence is neither primarily an individual (or collective) characteristic nor primarily a job characteristic. Rather, the emphasis is on the connection between the individual and the task, as well as the competence that the individual employs in performing the job. This results in, competence-in-use can be viewed as a dynamic learning process that mediates between an individual's ability and job needs. This suggests, among other things, that an individual's ability to use and improve their actual competence is influenced by both personal and work-related conditions. Individual aspects are likely to be influenced by previous experiences as well as attributes such as self-confidence [7]. Competence profile and Digital transformation itself is an enormous area to be explored while forming of this with calibration of Digital transformation makes it a mammoth. Also, there are multiplicity topics concerning competence model, competency matrix, digital transformation maturity model (DTMM), management of digital transformation (MDT) affiliating competence profile which can be further involved in research.

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DIGITAL TRANSFORMATION IN EDUCATION AMID OF COVID-19

Atik Hasan
Faculty of Computer Science, Dortmund University of Applied Sciences and Arts
Dortmund, Germany
atik.hasan001@stud.fhdortmund.de

***Abstract**: The Covid-19 epidemic has impacted negatively on the worldwide health system, wreaking havoc on socioeconomic activities including schooling. The Covid-19 crisis, on the other hand, cannot be viewed just as a moment of instability, but also as a period of rapid acceptance of digital technologies, which has led in an increased use of digital technology and, as a consequence, a digital transformation in the education sector. This paper provides concrete reflections on whether and how the Covid-19 outbreak has accelerated digital transformation in education sector. The study is based on theoretical research, including a survey of literature and formal reports in the context of higher education's digital transformation during Covid-19. This research will assist higher education institutions in rethinking their strategy in light of the demands of such fast-digital revolution. The findings of this study may be useful to startups and existing businesses looking to investigate or capitalize on digital transformation prospects.*

Keywords: digital transformation, digital transformation in education, education 4.0, Covid-19

1. Introduction

Covid-19 is a new coronavirus that is also known as SARS-COV-2 (Severe Acute Respiratory Syndrome Coronavirus-2) [1]. Scientists have linked this virus with the disease referred to as Covid-19, which was initially discovered in China in Wuhan City towards the end of 2019 [1]. This epidemic has prompted physical closures of companies, sporting events, and schools throughout the world, forcing all institutions to transition to online platforms through digital transformation.

Digital transformation is not a new term; it has long been linked to higher education institutions. It may be viewed as a summation of all digital processes required for attaining transformation processes in higher education institutions, as well as the capacity to apply digital technology in a positive and optimum manner. Higher education institution digitization should not be referred to as e-learning since remote learning is only one of numerous elements of higher education institution digital transformation [2]. The rapid spread of remote education and a surge in innovations in educational technology are two current trends in digital transformation in the educational industry during the Covid-19 pandemic [3].

Teachers are being forced to explore and utilize remote learning strategies more than ever before as a result of the Covid-19 epidemic. Although there were remote education techniques prior to the Covid-19 epidemic, they were uncommon, and most of the activities took place in a classroom [3].

2. Background Study

In the context of higher education institutions, digital transformation may be measured in terms of all digital activities necessary to complete a transformation process that allows higher education institutions to optimally employ digital technology [4]. The digital transformation of higher education has already been explored in the context of digital content creation [5] and life-long learning [6], but the Covid-19 epidemic has triggered the shift of educational processes to the online beyond March 2020. Firs of all, the terms online learning, e-learning, digital learning,

and blended learning must be defined. In online learning the most of the material (commonly 80% or more of total program) is supplied online whereas in blended learning the face-to-face and online learning is combined where 30 to 79 percent of the program is delivered online [7]. E-learning and digital learning are similar to online learning. Any learning that is supported by digital tools and technology is referred to as digital or e-learning [8]. It is clear that higher education's digital transformation has necessitated the arrangement of teaching and learning in an online context. But the question is what exactly has to change in order to attain high efficiency of teaching and learning?

2.1 What is Digital Transformation?

Digital transformation is a transition in an organization's use of technology from a support function to one that is incorporated into all aspects of the company, radically changing its operations and how it offers value to consumers [9]. This differs from business process re-engineering in that it focuses more on re-imagining company models and operations rather than just automating rule-based procedures [10]. Social media, the internet of things (IoT), big data and analytics, cloud computing, artificial intelligence (AI), machine learning, blockchain, cybersecurity, robotic process automation (RPA), and quantum computing are some of the new technologies driving digital transformation. Nonetheless, technology has been a major game changer for many years, transforming global value chains and business models and causing a dramatic change in skills, bringing in the Fourth Industrial Revolution (4IR), also known as Industry 4.0 [11].

2.2 What Does Digital Transformation Mean for The Higher Education Sector?

In recent years, there have been substantial developments in the higher education sector. The higher education industry has now adopted the Fourth Industrial Revolution and is undertaking its own digital transformation, termed Education 4.0 [12].

The Covid-19 epidemic has expedited the higher education sector's digital transformation. Universities have been experimenting with synchronous and asynchronous lectures, online learning communities, online evaluations, and other new pedagogies, and relying extensively on data analytics to measure student involvement, since March 2020. Despite the fact that this was more out of necessity than choice, there are some advantages to this faster digital revolution in higher education. For example, the sector has been able to increase participation, enhance educational access, and better educate students for the complicated and unforeseen conditions that the world revolves around [13].

It is important to note that effective digital transformation requires more than simply switching from conventional to online methods. Simply switching a paper-based exam to a computer-based exam, for example, is not real digital transformation. It can be stated that digital transformation has truly taken place by using biometrics and artificial intelligence to check identity of exam candidates, historic data are analyzed to improve the education quality, exam securities are ensured by using digital tools and even possibly remote proctoring [14]. This is only one example, but the idea is to use technology to fundamentally restructure all processes, as well as organizational culture, to suit future demands [14].

3. Technologies and Trends in Education

Faced with this unprecedented health emergency, countries all around the world have been forced to develop an educational continuity plan that can be implemented as soon as possible [15]. Educational continuity plans are meant to sustain the pedagogical connection between students and instructors in the case of temporary school closures. The major goal is to help students retain their existing knowledge while also assisting them in acquiring new knowledge. Despite the numerous challenges connected with synchronous and asynchronous distance education, the desire to deliver high-quality education remains. Physical distance and socio-

emotional support; correct understanding of technological tools; access to a steady and secure Internet connection; and access to suitable computer equipment are just a few examples. Organization for Economic Cooperation and Development (OECD) stated that 95% of students in Austria, Norway, and Switzerland have access to a computer to do their coursework, but on the other hand only 34% of Indonesian students have access to such devices [16] - [18].

Higher education now uses a variety of programs, platforms, and instructional materials for both synchronous and asynchronous distant learning (Fig.1). In the literature, several classifications containing multiple categories have previously been presented [19].

• MOODLE, an internationally supported open learning platform, is an example of a digital learning management system (with more than 60 partners in the Asia-Pacific region, Europe and the United Kingdom, America, and Africa).

• Massive open online course (MOOC) platforms, which include a wide range of subjects such as engineering, medicine, economics, the arts, and culture, among others. During the Covid-19 epidemic, approximately 200 higher education courses were made available to students all across the world for free.

• Self-directed learning content: One example is the Khan Academy's interactive platform, which has provided thousands of online courses for undergraduate students spanning a wide range of scientific areas since 2008. Students from all across the world were able to use this site during the Covid-19 epidemic.

• Collaboration platforms: Google Meet, Microsoft Teams, and Zoom are three notable examples of collaboration tools that offer live-video communication. Teams provide the facilities that includes chat, call, and collaboration services. Zoom is a web-based video and audio conferencing, collaboration, chat, and webinar platform.

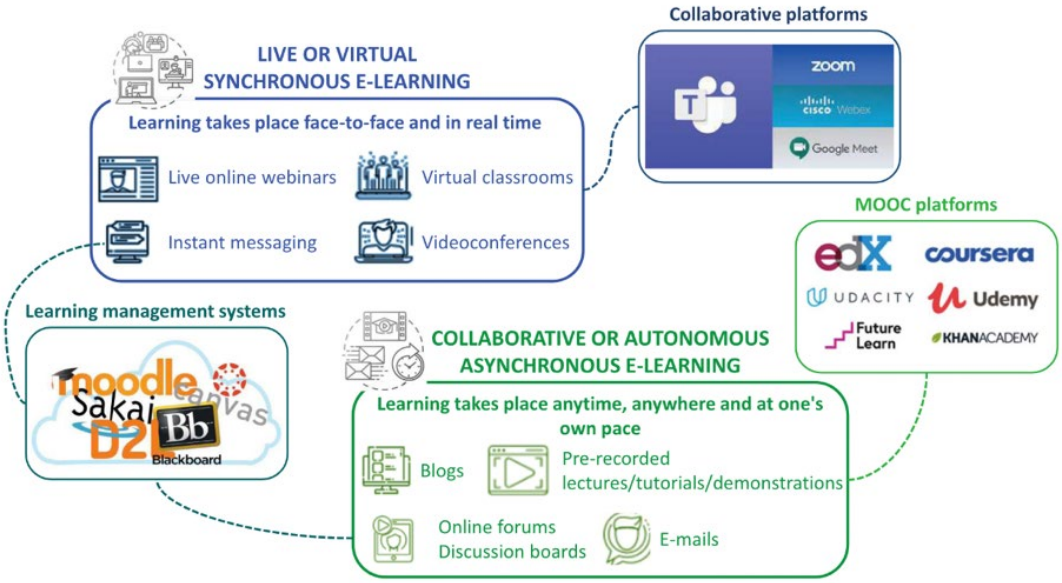

Fig. 1. Applications and platforms used for synchronous and asynchronous distance learning [20]

3.1 Impressions of The Virtual Classroom in Higher Education

Maintaining active connection between students and professors, as well as among students, is one element to successful distant education during the Covid-19 epidemic. Many recent studies have found that this level of interaction is substantially higher in a virtual classroom, i.e., when distance education is delivered synchronously [21]. Distance learning, according to some

academics, can dramatically reduce absenteeism also students feel less shyness to ask questions. However, some types of teaching, such as practical work and projects that need particular laboratory equipment, are not well suited to distant learning. In many circumstances, the level of human interaction in a real classroom is impossible to replicate in a virtual setting, according to these writers [21].

Despite having many positive points, several authors suggest that virtual education teaching styles should implement a variety of innovative methodologies to fully engage students and assist them in achieving the main pedagogical objectives, such as successful learning and the acquisition of relevant skills. Compared to face-to-face instruction teachers need to expend a significant amount of time and effort to create effective virtual classrooms.

To sum up this part, distant education is not a new concept; many top institutions all over the world have been using it for many years. New matter is the extent to which institutions are utilizing collaborative digital platforms and online resources to instruct both synchronously and asynchronously while maintaining student motivation [20]

3.2 Overview of Some Digital Tools Used for Conducting Remote Teaching

Collaborative platforms such as Google Meet, Microsoft Teams, and Zoom, which were initially designed for commercial uses, have become increasingly popular in recent years, particularly for the digital transformation of higher education. Microsoft Teams, for example, is a customizable collaborative platform with numerous integrated features such as instant messaging, video conferencing, scheduling and facilitating team meetings, file storage and sharing, integration and working with Microsoft Office documents [22]-[23].

Zoom, for example, is a teleconferencing tool that combines video conferencing, online meetings, chat, and mobile collaboration utilizing proprietary software. Zoom is currently the most popular video conferencing application due to its easy-to-use features [24]. It allows a large number of participants to join its virtual room with possibility to interact with each other. It also has excellent features like screen sharing, screen recording, and team chats [24].

During the Covid-19 epidemic, several universities throughout the world used the Zoom platform. Since March 2020, the number of downloads for this California-based software has increased dramatically. Zoom was extensively used by all students at prestigious universities such as Stanford, Princeton, and Harvard, due to its simplicity and user-friendliness.

The efficiency, quality of service, data security, user ergonomics, and cost of a remote learning tool are all factors to consider for using a tool in remote learning.

4. Literature Review

Several questions arise in terms of using digital tools for distance learning, the study [20] tries to answer some of the questions and propose an approach to remote knowledge acquisition and assessment described in this case study entails four key phases (Fig. 2).

- Phase 1: Students are prepared for distant learning. This step entails providing each student with access to various collaboration platforms (such as Microsoft Teams, Zoom), as well as online apps (such as Google Drive) and other study related softwares.

- Phase 2: The learning phase, during which students are supposed to gain information, develop skills, and build on their accomplishments.

- Phase 3: Knowledge and skill assessment using synchronous knowledge exams
- Phase 4: Online satisfaction surveys for students to rate their distance learning experience.

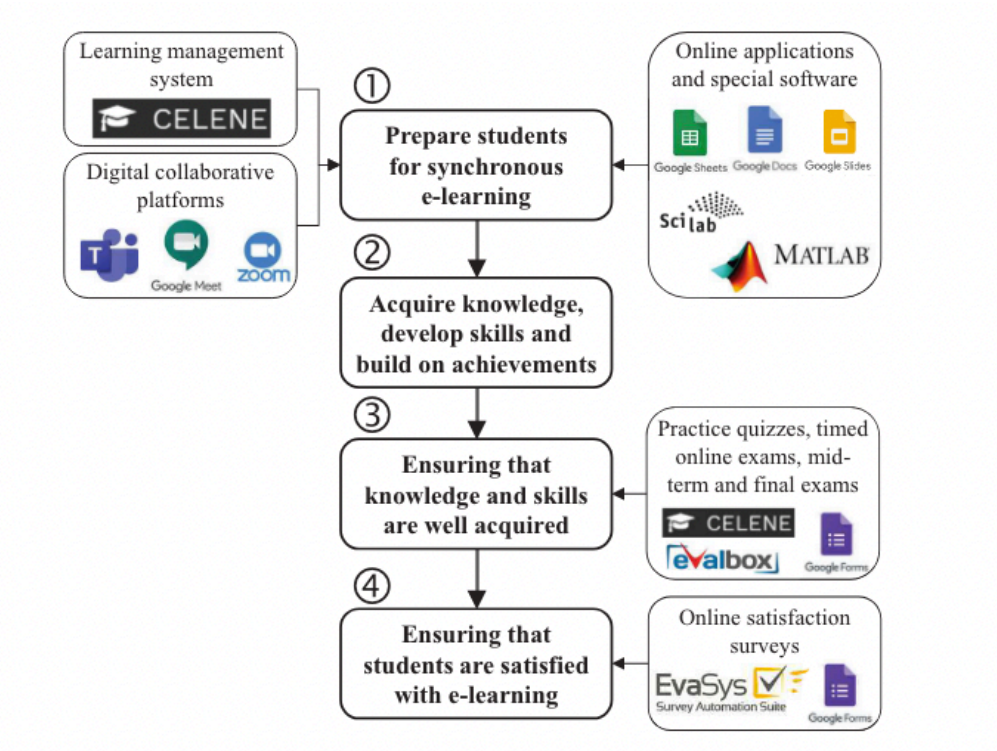

Fig. 2. Proposed method for the distance acquisition and evaluation of knowledge [20]

According to the study [25], a paradigm change in university education has happened following a few months of online experiences. Even after the Covid19 epidemic, online education has acquired prominence and will continue. The research shows that a number of technological tools and platforms, such as online learning platforms, audio-video conferencing tools, messaging tools, and various educational applications, are utilized to facilitate distant learning [25]. The many actors in the learning processes (students, instructors, institutions) faced significant hurdles in adapting to this new context since the shift to online learning was fast and driven by situations. Universities must be aware of these obstacles and deploy resources to solve them in the short term, with a focus on digitalizing learning processes and providing appropriate technical training to academics, administrative staff, and students. The study suggests that to satisfy students' expectations and enrich their learning experience in the contemporary digital world, institutions should establish a blended face-to-face and online learning.

The research [26] gives an in-depth examination of the obstacles of accelerated digital transformation and four types of digital transformation agents. They conducted a thorough literature analysis for this study and presented a framework (Fig. 3) for understanding rapid digital transformation that may redefine what digital transformation is and how to steer a rapid transformation process. They discussed several limits and recommendations, including the need for digital technology research and development. The design of a well-being-based system will benefit both individuals and enterprises, facilitating the rapid adoption of digital transformation.

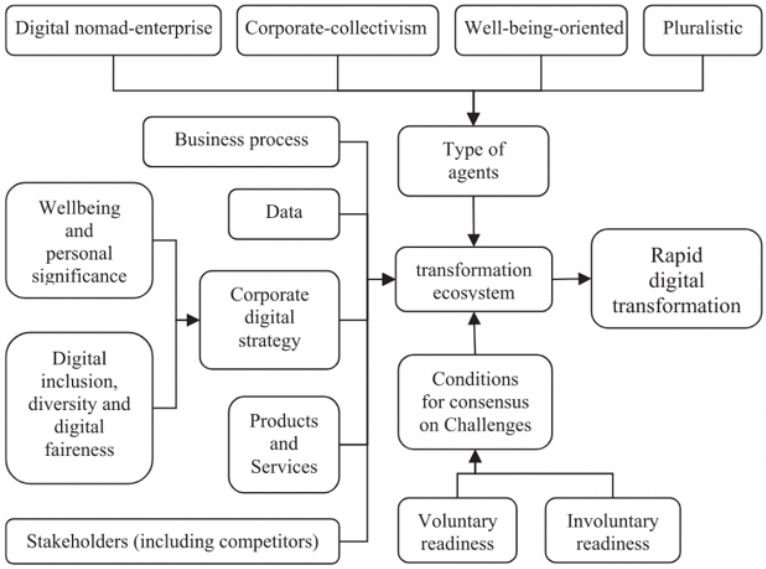

Fig. 3. Framework for understanding rapid digital transformation [26]

Secondary research was conducted in this study [27] to determine the influence of Covid-19 on the educational sector's digital transformation. Specifically, the study looked into how education sector implemented 4IR technologies during the Covid-19 lockdown phase. During the lockdown, the South African education sector embraced various 4IR technologies in large numbers, ranging from basic to higher and tertiary education. The lockdown prompted the development of virtual learning, the use of educational apps and websites and lastly, a shift in the industry toward remote. They also stated that data traffic spiked between 35 and 60 percent a few days after the lockdown in South Africa, as reported by local networks.

Study in Saudi Arabia [28] describes the well preparation of the country in terms of digital transformation in education sector. The country's education was supported by e-learning since early 2000 and by 2002, Saudi Arabia had established a national school e-learning platform with tailored electronic lessons [29]. In conjunction with foreign partners, e-learning was expanded and improved in the years after that [29]. The National Center for e-Learning was created by the Ministry of Education (MOE) in 2017 as part of Vision 2030.

During the time of the Covid-19 outbreak, Saudi Arabia already had public and commercial e-learning infrastructure. Saudi universities held webinars and training sessions to quickly boost their faculty's e-learning capabilities. They also mentioned in one of the webinars the future potential of e-learning to improve web-based question banks and electronic resources, further involve faculty, embrace remote administrative meetings, reduce expenses, and improve results. As it looks to be the new standard, the Minister of Education suggested that remote learning will be integrated into the Kingdom's normal education system.

Survey study [30] shows that the digital transformation due to the Covid-19 was not without obstacles, but half of the students liked it and they would prefer it in the future. Their analysis allowed to draw a few remarks and conclusions. Remarkable finding of their studies was that half of the students preferred online education and they are willing to continue it.

5. What's Next?

The Covid-19 epidemic has forced higher education to rethink and reshape its whole atmosphere and experience. Nobody knows where Education 4.0 will lead us, but a fully digitally changed, futuristic higher education setting is likely to include most of the following technologies.

- Chatbots: Some universities have already begun to use chatbots to help with quick replies to a flood of student queries during peak enrolment periods, directing students to the appropriate department or web page for more help, and even providing library assistance services [31]. If chatbot technology could be improved to provide more than just administrative assistance, such as help for reflective learning, it might revolutionize teaching and learning approaches.
- Augmented reality, virtual reality, and mixed reality: Augmented reality (AR) is a method of overlaying digital information onto the actual environment in real time using a camera-equipped device such as a smartphone or laptop [8]. Virtual reality (VR), on the other hand, takes things a step further by allowing users to fully immerse themselves in, explore, and interact with a virtual, artificially produced, 3D environment with the use of a specific headset [32]. Furthermore, mixed reality (MR), which combines the artificial simulations of VR with the real-world interactions of AR, is becoming increasingly popular. The AR/VR sector is anticipated to increase by more than USD 125 billion by 2024 and dramatically change multiple industries [33]. It might be used to supplement case studies, accurately imitate real-world work scenarios for integrated assessments and encourage introspective and creative learning.
- Smart classrooms and smart campuses: A smart classroom is one that is completely digitally equipped and uses technology to implement a variety of teaching and learning methods. Smart gadgets and software, learning assistive devices, virtual reality, technology to encourage and increase student engagement, and complete accessibility for students with mental health difficulties and learning challenges are all included [14]. A smart campus would take this idea a step further by digitally integrating numerous services to improve experience, education, and efficiency. A smart campus may also employ AI and other technologies to optimize resource use and allocation, monitor noise levels and recommend a quiet study space to a student, or assist cafeteria workers in improving food offerings based on consumption statistics. The options are limitless [14].

6. Conclusion

To summarize, the higher education industry has gone a long way in terms of digital transformation, and there is yet a long way to go. The need for adaptability of digitization in education sector is very essential, and a forward-thinking digital strategy incorporating a variety of effectively adapted digital technologies could revolutionize the sector in terms of innovating and improving the teaching, learning, and assessment experience, as well as increasing collaboration and research. Thus, distance education will continue to grow.

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SOFTWARE-INTENSIVE SOLUTIONS ON DIGITAL BUSINESS PERSPECTIVES

Khalid Md Ashik
Dortmund University of Applied Sciences and Arts
Dortmund, Germany
Khalid.ashik001@stud.fh-dortmund.de

Abstract: *Software is an essential element of the digitalized business system. It transforms a business model to function in a digital way. This enables a comprehensive understanding of the connection between business models and software engineering. This paper focuses on digital business workflows and how some digital businesses use software to function their business processes. This paper analyzes how some business companies in Germany such as Gorillas, Flink appeared during the meantime COVID-19 pandemic situation and mobilized the online grocery delivery business with their services through the software applications similar to Chaldal.com (2013) in Bangladesh which was the pioneer and world's first self-warehouse basis online pick order and deliver grocery delivery and a discussion of their business model. Due to digitalization, the services in businesses are provided remotely. In the modern world, digital business workflow is about how to structure and convenient the way the services can be provided to the customers or consumers. Nowadays most companies and organizations are realizing the advantages of the use of business software to conduct their services faster and in a broader way. In a short, the paper describes the advantages of business digitalization and the maintenance steps for an ideal digital business process service.*

Keywords*:* business software, digitalization, ecosystem, digital transformation, value chain, supply chain

1. Introduction

Digitalization and technologies have mobilized the industry and organization sectors to bring new concepts and services to provide to the consumers and customers. Thus, it brings new opportunities for the companies to execute in the business to stay in the competitive race to generate more revenues with their services. Digitalization brings important impactful changes to the process, organization, and business level of any company and its customers [1]. Digitalization offers a much shorter but faster and more impactful business process than any business model [2]. Companies entering new markets and business ecosystem finds digital system and services playing dominative roles [2]. Software and IoT devices are the key elements of the digital business ecosystem and recent states describe to initialize successful machine tools with software-based industry or business remains a challenge for both: platform providers and business companies in the total IoT ecosystem [3]. In the competitive world, it is important to look into innovative ideas and adapt them to be ahead in the race [4] and this enables the software engineers and operational management department to ponder the strategies frequently to ensure proper alignment with the digital business nature [2]. It is quite obvious that the companies that are unable to adapt to digitalization in their business unlikely may fall far behind in the competition, whereas the companies that remain the most adaptive and responsive to technology tools and softwarebased systems are likely may survive. This paper is structured in such a way that primarily it discusses the digital transformation of business and later how software is linked with IT-based transformation and strategy for business models. The paper discusses the transformation of digital business and how software-intensive system solutions have an impact on business companies.

2. Digital Transformation of Business

Digital business is structured in a way that uses technology in order to generate new values in business models. customer experience and the internal capabilities that support its core operations [5]. In the modern world, the term is being applied most often in every new business startup. in fact, traditional businesses are now adopting new technologies to function digitally. Nowadays the expenditure is getting popular in the online method for products and services which led the companies and organizations to shift business emphasis to digital sources of revenue and digital channels. That's why a noticeable number of software-based system has been introduced to serve digitally from purchase to payment till delivery of goods and products. During the COVID-19 pandemic, digital business and services are much more impactful. Lots of new companies are introduced that function digitally with their value propositions and traditional companies had embrace the new concept to function in a digital way. There are some common elements of a digital business and which are to use the existing technologies to reduce the expenditure and provide a better customer experience, embrace the concept of digital transformation in order to implement it in a proper method, and explore the new business models that put customer experience in the middle of digital strategy [5]. In general, digital businesses rely on technology to operate and grow [6]. Depending on the structure of the industry or business that may look like [6]:

- Adopting some productivity apps for purchase or display and task management to maintain workflows.
- Introducing AI (Artificial Technology) to improve customer experience.
- Analyzing data in order to improve the business model.
- Or for online-based companies, perform the entire workload digitally on digital platforms.

True digital transformation is the process of shifting away from the manual process in order to establish a customer-centric and technology-focused business model [6]. The idea behind digital transformation is a mixture of the personal and organizational information technology environments which contains the transformational adaptation of new technologies such as social, mobile, internet, cloud, and IoT [7]. With the use of these technologies, a business is functioning digitally. Organizations need to adapt these technologies to survive and succeed in the complex business environment processes and domains which are gradually increasing in the modern world [8]. In more depth view of digital transformation with the uses of these technologies, impact three organizational layers: externally, where the customer experience and life cycle of transformation remains digitally focused; internally, in which the operations of the business, decision-making, and the structure of the organization are being affected; and holistically, where segments and functions of the business are being affected and lead to a new model for business [9]. In business, the digital transformation always does not go in a linear progressive way, and the leading team and management authorities have to take the challenges and face obstacles most often to implement the strategies to utilize the best practices of digital transformation [9]. So digital business is a complex type of technological movement for any business transformation which needs strategic roles and capabilities to generate decisions for successful digital innovation in the modern world [10]. Companies can converge with multiple new technologies with the goal of reaching upper positions in the market by transforming their business dimension which includes business model, and customer experience (with the products and services which are provided digitally), and impacting people and networks of the entire value system of the business [11].

3. Software Intensive System

The software has a rudimentary position in the software-intensive system which has an impulsive impact on the design, construction, and evolvement of the entire system [12]. The software consists of several elements of function which includes the program, methods, data, and the system control instructions and information process [13]. Software is used in various fields of the business applications such as telecommunication, logistic, industrial automotive sectors, food delivery, manufacturing, and
Information Technology organizations, where all of these have a very complex system that is networked and distributed [14]. in order to be interactive, a software-based system must have a broader view of the physical environments and also the recent internal status which helps the system to interact through its function [15]. The development of a Software-Intensive System has several processes including agile methodology, lean technology, spiral, and waterfall models [14]. In computer technology software is always present and system engineering is a necessary step in a computer-based system where software can be developed alone or with a combination of electronics and mechanical parts [16]. In business models, the usage of software and IT tools brings dramatic changes to the tasks of the processes of the business which enables the organizations and companies to serve various customers and gain the competitive considerable advantages [11]. According to Gouillart and Kelly's (1995) categorization, there are four constructs for IT-based transformation in business [11]:

- **Reframing** the views of the company and perceptions of the business are related.
- **Restructuring** the structure and configuration of the companies provide more flexibility.
- **Revitalizing** the companies with the value chain and marketplaces of opportunities.
- **Renewal** of the skill modification where the human resources issues are involved.

Morgan and Page (2008) presented a proposal for IT-based transformations where they mentioned four phases through which organizations progress and those phases are **adapting,** relating to the automation for some selective activities, **evolving**, is the establishing an alignment for ICT, **envisioning**, in which the network of the business process is redesigned and **renewing**, is the reformation of the business scopes [11]. The rapid growth of digitalization and technologies in the software field has opened many potential opportunities for business innovation and thus new business models for organizations and companies evolve [17]. This transformation in business fields through the usage of software has a variation on a different scale, where it stands in the formation of digitally modified for the current business or inventing a completely new model for digital business [18]. In business models, there are mainly a couple of important areas which are creating the value chain for the organization being digitally transformed and these are operational and human element areas [19]. Transformation in the operational element in business operation and processes, the companies look into the operations of the business process and integrate the processes [17] with digital performance management system through software-intensive tools and systems [20]. Companies spend much investment on the research and development department for the improvements in the company's IT and software system parts so that it ensures much flexibility to work processes and services the companies are providing [21].

4. Strategy Behind Digital Business Transformation

Strategies for a digital transformation are pondered to be a spreading and company-wide strategical guideline for an organization and the journey of its work processes [11]. In this way, the company surpasses its functional analytical thinking and handles the opportunities and risks

which are associated with digital technologies [17]. The formation of a company-spanning strategy is to enable that company to incorporate the opportunities of the economy by utilizing the digital resources and capabilities and transforming multiple dimensions of business which are operational, customer-centric, and business models [11]. Digital transformation strategy recognizes the fusion of the business strategy and IT strategy and provides the guidelines for future states on transformation with the translation of the digital layer of business strategy and its various functionalities [11]. These are the characteristics and also the alignment mechanisms of a digital transformation strategy that is positioned according to the company's hierarchy for the business strategy level and in this way the companies get more opportunities to incorporate the digital environment software and technologies [7]. Fig. 1, shows the overview of the required functional alignments is shown which fulfill the digital transformation strategy.

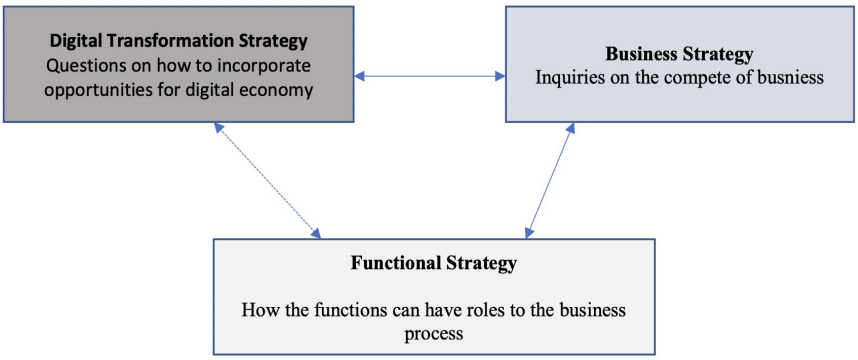

Fig. 1. Functional alignments for Digital Transformation Strategy [7]

Companies have to make appropriate strategic decisions in several key fields according to the design of the digital transformation strategy and in Fig. 2, the structure of the strategical content for digital transformation is shown

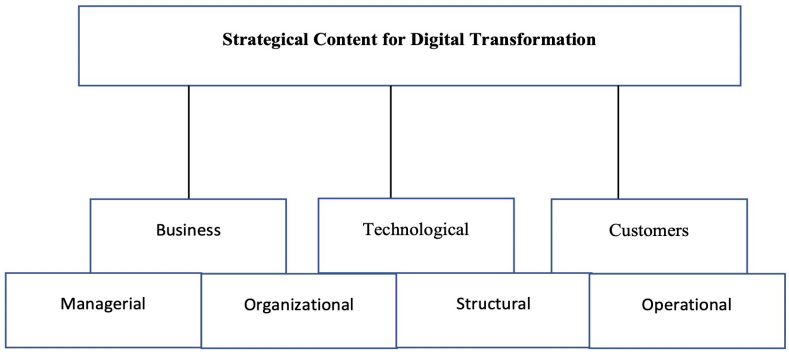

Fig. 2. Structural Content for Digital Transformation [11]

In business perspective content, a business case has to be made in such a way that a long-term objective is being achieved and pursuing maximum gains from it in order to understand and bring overall changes in company's performance, problem-solving, vulnerabilities, opportunities, and risks [22].

Technological point of view, it is a more important and crucial matter to decide for introducing new technologies IT tools software, and hardware to the companies which play a notable role in achieving strategic goals [11]. Customers are the most important elements of business strategy for which companies bring various strategical decisions and investigate how new benefits can be

created to improve the relation and interaction with them through their products and services [23]. Managerial decisions are related to the financial element and it develops around selecting how the digital business transformation can be financed [24]. In the organizational sphere, companies are guided to have a closer look at the employees, culture, talent, skillset, and leadership where employees are assessed through the maturity level in which their roles, experience, and abilities are inspected [25]. Structural decisions are involved with internal governance, collaborating with external partnerships to support the execution of digital transformation where software and IT is enabled to run the operations for the company's business so that they can incorporate current structures or separate new units for workflows [26]. On the other hand, from the operational point of view, the strategic decisions cannot be ignored in digital transformative business and projects where the main incorporation relates to operational changes and adaptation of recent business processes [27]. In the further section of this paper, there is a structural digital business model discussion of the online food groceries delivery system and how this business model and its operation relate to digital software technologies that become much more popular during the COVID-19 pandemic. Also, there are some companies in Germany based on online food groceries delivery such as Gorillas, Flink that appeared during the COVID-19 pandemic situation with their business concepts using digital technologies and software systems and generating revenues are discussed in the further sections as well.

5. Online Grocery Food Items Delivery Business Model

The year 2020, is the time period when many business fields had experienced rapid growth in their business that was supposed to happen several years in the future, and the food delivery sector holds an important position in this category of industries during the COVID-19 time period when the world faced lots of restriction and lockdowns which upset the whole distribution chains all over the world [28]. At one point brick and mortar stores had faced a tough situation while digital retail-based channel businesses saw a dramatic increase in demand from customer sides, especially in grocery food deliveries [29]. Chaldal.com in Bangladesh is the first and pioneer online software application-based grocery delivery business startup in the world appearing in 2013, picks and delivers all the grocery items from its own warehouses instead of other retail store partners [30]. According to the report by TechCrunch, the company has secured around 10$ million in funding after its initial journey in business. The CEO of Chaldal.com Wasim Ali said that before Chaldal.com company the local customers had limited access to buy all the different kinds of grocery products from a single place and not even online as well and they had their own inventory combined with the modern technological tools software platform which allowed them to perform real-time availability and deliver the items in quick shortest possible times [30]. This concept of business later became popular across the world, especially during the COVID-19 situation and lots of companies appeared in many countries, especially in Germany such as Gorillas, Flink has similar business model concepts. There will be a brief discussion about these companies' business models in the upcoming sections of the paper.

In order to understand the workflows of digital food delivery systems, it is important to have an overview of the specific business model configuration these types of business companies are adopting which is a multi-sided platform basis model [28]. This business model is made up of digital platforms which connect multiple separate groups of customers and create values through enhancing relationships and it enables interactions among various types of customers [28]. The “network effect” concept is the main element behind the multi-sided business model concept which is a remarkable thing that allows the increment of platform-based ability to attract more users inside [31].

From the illustration in Fig. 3 it is quite clear that there is a very specific rudimentary structure for the multi-sided business model. This is the structure of the business model canvas from Alexander Osterwalder who gave his suggestion that there are at least a couple of customer segments that have connections with their own value proposition and revenue flows. Platform management and development are the main sources of the cost structure. The key activities consist of platform management and service provisioning which are fundamental for different kinds of customer segments [31].

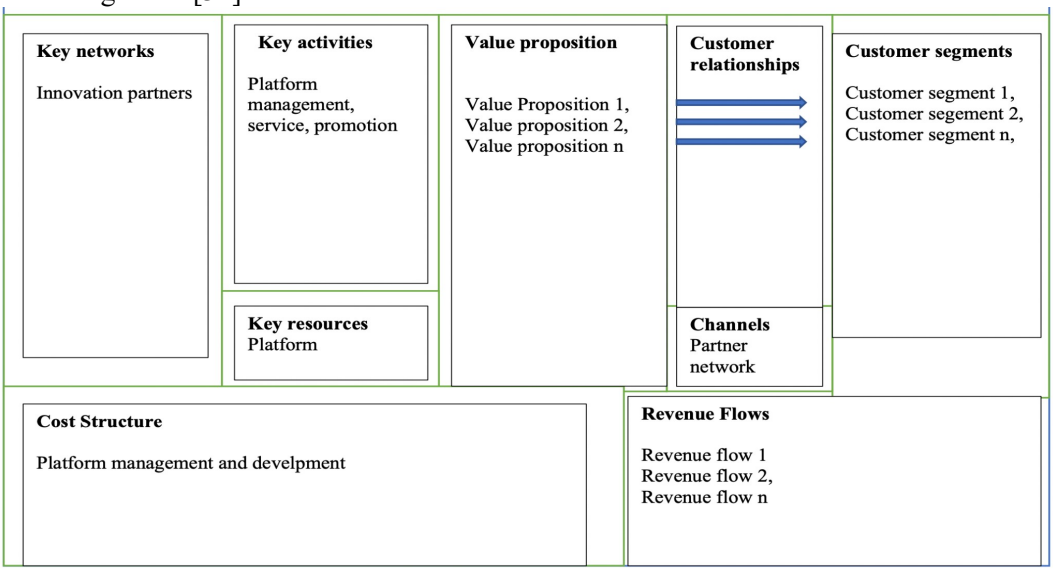

Fig. 3 Multi-sided platforms Business Model Ontology Canvas [31]

The digital way of food delivery business platforms is nicely adopting the multi-sided new business platform configuration in which new delivery players are based on the same principle that holds the characterization of the aggregators [28]. In this configuration, users can browse the software application or website to have a comparison of product offerings and orders where the main feature is that this new configuration of business companies also provides the logistic, product, grocery, etc. services [28]. In short, this new configuration of the delivery players in business manages both order picking and physical delivery through a bunch of staff working in the companies as riders/drivers and this is the representation of the core surplus of compared aggregators [32]. This new delivery system of this business model follows some steps where firstly the customer uses an online software application to order products and place their orders through selections. Then they make their payment online purchase payments through bank debit cards, credit cards, visa cards, etc. After that, the warehouses receive the orders and start picking them the rider/ driver takes the packed order and scans the code for receiving the address of the customer in redirect in google map and then follows the navigation with their e-bikes or cars and delivers it to the customer and complete the order notification as finished [28]. Here all the processes are done and monitored through digital tools software system application. Gorillas, Flink, and Getir in Germany follow this structure of delivery models for their business operations. The next section provides a brief discussion about these companies and their business models.

6. Business Model of Some Grocery Delivery Companies in Germany

In this section, there are some discussions about some recently established new online software applications based on grocery delivery businesses that appeared during the COVID-19 pandemic situation in Germany and rapidly having growth in their business.

6.1 Gorillas

Gorillas is an online-based German grocery delivery business company. The business model of this company shares an offering to its customer an option to select and order the necessary grocery items from the store which are delivered to their doorstep within minutes [33]. The company appeared in 2020 when the world and also in Germany were in a situation of lockdowns and restrictions because of COVID-19. Kaan Sümer and Jörg Kattner were the founder of this company with an ambition of targeting the underserved sections of the supermarket where Sümer realized that customers are intended to buy the foods around the supermarket supply chain needs, rather than store organizing around the consumer's purchasing needs [33]. For this reason, it is foreseen that people are opting to buy groceries in quantity on weekly basis and this trend has mobilized the long-life shelf item focus on storing even fresh food items as well but consumers who choose to make a smaller purchase are facing difficulties to this pattern and to resolve this issue Sümer and Kattner came up with the planned project to migrate the customer from weekly shopping to ad hoc grocery shopping [33]. Now the company operates its business across the major cities in Germany and some other parts of Europe as well and became one of the quickest start-ups with a value worth of around $1 billion, in March 2021 [33]. Unlike using other independent contractors like Uber and DoorDash, Gorillas use its own warehouse employees for pick, storage, and delivery riders to deliver it to the customer [34]. The business procedure of Gorillas linked with Smartphone software applications and the navigation capabilities must be checked with this sort of business model [33]. The application is nothing special rather it is a bit simple where the address is entered and the navigation geolocates the address through Google maps and informs the estimated delivery time [33]. The company generates revenue by selling the products and charging delivery fees [33]. The products they are offering are usually acquired and stored by them in their warehouses and they are not delivering any items from supermarkets or other retailers which results in any items they sell generating profits [33]. The company also generates revenue from delivery fees as well which is around 1.89€ and the fees are designed in such a way that it covers the cost of delivery not intending to generate profit since the company owns its warehouses and the delivery times are generally faster [33]. In near future, the company might use robots to deliver products in order to speed up the picking and lower costs [33]. The company has generated around $220 million in revenue in 2021 where near to 900,000 people have used the Gorillas application at least once a month and the company has crossed its value up to $3.1 billion and the users of the software application of Gorillas app increased to 3.5 million from 0.2 million between the 2021-2022 year [34].

6.2 Flink

The foundation of the grocery delivery company Flink came up from Oliver Merkel (CEO), Christoph Cordes, and Julian Dames [35]. Christoph Cordes had invested six figures in Gorillas in the past which brought a revolutionary surprising delivery model in Germany earlier in 2020 and after his inclusion in Flink, the company obtained 10€ million in funding initially which valued the firm up to 30€ million afterward [35]. The company had an agreement of collaborating partnership with a Humburg-based delivery software app named Pickery in late 2020 and the creators of Pickery Saad Saeed and Nikolas Bullwinkel later became the technology and experience directors at Flink [35]. Flink is now worth its value at around $2.85 billion after the announcement of its latest fundraise which was in December 2021 [36|. The delivery process through Flink works similarly to the Gorillas, where first the mobile software application needs to be downloaded which is currently available on both Android and iOS devices [36]. Gorillas became the biggest competitor for Flink over four months to expand into its second city and in June 2021 the company raised its third round of funding and that time investors invested a huge amount of money around $240 million into the business which made Flink one of the unicorn

companies just after the six months of its foundation and making the company as the fastest company to reach that status in Germany's startup history taking over the title from Gorillas which needed around nine-month to reach that unicorn status [36]. The company later had a partnership with German supermarket giant REWE and it became Flink's exclusive supplier for products [36]. Flink generates its revenue mainly from selling its groceries item products at comparatively lower prices than other convenience stores or Kiosk in the case of Germany since it has its sourcing deal with REWE which gives the company very favorable conditions to buy products and for this reason, the company doesn't require to rent very large retail space rather it relies on small and optimized warehouses locating in cheaper areas [36]. Another thing is that the whole purchase process is done through a software application and for this reason, the delivery riders don't have to waste time at the customers' doorstep for receiving the payment which saves the productive and processing runtime for the company and also the company learns customer preferences to buying items which enable the company to provide recommendations to the customer for items through the software application and allows them to sell higher-margin products [36]. The company has an income stream from delivery fees as well. It charges a delivery fee of €1.80 on top of every order and Flink only has a minimum order amount of €1.00 which allows the customer anything from the store [36] this decision on serving even on low orders company is losing money but it is an effort to gain the market share in border sense to compete for its competitors [36].

7. Conclusion

Digitalization has mobilized the world's economy to a greater extent and to be in the queue the organizations and companies are adopting new technology, and IT tools such as software to gain much productivity and compete with others. This paper has shown the digitalization strategies in business models and companies and how software-based intensive system is present in almost all digital business models. Finally, the paper provided a brief discussion about the business model of Gorillas and Flink it is quite clear foreseen how software acts as the bridge between companies and customers to complete the digital business model. In this way, software-intensive system solutions act a vital role in almost every digital business.

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THE CURRENT STATE OF IOT SECURITY: VULNERABILITIES, ATTACKS, AND PROTECTION STRATEGIES

Janko Govedarica
Faculty of Computer Science, Dortmund University of Applied Sciences and Arts
Dortmund, Germany
janko.govedarica001@stud.fh-dortmund.de

Abstract: *As the Internet of Things (IoT) gains more traction with each passing year, with the fields of application raging from smart cities, smart vehicles, environment monitoring, to healthcare and smart agriculture, the security of such systems has become a key area of concern. The current IoT systems and technologies still have a long way to go when it comes to improving this salient field, especially considering that the cyber threats and potential attacks are constantly growing in scale. This paper tries to give an overview of the current state of the affairs in the field of IoT security by tackling the various vulnerabilities of the IoT systems and inspecting the best routes for enhancing their security features.*

Keywords: Internet of Things (IoT), IoT security, cyber attacks, blockchain, machine learning

1. Introduction

Due to their specific characteristics, such as heterogeneity, memory and computational power constraints, heavy distribution, and unpredictable environments in which they are deployed in, Internet-of-Things (IoT) systems have considerable security demands which need to be met to guarantee security and reliability for their users [1]. If not properly addressed, these potential risks could lead to hazardous outcomes that could endanger the lives of humans [2]. The challenges in the area of security currently faced by IoT systems do not only pose threats to the users of such systems, but they could also hinder the overall future development of the IoT technology [3]. If sufficient improvements in the field are not made, the upcoming IoT applications could face serious obstacles that could reduce their sphere of influence and prevent them from realizing their full potential [4].

In the past years there have been several large-scale attacks that targeted the IoT devices, also referred to as “things”, such as the Mirai malware in 2016 which launched a distributed denial of service (DDos) attack on Dyn, a DNS provider from the U.S. and caused downtimes for several websites and services which ultimately resulted in considerable losses in revenue and the number of customers for the company [4] – [5]. These botnet attacks are made possible by a noticeable lack of focus on security from the producers of IoT devices who, in order to release a new product to the market within the shortest period of time, end up brushing over this crucial characteristic [6]. The domain of IoT is also noticeably marred by the lack of standards for manufacturing of the devices that directly impacts the integration of new IoT devices into existing networks which could possibly result in novel, previously unencountered security threats [7].

The goal of this paper is to identify the current IoT security threats by addressing the different types of attacks that an IoT system could undergo, as well as to succinctly present the available solutions for tackling the various weaknesses of the IoT devices that, if not improved, could lead to a breach of security. To do so, a systematic literature review of the existing research papers on the topic at hand was conducted. The remaining part of the paper is structured as follows: Section 2 talks about the vulnerabilities of IoT systems while looking into the architecture and layer-specific threats. Section 3 addresses the most common types of attacks against IoT systems, while Section 4 concerns itself with the best strategies for improving the IoT security and protection against possible threats and attacks. Finally, conclusion and final remarks are given in Section 5.

2. Security Vulnerabilities of IoT

To successfully tackle the strategies and approaches for improving the security of IoT and preventing possible cyberattacks, it is first necessary to have a proper understanding of the most salient vulnerabilities of IoT systems. One of the most obvious and common vulnerabilities of IoT lies in its hardware, whose producers generally put more emphasis on and give more space to functionality over security, which makes the hardware prone to remote exploitation [3]. On the software-side, there are various points of vulnerability too which are often taken advantage of by the attackers. For instance, the default configuration of the device software which is often left unchanged by the users provides an easy entrance point for attacks, while outdated software is also a cause of difficulties. Data security and privacy is also a big area of concern, as IoT systems generate large amounts of valuable, confidential data, and any breaches could compromise the entire systems [8]. Poyner and Sherratt [9] analyzed data security in healthcare IoT applications and identified numerous requirements that need to be met in order to guarantee it, such as confidentiality, integrity, and consent management, but also suggested that additional requirements such as the freshness of the data as well as proper archiving need to be considered.

2.1 Architecture-Wise Vulnerabilities

For better understanding of the vulnerabilities of each part of an IoT system, it is necessary to investigate the architecture. An average IoT system's architecture usually consists of the three following layers: 1) perception/sensing layer, the role of which is to gather data about the environment using sensors; 2) network layer, with the role of transmitting and processing the gathered data via the Internet connectivity; and 3) application layer, which delivers a specific functionality based on the needs of the user [4] – [11].

While the described three-layer architecture is the most essential one, a five-layer architecture is also quite common [12]. In addition to the three previously mentioned layers, this architecture adds two additional ones, namely the middleware/processing layer and the business layer. The former actually takes the processing duty of the network layer, the roles of which are mostly taken over by the transport layer in the five-layer architecture, while the latter applies visualization techniques for the purpose of managing and controlling the application to determine the appropriate business strategies for improving the overall profit [13]. A comparison of the two main IoT architectures is presented in Fig. 1.

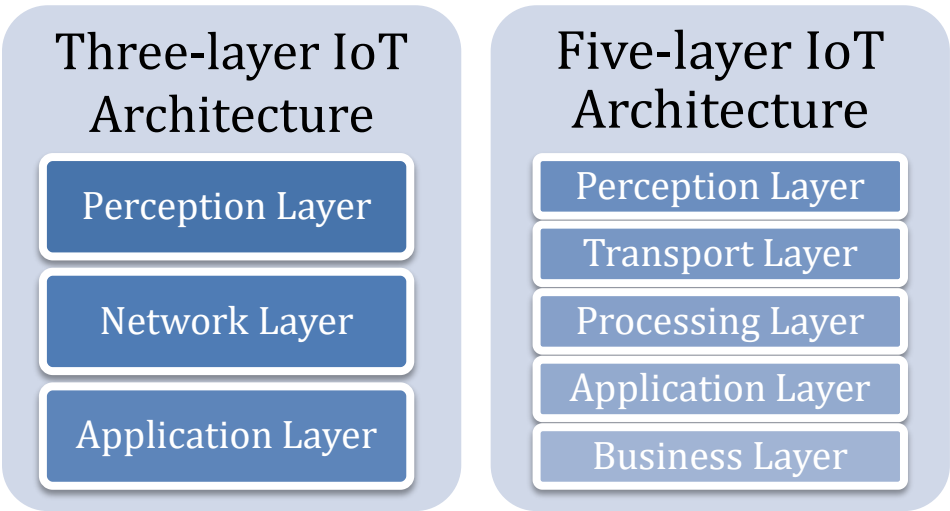

Fig. 1. IoT architecture layers (adapted from [11])

The perception layer is often named as the one with highest security risks, considering the fact that the sensors and actuators are often placed in very unpredictable and hostile environments [14]. One of the currently most common ways of taking advantage of the physical IoT devices is by gaining access to them through the use of default passwords and credentials which are often left as they are. Also, depending on the conditions in the environment it is placed in, a device could malfunction either due to different conditions such as the weather, but can also fall victim to a direct physical attack, with the attacker directly tampering the hardware components [3] – [15].

The previously mentioned data breaches occur in the network layer, as this layer is rather prone to eavesdropping or passive monitoring attacks. During transmission, which is achieved through the use of technologies such as RFID, Wi-Fi, Bluetooth, ZigBee and others, there is a big risk of the data transfer being interrupted or manipulated [15] – [16]. Main areas of concern in this layer are privacy and confidentiality, but also compatibility [17].

The application layer is also vulnerable to different kinds of attacks. In their study from 2019, Shakdher et al. [18] specifically analyzed the threats faced by the application layer by performing extensive penetration testing on IoT applications from different domains, raging from smart homes to connected cars, and they identified that many IoT applications are very lacking when it comes to security, as the ones that were tested returned unsatisfactory results [18].

3. Types of Attacks Faced by IoT Systems

Attacks on IoT systems can be classified based on the layered architecture discussed in the previous section [19]. The focus here is on the three-layered architecture and the attacks specific to each of the layers. One common attack for all the layers is the denial of service (DoS), as it can target all three, but it most commonly occurs within the network layer [15]. Fig. 2 presents an overview of the most common attacks affecting each architecture layer. In the following text each of the attacks from the diagram will be briefly elaborated on.

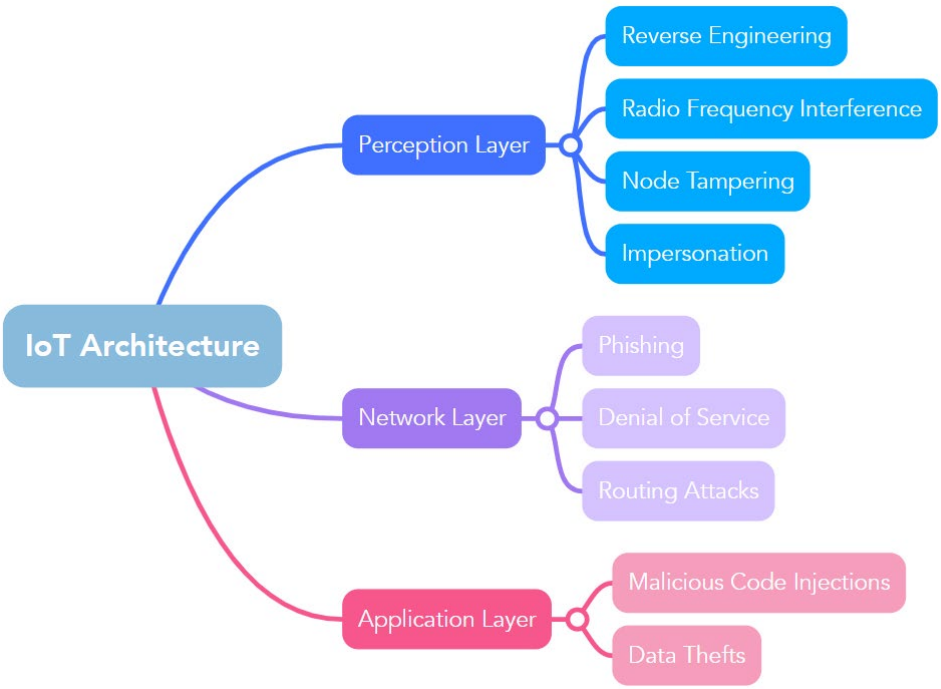

Fig. 2. Overview of the most common attacks affecting each layer (own source)

3.1 Perception Layer Attacks

At the perception or physical layer, the attackers focus their energy on specifically attacking the devices themselves or targeting the network as a whole through wired and wireless intermediaries [20]. Some of the most common attacks on this layer are:

1) *Reverse Engineering*: Here, the attackers focus on identifying the vulnerabilities of a device through a step by step process of breaking it down and afterwards exploiting the discovered vulnerabilities, which could subsequently be replicated on other devices within the network [20].

2) *Radio Frequency Interference*: This attack features the use of one device to obstruct the connectivity of other IoT devices within a system, but for it to be performed the attacker has to be located close to the device [19].

3) *Node Tampering*: Here, the attackers target the sensors and either alter them partially or completely, all with the purpose to obtain valuable, sensitive information such a login credentials, encryption keys etc. [10] – [19].

4) *Impersonation*: These attacks occur due to the difficulty of properly authenticating devices within a distributed environment. As a consequence of that, fraudulent devices can assume a forged identity and perform attacks on the rest of the system [10].

3.2 Network Layer Attacks

As mentioned before, the network layer chiefly concerns itself with transmitting the data from the physical layer toward the application layer or the end-user. Common attacks that target this layer include eavesdropping, DoS, phishing, routing attacks among others, some of which are elaborated on below [4] – [20].

1) *Phishing*: This kind of attack usually includes several IoT devices within a system. As with most standard phishing attacks it is quite common for the entry to happen via users visiting and clicking suspicious links, eventually leading to the entire system becoming compromised [4].

2) *Denial of Service*: This attack includes the use of attacker's own assets to flood the sever with a very large number of requests that puts the server out of commission with the real end-users not being able to access it [4] – [20]. A DDos attack on the other hand generally implies the use of IoT devices controlled as botnets for similarly attacking the servers [5].

3) *Routing Attacks*: Two common types of routing attacks are sinkhole attacks and wormhole attacks. The former features a fake route that is promoted as the most ideal one through the use or a forged node, while the latter implies an out-of-band connection between nodes which is used for faster forwarding of data packets, and can be especially damaging if used in combination with the sinkhole attack [21].

3.3 Application Layer Attacks

Due to its specific nature, the application layer has certain unique vulnerabilities which make it prone to unique attacks, mainly referring to the misuse of data and privacy breaches [4]. The challenges provided by this layer have a lot do with the information that is collected from regular use of the IoT applications, this data being very private and the implications of its misuse being

very grave and discontenting [10]. Some of the more prominent attacks on this layer are presented below.

1) *Malicious Code Injections*: These attacks feature the input of malicious scripts in the application to target the open vulnerabilities [10]. The often used approaches are SQL injections, where an SQL query is entered into an unsecured field and later executed, as well as cross-site scripting, which features the adding of malicious scripts into the code of a website [4] – [20].

2) *Data Thefts*: Data of an IoT application is prone to being stolen, which is not a difficult task for an attacker who is aware of the application's vulnerable points, and as previously mentioned, if the confidential data (e.g. private information about a user) is to be leaked, the consequences could end up being very grave [10].

4. Strategies for Improving IoT Security

Based on the previously described vulnerabilities and threats faced by the current IoT systems, some different strategies than before need to be implemented in order to enhance the security characteristics and, as much as possible, secure the system again malicious intruders and attackers. This may sound easier said than done, but recently there have been certain suggested solutions that seem to be beneficial for this problem. Namely, those are the use of machine learning (ML) and blockchain technologies, both of which will be elaborated on in the text that follows.

4.1 Machine Learning in IoT Security

ML can empower IoT systems with the possibility of inferring and deriving certain sound conclusions from the large amount of generated data, making the overall system much smarter [22]. Its potential contributions to the field of security are not to be ignored though, and this is the main focus of this chapter. Canedo and Skjellum [23] proposed the use of ML for detecting irregularities in IoT systems, and namely the use of neural networks for training the system to identify the faulty data points which proved satisfactory in the tests they had conducted. In their 2018 study, Xiao et al. [24] suggested that supervised learning techniques, such as for example support vector machines (SVM), can be used for detecting network intrusions or spoofing attacks. The authors also implied that the unsupervised learning techniques, one of which is multivariate correlation analysis can be successfully employed for detecting the DoS attacks [24].

In their 2020 study Al-Garadi et al. [25] conducted a thorough survey of the available ML and deep learning (DL) methods for enhancing the IoT security, and suggested that these methods can be used for preventive predictions of future attacks through the use of historic attack data for inferring conclusions. The authors also identified that the ML and DL methods can be used for early detection of malicious behaviors, and that they enable the systems with early and adequate responses [25]. Saba et al. [26] presented results obtained by implementing a ML-based protocol for autonomous IoT security, which was able to identify the most ideal routes for data transmission, while having a much lower energy consumption compared to other similar approaches.

In their 2022 study Sarker et al. [17] addressed the topic of data quality used for training the ML models, and came to the conclusion that data sets of poor quality will yield results with unsatisfactory levels of accuracy, which could in the end be of no use at all. They also suggested that considerable attention should be paid to methods of data gathering to ensure that only the relevant data is captured, while also keeping in mind the subsequent cleaning and preprocessing of the gathered data which was deemed as necessary [17].

4.2 Blockchain in IoT Security

Blockchain can be a very suitable solution for the security problems faced by IoT, considering that one of its characteristics is enhance security achieved through smart contracts, which ensure that only the authorized blockchain nodes can access the data [27]. In [28] Kshetri questioned the potential contributions of blockchain in empowering the IoT, and ultimately gave preference to blockchain over the traditionally used cloud, by arguing that that: "*Blockchain's decentralized and consensus-driven structures are likely to provide more secure approaches as the network size increases exponentially* [28, p. 71]." In their study [29] Jeon et al. proposed incorporating blockchain into IoT systems by using it as data storage for the sensor data received in real-time. They implied that this method, which included using smart contracts as vehicles of encryption and authentication, improved the overall security of data transmissions, namely by having them sent in a distributed way [29].

Dorri et al. [30] also demonstrated the use of blockchain for IoT security and privacy on the case of a smart home application, and based on the generated results they suggested that their blockchain-based method is worth implementing when having in mind the enhanced security, with the overheads such as the increased processing time and energy consumption being disregarded, with the argument of the latter being outweighed by the security benefits. Notably the same authors have in [31] proposed a lightweight IoT architecture based on blockchain, meant to eliminate the overheads that come with more regular blockchain solutions, employing a centralized private immutable ledger at the local level which worked really well for overhead elimination, while on the other hand a decentralized public blockchain was used at the higher levels as a way of promoting better trust.

Despite blockchain being quite an effective way of solving the general security issues in IoT, Du et al. pointed out in their 2020 study [32] how the blockchain technology itself is vulnerable to attacks, which could eventually compromise the IoT devices as well. To address this concern the authors developed an enhanced blockchain system with a three-dimensional ledger architecture, which considerably improved security, while also successfully dealing with other areas of concern for IoT, such as heterogeneity and scalability [32]. Kamal et al. [27] also listed the issues faced by blockchain-based IoT security systems, such as the limits in storage due to the low capacity of IoT devices not being able to accommodate the continually growing ledger sizes, and the high energy consumption required to process the consensus protocols for implementing the blockchain technology.

4.3 Other Possible Strategies

Except the two strategies above that have been receiving the most attention from researchers, there are also some other possible approaches which will be presented in this chapter. Driss et al. analyzed the use of microservices for securing IoT applications and concluded that they can indeed be used for meeting a certain number of the security requirements, but vouched for more research in this field with the goal of securing the entire IoT technology stack with microservices [33]. In [34] authors stressed out the importance of network function virtualization (NFV) and proposed a Docker-based virtualization architecture for IoT security. They argued that the container-based virtualization is beneficial, and the results of the tests they ran showed positive results but as the focus was on smart homes, they implied that more investigation in other application areas would be necessary [34].

In a 2022 study [35] the authors named lightweight cryptography as an ideal solution for optimizing the energy consumption and costs, while adding significant improvements for the security vulnerabilities of IoT. Their contributions featured suggestions for improvement of the lightweight cryptography operating in the wireless sensor networks – CurveCP, namely the length

reduction of the cryptographic key, and they finally implied that they will work on combining this technology with overhearing mechanisms with the goal of preventing the DoS attacks [35].

5. Conclusion

This paper presented a comprehensive review of the available literature on the topic of IoT security, with considerable attention being given to the main areas of vulnerability and most significant threats faced by the current IoT systems. The most common attacks on the IoT systems were analyzed and the currently trending strategies for hindering them were explained.

The field of IoT security is still developing and has a long way to go when it comes to addressing and eliminating many of the vulnerabilities listed in the paper. The amount of data transmitted through IoT networks has been exponentially growing over the years, but in parallel the cyber attacks that target those data have been growing in scale as well. In order to secure privacy and safety of the end-users, strategies with clear goals and adequate approaches need to be undertaken. Some of them, like the use of machine learning and blockchain have been discussed in this paper, but there is still no cut and dry option that ideally addresses all the concerns for security in IoT, and considerable research in the field still needs to be undertaken.

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IMPACT-ORIENTED CONTROLLING AT THE POLICE OF NORTH-RHINE WESTPHALIA

Corinna Köbler
IDiAL Institute, Dortmund University of Applied Sciences and Arts
Dortmund, Germany
ORCID 0000-0001-8892-0140

Abstract: *In total, the police force in North Rhine-Westphalia (NRW) employs around 56,000 people in three higher state authorities and 47 district police authorities. The annual budget volume amounts to approximately 3.8 billion euros for 2022. Every year the police of NRW requests more resources to cope with their daily business: ensuring internal security. At the same time, overtime is increasing along as well as citizens are demanding for more transparency about what is done with their tax money: the so-called legitimacy gap. Moreover, there are increasing demands on the administration to use limited resources efficiently and effectively, and increasing pressure on politicians to demonstrate the effectiveness of the actions they take. In this context classical input-output controlling has long since reached its limits and has come under public criticism. As a consequence, limited resources and the demand for more transparency of their allocation require new steering methods. Otherwise, the legitimacy gap vis-à-vis citizens and their political representatives cannot be closed. This leads to the research question: How can impact-oriented controlling contribute to ensuring internal security and at the same time close the legitimacy gap towards stakeholders?*

Keywords: connecting expectations and goals of citizens, controlling, controlling instrument, impact-oriented controlling, internal security, New Public Management, public services, police of North Rhine-Westphalia, project management, quality of life, resource allocation, result-oriented controlling, stakeholder expectations

1. Introduction

Ensuring internal security is the task of the state [1]. And it is not just a public service but a promise that the state gives to its citizens. This is why police is a public service which is exclusively delivered by the state. Citizens expect that the state can justify their trust into the police with security as the desired impact on society. As of today, the police lack transparency about its actual efforts as well as a statement about the effectiveness of the measures taken. The annually published police crime statistics focus on the efficiency of the resources used in relation to the police activities, but do not allow any assessment of the effectiveness of the measures and activities carried out. The classical input-output controlling in use has long reached its limits and is under public criticism. Against the backdrop of limited resources, the NRW police must find ways to use its resources not only efficiently, but above all effectively. The objective is to close the legitimacy gap vis-à-vis citizens and their political representatives while ensuring internal security at the same time. In September 2017, the Federal Ministry of Finance (BMF) states the following reasons for more impact orientation:

- *"Citizens are rightly demanding more transparency about what is being done with their tax money.*
- *There is increasing pressure on policymakers to demonstrate the effectiveness of the measures they take.*
- *The demand on the administration to use the limited resources efficiently and precisely is increasing.*
- *Sound knowledge about the effects of expenditure helps to make more targeted spending decisions."[2]*

2. Impact Orientation in Controlling

2.1 The Roots of Impact-Oriented Controlling: New Public Management

The roots of impact-oriented controlling can be found in the concept of New Public Management (NPM) which is originally a concept for municipal administrative reform aimed at strategically managed administration [3]. The New Public Management (NPM) movement originated in the Anglo-Saxon world in the 1980s. It was not until about ten years later, in the early 1990s, that Germany also began to reflect their administrative structure. In this context, between 1988 and 1991, the German Association of Local Authorities for Public Management developed the reform model "New Steering Model" (NSM). The New Steering Model corresponds in large parts to the international trend of New Public Management and thus the term NSM stands for the German version of NPM. In addition to the decentralised management and organisational structure, impact orientation is one of the core elements of the new steering model [4].

2.2 What Exactly is Impact-Oriented Controlling?

In short, impact-oriented controlling complements the statements about efficiency by considering impact goals and adding the perspective of effectiveness. Impact orientation can be implemented on the one hand by means of higher-level strategic overall planning or within the framework of internal management at the administrative level. Strategic overall planning means the specification of concrete impact goals by politicians (what should be achieved?); while the selection of operational measures is carried out by the administration (how can the impact goals be achieved?) [4]. In this approach, impacts are understood as a link between the disciplines [4]. Internal steering aims to complement performance agreements between leading and implementing administrative activities. Through the systematic integration of impact information, the focus is also directed to the effective use of resources in addition to the question of efficiently used resources. The view of impacts enables the assessment of the effectiveness of the measures and activities implemented [4]. In this respect, the i-o-o-i model [5] is an instrument that helps to make desired impacts visible and plan them accordingly (Fig.1).

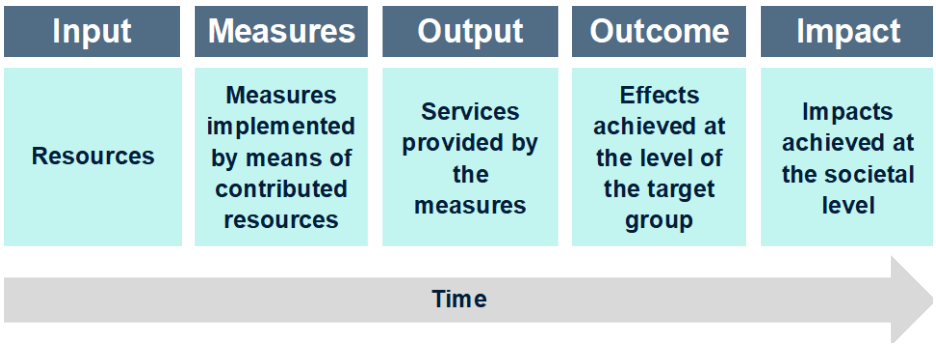

Fig. 1. Model of the i-o-o-i method extended by measures (own design)

Inputs are all the resources needed to achieve the objectives. The outputs correspond to the offers or products generated by the inputs and the outcomes finally show the effects achieved at the level of the target group. The impact describes the effects at the societal level [5]. Within the impact structure, the measures that transform the inputs into outputs are also mapped. This procedure serves as an illustration and facilitates the selection of the measures to be used in the second step. In order to be able to measure and assess the effectiveness of the measures used, corresponding quantitative and qualitative indicators need to be defined for each measure. However, the long-term effects (impacts) can be clearly decoupled from the end of the project and may only become visible years later. In general, it can be stated that impacts at the societal level are usually not immediately identifiable, as each impact structure involves many individual cause-effect chains, which are to be seen as a process with its own time frame.

2.3 State of the Art

Since the start of NSM in the 1990s, numerous business management approaches from the private sector were supposed to get a grip on the management problems in public administration. 30 years later, it can be stated that the adoption of business management methods in public institutions has taken place in very different ways and by no means across the board [6]. With regard to the use of impact-oriented management, the Organisation for Economic Co-operation and Development (OECD) sees the German budget system as clearly lagging behind internationally in its 2015 study. For future development, the OECD recommends greater consideration of impact orientation. Among other things, the introduction of impact goals contributes to greater transparency for all stakeholders [7].

Impact-oriented controlling is a well-known tool in project management. Transparency towards stakeholders and the ability to provide information on the effectiveness of activities carried out are essential within project environments. In fact, the assessment of project success often depends not on compliance with time, budget and quality objectives, but on the impact achieved. This can be clearly decoupled in terms of time from the end of the project and only become visible years later [8]. The work of the police is not a project business, but it is also intended to achieve certain impacts: first and foremost, ensuring internal security. The fundamental expectations of the stakeholders and the transparency required for legitimisation therefore make the use of impact-oriented management obvious. Nationally and internationally, there are already numerous examples within the public sector and also in police forces in which impact-oriented controlling is used: either as a holistic concept or at least components of impact orientation have found their way into the controlling mechanism. The Anglo-Saxon nations in particular, such as the United Kingdom, Canada and Australia, can be seen as the pioneers of impact-oriented controlling [9]. The objective of the research is to support the NRW police in benefiting from these experiences and in taking advantage of the opportunities of impact-oriented management through individual integration and design.

In fact, the topic of impact-oriented controlling is also not new to the NRW police. With the introduction of numerous reform elements within the context of the New Steering Model at the police of North Rhine-Westphalia in the late 1990s, the police had turned away from the classic input-output perspective and implemented an impact-oriented controlling approach. At that time the attempt to transfer cause-effect relationships into impact indicators by means of impact-oriented controlling ended in a flood of indicators with more than 1500 indicators [10]. Among other things the reasons were high complexity of cause-effect relationships and insufficient knowledge about them. In the end, high administrative costs with limited informative value inevitably led to frustration and rejection within the police departments. As a consequence, the first attempt to use impact-oriented controlling failed and in 2005 the police returned to classical controlling (input-output) and has since focused on activity indicators. It can be stated that the Ministry of the Interior of North Rhine-Westphalia has understood the principles of impact-oriented management in general, but it lacks applicable instruments that can be transferred to the police force in North Rhine Westphalia.

3. Research Gaps and Questions

Research on the police in North Rhine-Westphalia proves to be particularly non-transparent. Not only academia, but even the Ministry of the Interior lacks accessible information on an objective evaluation and steering of the police executives in North Rhine-Westphalia [11]. Limited resources, lack of transparency and the resulting lack of legitimacy vis-à-vis citizens and their political representatives arise the question to what extent the current input-output management can endure in the future? In addition, when it comes to scarce resources, it is also about resource availability, performance, sick leave, work-life balance, healthy age structures, etc. These challenges also affect the NRW police. For this reason, a binding health management system was already established in the police in North Rhine-Westphalia in October 2010. Unfortunately, the

current structure within the police authorities does not meet the strategic goal of effectively addressing the shortage of resources. The Ministry of the Interior was commissioned to develop a new concept that ensures that the defined measures also stand up to the aspect of impact orientation. This project is to serve as a case study for the research project. In this context, the Ministry of the Interior allows access to anonymised data and the possibility to conduct expert interviews in two police departments.
The research activities take place within a doctoral thesis and will contribute to the solution of a political dilemma and thus create an added value for society: it will proof if impact-oriented controlling is an appropriate tool to consider effectiveness of allocated resources at the police force in North Rhine-Westphalia. The results are transferable to any ministries and areas of public services as well as wherever cross-organisational cooperation takes place and impacts are to be achieved. By means of a combination of an inductive and a deductive approach, the following research questions are to be answered and recommendations developed as to how impact-oriented controlling in the NRW police can counter the problem of limited resources while at the same time guaranteeing internal security. For this purpose, the results of a structured literature analysis (deductive approach) will be combined with the observations and results from the case study (inductive approach).The following research questions were derived for the doctoral thesis:

1. How can the use of impact oriented controlling support the Ministry of the Interior and the police in North Rhine Westphalia in using limited resources as efficiently and effectively as possible?
2. How can transparency towards the citizens and their political representatives be increased by means of impact orientation in order to contribute to closing the so-called legitimacy gap?
3. How can health management in particular maximise the contribution to ensuring internal security in the context of limited resources?

4. Résumé

Security is one of the main concerns of citizens when it comes to the quality of life in cities and states, and it is not only a public service but a promise that states give to citizens. The assessment whether the police fulfils this expectation is made by its stakeholders (e.g. citizens, political representatives) and requires transparency in reporting. Current police crime statistics provide a great variety of information, all of which is quantitative but with no insight into the effective use of the resources provided. Therefore, the police of North Rhine-Westphalia need to find ways to provide transparency of their achievements made with the provided resources in order to close the legitimacy gap towards its stakeholders. This is not possible with the actual input-output controlling in use. Impact-oriented controlling is not only a well-known tool in project management, it is also one of the core elements of the New Steering Model (NSM) and it adds the perspective of effectiveness.
In the late 1990s the first attempt of the police in North Rhine-Westphalia to introduce impact-oriented controlling mechanisms failed, but the NRW police is well aware of the need to adapt changes in their controlling methods.
The objective of this research is to proof if impact-oriented controlling is an appropriate tool to consider effectiveness of allocated resources at the police force in North Rhine-Westphalia. The results will contribute to the solution of a political dilemma and are transferable not only to other ministries and the public sector in general but wherever impacts are to be achieved. The next step is to conduct a case study within two selected police departments to gain insights on how the NRW police effectively tackle the challenge of limited resources with their health management measures. The research project combines the scientific fields of controlling, project management, new public management and digital transformation. It is therefore an interdisciplinary project with transdisciplinary cooperation with the NRW police.

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CONCEPTUAL MODEL OF INTELLIGENT INFORMATION SYSTEM FOR URBAN SOCIAL AND ECONOMIC SECURITY

Khrystyna Lipianina-Honcharenko [1], ***Carsten Wolff*** [2], ***Anatoliy Sachenko*** [3]

[1,3] *Department for Information Computer Systems and Control, West Ukrainian National University,*
[2] *Dortmund University of Applied Sciences and Arts,*
[1,3] *Ternopil, Ukraine,* [2] *Dortmund, Germany*
[1] *0000-0002-2441-6292,* [2] *0000-0003-3646-5240,*[3] *0000-0002-0907-3682*

Abstract: *The article develops a conceptual model of an intelligent information system to ensure the socio-economic security of the city and the structure of data flow in the information system.*

Keywords: model, information system, socio-economic security, data flow

1. Introduction

The issue of economic security at all levels of the socio-economic system of the country has been actively studied in recent years. The results were the synthesis and systematization of objective knowledge about the economic security of specific objects (state, region, enterprise). The results reveal the essence, explain the patterns of provision and cause-and-effect relationships at the levels of the economic system.

Recognition of the importance and even the priority of the social component in the economic security of the state and the region has led to the formation and application of the category of "socio-economic security" in relation to the state and the region. Its emergence and spread are explained as follows: increasing the activity and efficiency of economic entities is not the ultimate goal, such growth should affect the welfare of the population, in particular by increasing wages, social assistance, improving the quality of its social services, improving the environment.

Socio-economic security is an important condition for the stability and effectiveness of the socio-economic system of any level. Cities, which are the result of long-term urbanization processes in the world, in modern conditions are playing an increasingly important role in the country's economy. Because it is in the city that its industrial and scientific-technical potentials, financial and commodity markets are mainly concentrated, decisions are formed that determine the vectors of socio-economic development of regions and the state as a whole.

This circumstance determines the need to develop an intelligent information system of socio-economic security of the city. That will further automate the distribution of powers between state and regional government, in the development of master plans for urban development, social programs and other documents aimed at improving the quality of life.

This topic is devoted to this work, which is distributed in an offensive way. Section 2 considers the analysis of related works; Section 3 presents a conceptual model of intelligent information system for urban social and economic security. Chapter 4 presents the findings for the study.

2. Related Work

Article [1] explains the lexical and economic meaning of the term economic security. To assess [2] the level of economic security, a comprehensive approach is proposed, which consists in combining a number of indicators into a single integrated indicator that summarizes the level of sustainable development of the enterprise, which allows it to be used in both operational management and strategy. A resource-functional model [3] of security (which consists of partial

indicators and components of economic security of business) has been developed and a resource-functional approach to calculations has been applied. In [4] a quantitative assessment of the level of financial solvency of countries based on the use of multidimensional methodological tools for assessing the financial performance of the country, which leads to the construction of appropriate integrated security indices. In the article [5] the term "economic security" means the economic basis of the state, national economy and society. The consequences for the socio-economic development of the dependencies between the economic security of the state and its economy and the prosperity of the population are indicated.

Article [6] assesses the satisfaction of users of the electronic social security system (SSES) as a widely used HIS in Iran. In [7], the Hans-Böckler-Stiftung and its Research for the Future research unit present a revised DSS model by Enzo Weber. DSS (Digital Social Security) solves the problem of serious gaps in the social security of employees of the platform. The model assumes that platforms around the world implement a digital mechanism to transfer a portion of each agreed remuneration to the global DSS account of the platform employee. The DSS account collects contributions generated worldwide and transfers them on a regular basis to the social security system of the country in which the employee of the platform is located. The article examines [8], five factors - psychological, technological, resources, risk perception and values - influence the approval of IT.

In article [9] provides new insight, develops a conceptual framework and identifies promising research issues by placing local government artificial intelligence systems under the microscope through the lens of responsible urban innovation. In article [11] offers a new IDSS conceptual framework for disaster control, with particular attention to wildfires and cold/heat waves. IDSS uses big data collected from open application programming interfaces (APIs) and artificial intelligence (AI) algorithms to help decision makers make faster and more accurate decisions.

The article [12] examines the impact of governance on sustainability and reflects the impact of information and communication technologies (ICT) on the decision-making process by improving policy effectiveness, accountability and transparency in urban systems. Also, conceptual system models of cognitive city and energy behavior are presented, including three sublevels: human-institutional, physical and data. And it offers integrated conceptual models to improve the efficiency of energy systems in complex and uncertain conditions, facilitate energy consumption and support capacity development at the individual, social and technical levels to improve future energy management.

The article [13] was based on a synthesized and aggregated review of the literature to build a new conceptual framework. An analysis of the literature showed an additional existing structure of a smart city, including urban services (basic services, non-basic services and additional services); city resources (superstructure, infrastructure, infostructure); architecture of the city (enterprise); and city goals (viability, efficiency and sustainability). This study contributes to a broader understanding of the smart city reference model for both Indonesia and other developing countries.

The above-mentioned works mostly assess economic or social security as a separate system. Few works consider social or economic security as an information system (analogues).
In this regard, the purpose of this article is to develop a conceptual model of an intelligent information system to ensure socio-economic security of the city.
In comparison with analogues [7], [9] and [12] the conceptual model of the intellectual information system of maintenance of social and economic safety of the city which will allow to develop further the intellectual information system is developed. The developed intelligent information system will automate the distribution of powers between state and regional

government, in the development of master plans for urban development, social programs and other documents aimed at improving the quality of life.

3. Conceptual Model

Intelligent information system of socio-economic security of the city (Fig. 1) should include at least four basic levels of security: economic, social, environmental and socio-political. It is also important to take into account both quantitative and qualitative indicators. Consider each level separately.

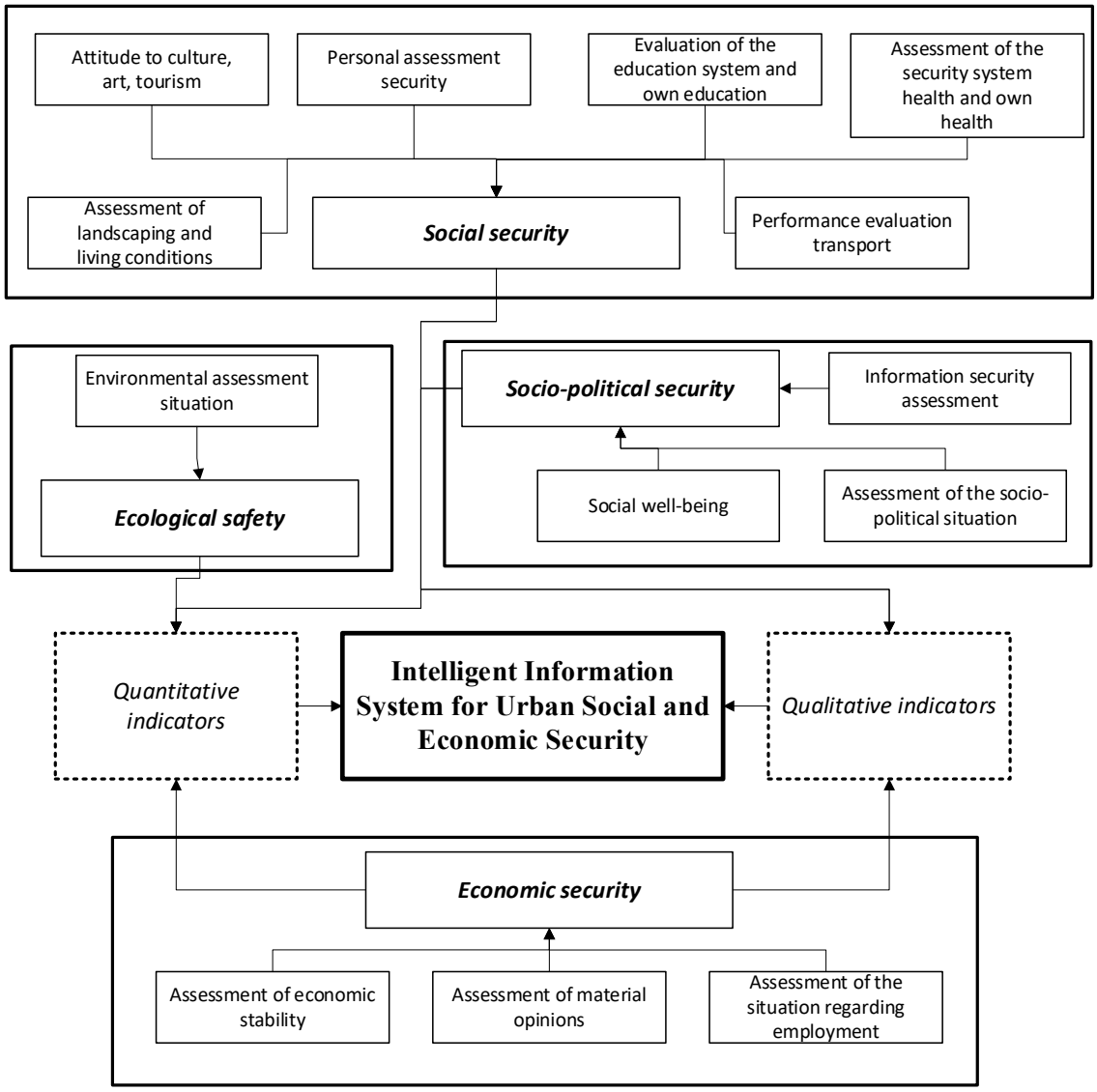

Fig. 1. Conceptual Model of Intelligent Information System for Urban Social and Economic Security

Social security should include people's attitudes to culture, art, tourism, as well as the assessment of personal security, education and self-education, health and health care, amenities and living conditions, transport.

The importance of environmental safety for humans is an assessment of the current environmental situation in the city.

When it comes to economic security, a city resident can assess economic stability, their financial situation and the employment situation.

Today, during the period of military aggression in Ukraine, socio-political security is becoming important for everyone and every city resident can assess the socio-political situation, information security and personal social well-being.

Consider in more detail the structure of data flow in the intelligent information system to ensure socio-economic security of the city (Fig. 2).

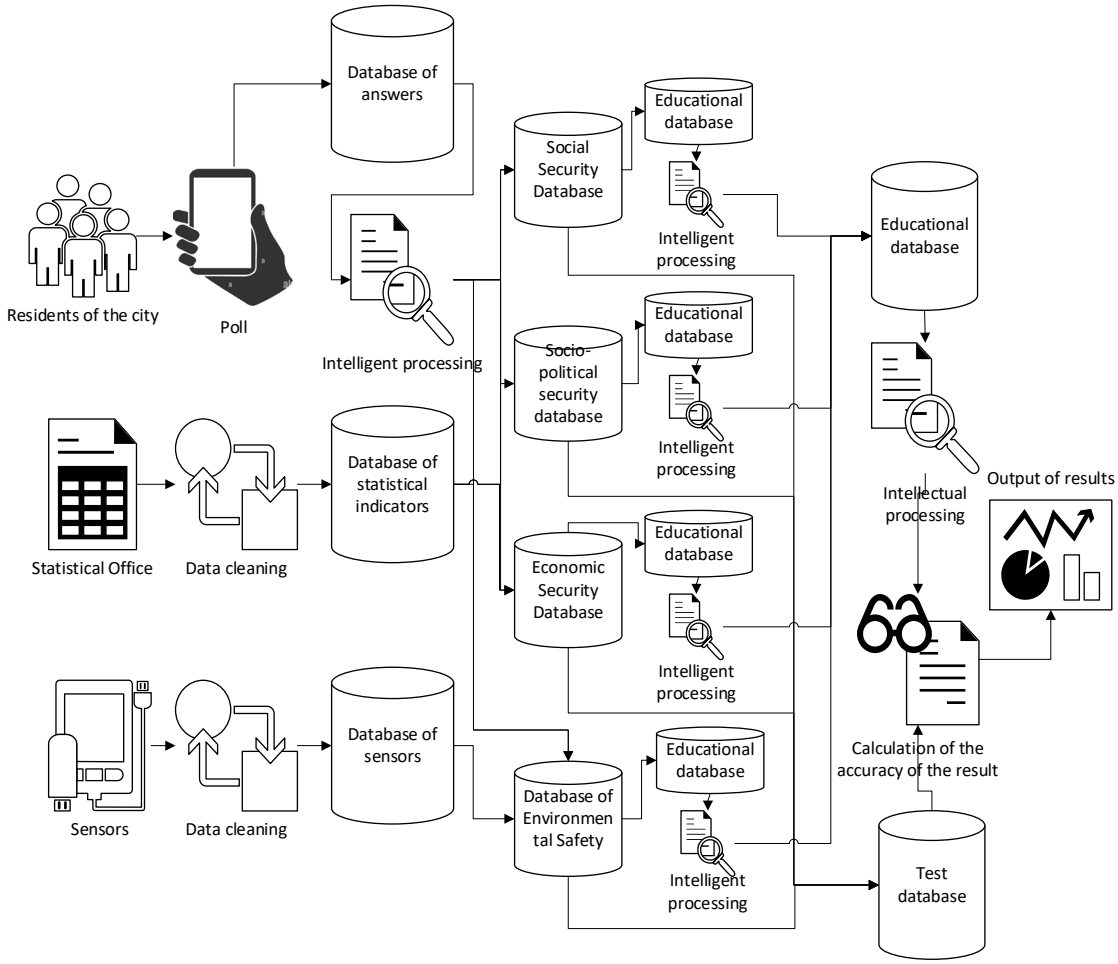

Fig. 2. Data flow

Data collection will be based on surveys of residents, as well as on the basis of collected statistics and indicators from sensors. The latter is important for studying the environmental safety of the city.

All quantitative data must be pre-processed and stored in the appropriate databases. If conduct a survey, then after collecting data in the database, it needs to be processed using intelligent methods to provide quantitative values.

Then all the data are transferred to the database of four levels of socio-economic security. At each level, intellectual data processing is performed, the results of which are transferred to a common training database. In parallel, data from the database of four levels of socio-economic security are transferred to a common test database.

The main intelligent processing is performed on a common database, followed by a calculation of accuracy relative to the overall test database. At the end, the results are displayed.

The conceptual model of the intelligent information system for ensuring the socio-economic security of the city and the structure of the data flow in it, allows real-time monitoring of threats to society in terms of social = economic security. The developed conceptual model can be part of a smart city [10].

A smart city with a component of the developed intelligent information system to ensure the socio-economic security of the city will help utilities to increase operational efficiency. In this context, sustainable, data-driven smart cities, developed using a kind of integrated real-time urban data analysis and analysis centers, dashboards and applications, offer a powerful tool not only for designing, living and managing cities in meaningful ways, but also for planning in terms of relevance and sustainable development. This includes developing future scenarios for how cities will develop based on data-driven technological solutions. Sick cities do not become wiser until the right people have the right to make the right decisions. Authorities and citizens are beginning to think rationally about the use of resources, rather than depleting them. Large networks of older systems combined with new IoT-based sensor systems make it difficult for smart cities to manage different data sources and turn data into useful, efficient information. Providing a common and effective context for data from these different sources creates many opportunities to improve productivity, increase security, reduce life cycle costs and improve the "quality of life" of citizens.

Nowadays an application "Diia" is employing in Ukraine, and it has prospects to become a platform for the formation of a smart city with a component of the developed intelligent information system for ensuring the socio-economic security of the city or an individual community. The application [14] allows you to store a driver's license, domestic and foreign passports and other documents in a smartphone, as well as transfer their copies when receiving banking or postal services, check into a hotel and other life situations. Also through the Action (application and / or portal) you can get such government services as eBaby (comprehensive service at the birth of a child), register a business and individual online, pay taxes and file declarations, sign any documents, change the place of registration and more. By 2024, it is planned to transfer 100% of public services to action. After the Russian attack, the "Action" application developed new opportunities, namely: fundraising for the Armed Forces, the formation of claims for damaged property, refugee status, information transfer (TV and radio channels), the status of the unemployed, surveys and more. Recognition of this is the fact that the Project " Diia.City" was shortlisted for the Emerging Europe Awards 2022 [15].

4. Conclusion

In the article the authors determined the relevance of ensuring the socio-economic security of the city and proposed the proper conceptual model of the intelligent information system. Moreover, the structure of the data flow in for this model has been developed.
The proposed intelligent information system will enable to automate the distribution of powers between the state and regional administration, during the development of citizens master plans, as well as social programs and other documents aimed at improving the quality of citizens life.

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ANALYSIS OF THE DIGITAL TRANSFORMATION IN PAKISTAN IN THE LIGHT OF THE BOOK "AI 2041" BY CHEN QIUFAN AND KAI FU LEE

Shazia Nadir Ali [1], Rao Aamir Khan [2]

[1,2] Department of Management Sciences, COMSATS University Islamabad,
[1,2] Islamabad, Pakistan
[1] sp21-pms-007@isbstudent.comsats.edu.pk (PhD Scholar), [2]rao_aamir@comsats.edu.pk (Assistant. Professor)

Abstract: *Artificial Intelligence (AI) is gaining vast importance around the globe because of its ability to influence the future, and Pakistan is no exception to this phenomenon. This paper aims to analyze the plausibility along with the current status and prospects of the digital transformation in Pakistan concerning AI in the light of the Book "AI 2041" by Chen Qiufan and Kai-Fu Lee. This book addresses a critical question what will the world look like 20 years from now? It contains ten short stories and an analysis section explaining AI's role in each narration and why a particular situation is possible 20 years from now. It is not difficult to imagine such a sweeping transformation after twenty years when unbelievable progress is already noticeable, even in the context of Pakistan. The authors of the book covered several important topics, including autonomous vehicles, deep learning, deep fake videos, augmented reality (AR), virtual reality (VR), implementation of UBI (universal basic income), quantum computing, big data, and employment situation as AI takeover becomes common. These concepts have been discussed separately in this paper, with examples from Pakistan. Pakistan, a developing nation, has many challenges in its path toward technological development, especially in AI. Therefore, Pakistan would have to devise effective policies and solutions for capitalizing on the strengths of advanced technologies like AI that could bring about technological transformation in the true sense.*

Keywords: technological transformation, digital technologies, AI 2041, artificial intelligence,

1. Introduction

"AI will change the world more than anything in the history of mankind. More than electricity" [AI oracle and venture capitalist Dr. Kai-Fu Lee, 2018]. Artificial intelligence refers to a computer's learning, seeing, and thinking capability. Artificial intelligence is virtually influencing the future of every industry and human being by acting as the primary driver of emerging technologies, and it is achieving vast importance internationally with time [1]. The forecasted global AI market revenue will reach approximately 125 billion in 2025.Artificial Intelligence is constantly attracting attention in Pakistan because of the ever-changing technological environment and increasing globalization. As per the GSMA 2020 Digital Societies Report, Pakistan has been progressing with rapidly increasing scores in digitization. The technology sector of Pakistan has experienced tremendous advances in the past few years, and the future is expected to maintain the pace. Pakistan is a country that produces more than 25,000 IT graduates per year. It has more than 300,000 Information Technology (IT) professionals, with an IT workforce ranked as the fourth highest earning globally. Pakistan has facilitated the development of approximately 700 tech start-ups since 2010. The IT sector of Pakistan possesses a sufficient export volume from the exports of IT-based products and IT-enabled services, increasing at approximately 15% every year since 2010.Additionally, the Government of Pakistan has recognized the need for developing a holistic digital ecosystem, identified in its "Digital Pakistan Policy" as one of the main drivers of economic growth [2]. Pakistan's potential could be gauged from the fact that 60 percent of its population falls between the age group of 15 to 29 years of age (as per the Census 2017), which is worthwhile. Therefore, Pakistan needs to prosper in the field

of technological advancement in order to take complete advantage of its lucrative potential [3]. As per the report by Alpha Beta, which was commissioned by Google, by the year 2030, digital transformation shall be able to render an economic value worth of PKR 9.7 trillion (USD59.7 billion), which in relative terms is about 19 percent of Pakistan's GDP in 2020[4].

This context provides an excellent opportunity for analyzing the plausibility, current status, and prospects of the Digital Transformation in Pakistan in terms of AI in the light of the Book "AI 2041-Ten Visions for Our Future", published in 2021. It is an enthralling work authored by Kai-Fu Lee and Chen Qiufan titled AI 2041 as an amalgamation of fiction and non-fiction about a forthcoming time that is supposed to be brought about by artificial intelligence (AI) around 20 years from now. This book addresses a fundamental question what will the world look like 20 years from now? It has ten short stories along with an analysis section explaining the role of AI in each story and why that particular situation is possible 20 years from now. Twenty years is not that far, and it is not difficult to imagine such a sweeping transformation in such a time frame as we have already seen unbelievable progress in the past ten years. The Authors have covered many important topics, including autonomous vehicles, deep learning, deep fake videos, augmented reality (AR), virtual reality (VR), mixed reality (MR), and X Reality (XR), big data, quantum computing etc. and their potential future applications. The book also covers issues such as job loss as AI takeover becomes more common, UBI (universal basic income) implementation, and quantum computing. In this paper, the AI predictions based on each storyline will be summarized along with the present related plausibility plus the technological transformation seen in a developing nation like Pakistan and the related future prospects. The respective headings from 2.1 to 2.10 are per the chapters from the "AI 2041" book by Chen Qiufan and Kai-Fu Lee.

2. Analysis

2.1 The Golden Elephant

This chapter in the book explains how people's lives are expected to rotate around the use of AI controlling each feature of one's life determined by the optimization of one's choices in life to reduce cost and improve health results [5]. The concept of deep learning is attracting attention globally and in Pakistan as well. Many businesses in Pakistan are taking advantage of AI. One of the most prominent examples of such a business is Daraz, a renowned e-commerce platform in Pakistan. Pakistan Telecommunication Company Ltd, the leading telecommunication company in Pakistan, is a significant example as it has also been using deep learning [6]. The use of Artificial Intelligence for deep learning is widely applied worldwide. The health sector in Pakistan is using AI and the associated technologies. The significant applications are diagnosis and treatment recommendations, patient management, patient information maintenance, and other administrative activities [7]. In Pakistan, most health-conscious people own technological devices that collect health-related data regularly. Such data is helpful for the population in encouraging health-conscious behavior and for the health care professionals and businesses in the health sector to customize products and services along with improving the quality of life [8]. Robots are operating in many hospitals in Pakistan, which shows that Pakistan has considerable indigenous potential to adopt AI [9]. AI, with its transformational potential, has brought about an unimaginable change in the medical sector in Pakistan, but still, there is a long way to go for the full fledge adoption of advanced technology [10]

2.2 The Gods Behind the Mask

This storyline in this book plunges into profound fake technology and its ability to shape the approaches and behavior of the public with the help of multi-media content. Advanced technological tools and tactics that are supposed to formulate a crisis with the help of information manipulation could disrupt a developing nation like Pakistan. If a country is made to believe

something false with the help of fictitious deep fake information, its entire communication ecosystem will fall apart [12]. When gone in the wrong hands, these technologies could create havoc by serving as a weapon for disinformation campaigns that might have dire consequences [13]. Therefore, Pakistan needs to take unprecedented steps to reformulate its strategy in dealing with such disruptive technologies [14]. Social media entities, including Facebook, which is widely used in Pakistan and most susceptible to such attacks, have been working hard to mitigate this problem, e.g., by trying to find algorithms that could identify deep fake videos [15].

2.3 Twin Sparrows

This story in the book is representative of the technological development in the understanding of natural language. It presents a concept regarding AI tutors for children who teach in ways most suited to them individually and have a symbiotic relationship [16]. Artificial intelligence in the education sector of Pakistan is on its path toward enormous technological transformation. Educational institutions in Pakistan are increasingly adopting AI technologies. A tremendous example is The City School Group which has 153 schools in 49 Pakistani cities and has announced the adoption of AI-related learning technologies in its schools nationwide in collaboration with London-based technology firm CENTURY Tech facilitating over 60,000 students [17]. Another example is an AI-based educational program launched with the name of "Parhai Buddy," which is supposed to be Pakistan's first AI learning coach. The entity behind this launch is the Knowledge Platform, a renowned education-technology project catering to more than 300,000 students across approximately 1,000 schools Pakistan-wide [18]. Such initiatives show the commitment of Pakistan toward AI adoption.

2.4 Contactless Love

This story delves into the situation of long-distance relationships in the world of games. The technology portrayed is the one in a post-pandemic world where each part of an individual's health is digital and freely obtainable [19]. In this story, a wearable skin implant is responsible for keeping records of an individual's information and serves as a vaccination passport. All types of wearable tech and robots roam the world giving all types of assistance to the people. Drug discovery takes place at an extensive speed responding to every transformation of COVID-19 by producing vaccine alternatives and infinite options. In the context of Pakistan, this is already applicable since Pakistan has already launched an immunization program against COVID, and its successful implementation took place with the help of AI Technologies using identification data of the population provided by NADRA. Digital Registration and digital certificates and applications to facilitate the process have been developed [20].

2.5 My Haunting Idol

This story is based in Tokyo and scrutinizes the immersive world of virtual reality (VR), augmented reality (AR), and mixed reality (MR), which are collectively known as XR [21]. This scenario is relatable since it seems possible even in today's world, as we can see that several companies have been working on this aspect of technology. Immersive capabilities like Microsoft Holo Lens are becoming more affordable even for developing countries like Pakistan, which could only be considered a myth a few years back [22].AR is a comparatively new concept in Pakistan, but it is gradually gaining recognition, and prominent telecom and media centers have adopted it. Numerous reputable companies and start-ups have undertaken futuristic implementations of AR. Such organizations include Wonder Tree and Jazz. Wonder Tree has established a gaming platform, using AI to promote therapy and education with the help of games. Jazz has also employed AI in designing and implementing its marketing and sales campaign. Jang Real is an AR application for readers to watch their favorite news clips from the headlines on other devices. Hajjmented is an application that uses VR and AR to facilitate Hajj pilgrims by

preparing them for traveling to Makkah and Madina for Pilgrimage. FiveRivers Technologies has operated on AR for many organizations and combined AR with HoloLens to create training modules for technicians to increase productivity. Technologies such as augmented reality secure a considerable scope in developing countries like Pakistan as people with proficient programming and designing and having some media exposure could be reasonably fit for such jobs since a specialized degree is not required [23]. Prominent organizations like Oztech and Foodpanda have also collaborated in the creation of a holographic advertisement deploying augmented reality. The Higher Education Commission of Pakistan also supports research and development in this field (Alam, 2018). Pakistan is doing exceptional work on a limited level in this field and has much non-utilized potential.

2.6 The Holy Driver

Another technology in this book chapter is autonomous driving [24]. In 2009 when Google announced its initiative of researching self-driven cars, the concept created much hype. Many renowned companies are researching and developing semi-autonomous and completely autonomous cars in Pakistan. Research has been done at the Mirpur University of Science & Technology (MUST, Pakistan) regarding the "First Autonomous Vehicle of Pakistan," with support from the Office of Research, Innovation, and Commercialization (ORIC). The inauguration of the initial prototype of this autonomous vehicle took place in 2016, while the launch of the second improved version took place in 2018 at the "DICE-2017 Mega Innovation and Entrepreneurship Event". The car would have state-of-the-art advanced features and be commercially and environmentally viable [25]. Another development in this area is that Changan Motors plans to bring such automobiles to Pakistan. The company is examining registered autonomous driving technologies based on AI and trying to tailor these according to the requirements of roads in Pakistan [26]. Sedenius Technologies is a company providing IT services in Pakistan centering on designing and developing autonomous driving vehicle software. It is a subsidiary of Sedenius Engineering GmbH, a German company that delivers software solutions for autonomous and automated driving. It has gained the confidence of the best European automakers like Audi, Volkswagen, and BMW. This company primarily functions in the European market but is interested in collaborating with car manufacturers in Pakistan to offer them practical and affordable solutions [27].

2.7 Quantum Genocide

This story revolves around Europe as a warning tale of how AI-enabled weapons like drones could be dangerous for the whole world if placed in evil hands [28]. Quantum computing is an emerging field but is expected to reach a point where it could cause havoc if utilized by the wrong people. In Pakistan, many institutions have been offering courses regarding certified ethical hacking. Numerous Pakistanis have made their mark in this field, proving the potential of Pakistan. One of the most prominent names in this regard is Rafay Baloch[29], a world-renowned Pakistani security researcher and an ethical hacker who holds numerous national and international awards and titles. Pakistan is also conducting research and development in this area. The Information Security and Ethical Hacking Institute, Pakistan (ISEH) is renowned for promoting awareness, skills and knowledge, research and development, innovation, and creativity in this area [30].

Quantum Computing is predicted to be an emerging field that will define technological development in the future. It is a procedure of making parallel calculations with the help of physics to replace the basic technology of today's computers. Pakistan is in its developing stage in this area. Lahore University of Management Sciences (LUMS) and The National University of Sciences & Technology (NUST) have pioneered research and development in this area. Thus Pakistan still has a long way to go in this field compared to other countries, and it may take some time to get in sync with the globe in terms of research and development along with

implementation in the area of quantum computing [31]. Pakistan needs to concentrate on quantum computing since this could facilitate Pakistan in reaching a whole new level of technological and scientific progression leading to uncountable opportunities.

2.8 The Job Savior

Another story orbits around job placement agencies. It is shown that AI takes away jobs and rehabilitates displaced workers as a potential future scenario [32]. The authors encourage the readers to ponder the concept of Universal Basic Income (UBI), which refers to the providence of essential financial support in which all the citizens of a given population are provided with an officially specified and correspondingly established basic income [33]. In developing countries, including Pakistan, a significant private health and education sector provides basic facilities at higher costs. While in many other countries, the private sector provides high-quality services at a lower cost than the public sector. Therefore UBI could be considered an incremental anti-poverty intervention [34]. Pakistan has also taken steps with the help of technology to benefit the marginalized population. For example, the Sehat Sahulat program provides medical facilities to underprivileged citizens without much financial burden with the help of a micro health insurance scheme facilitated by digitization [35].

Employment is one of the fundamental problems in Pakistan. Technological transformation has served as a facilitator in developing a bridge between employers and employment seekers. In the past few years, many online job portals have come into operation, including Rozee, Bright Spyre, Bayrozgar, Mustakbil, and Talent Hunters, to name a few. [36]. The Government is also making efforts to promote the employment industry. The National Vocational & Technical Training Commission (NAVTTC) is a governmental organization responsible for implementing and monitoring the Prime Minister's program "Skills for All" Strategy to assist in the development of the Technical and Vocational Education and Training (TVET) Division in Pakistan. The technological base is one of the major factors behind these initiatives. The NEXT jobs and skills portal, which uses AI, is developed by the NAVTTC and acts as a facilitation channel between skilled applicants and employers, thus introducing new employment and empowerment opportunities to promote national productivity [37].

2.9 Isle of Happiness

This story is based on an artificial island in the Arabian Sea which serves as a backdrop where AI is organized to help make people happy. Individual data is used, and experiences are customized according to their preferences. The data come from various sources like wearable sensors, cameras, and personal health devices, audio and social media [38]. This chapter makes readers think about the notion of Big Data. It refers to a combination of tools, methods, and procedures to assess data to gain valuable insights. Pakistan is an attractive data mine as it is a tremendously populated country comprising youth as its significant population chunk. The use of Big Data is a massive opportunity for Pakistan in which Big Data could serve as a practical governance tool for a developing country that lacks resources. However, Pakistan cannot entirely bank upon this tremendous asset because the significant data players in Pakistan are international instead of national firms. The Government of Pakistan shall promote empowerment for the national firms to bank upon Big Data. The optimum utilization of Big Data analytics could pave a path toward empowerment and good governance, leading to development. The National Database and Registration Authority (NADRA) in Pakistan have been banking upon the notion of Big Data analytics and is utilizing AI as a governance tool. It has achieved the status of being one of the largest national databases globally. It has succeeded in advancing and executing enormous projects related to good governance and data security. [39]

2.10 Dreaming of Plentitude

This story is based in Australia. The idea explored in this story is the portrayal of a scenario with no scarcity of resources by establishing an economy that is amplified with AI. Each individual is given a Basic Life Card through which that person can make payments for essentials of living and entertainment [40]. Although not fully applicable, Pakistan has taken some steps in this concept of basic income. One of the most prominent examples is The Benazir Income Support Program (BISP), a federal poverty reduction program facilitated through income providence in Pakistan. It was launched in July 2008 and proved Pakistan's most extensive solitary social safety net program [41]. The amount is associated with the Consumer Price Index, and a smart card is used for payments, another application of AI in Pakistan as it uses databases, biometrics, and cellular technology to achieve its purpose [42].

2.11 Challenges

Pakistan, a developing country, faces many challenges on its road toward technological development, especially regarding AI. One of the significant challenges faced by Pakistan is that the AI applications that are the main factors in technological transformation pose significant risks and challenges regarding ethics and security. Though AI-driven algorithms and applications are experiencing a fast-paced growth in Pakistan, most of this is in the private sector, primarily controlled by multinationals. Therefore, Pakistan is not receiving the net benefit from such advancements directly.

The consideration for human rights and the absence of a formal regulative framework in Pakistan with regards to the application of AI from the perspective of human rights is a huge problem. This causes concerns concerning data protection and data privacy. Pakistan shall adopt a human-centered approach to benefit from technological transformation while mitigating the risks [43].

A significant challenge Pakistan faces concerning the use of data, specifically Big Data, is the lack of comprehensive formal regulation. A legislative initiative known as the Personal Data Protection Bill 2020 exists. However, it focuses on the security of personal data and does not comprehensively deal with the problems related to data manipulation collected by numerous entities, including foreign organizations. Pakistan is supposed to consider the European Union's General Data Protection Regulation (GDPR) framework and other comparable policy frameworks [44] to stop the inexplicable use of AI and personal data usage for system training.

Another challenge is that the private sector companies in Pakistan are banking on gathering, distributing, and examining the data. In contrast, the public sector organizations are not very active in this regard. The public sector has the potential for rapid advancement in AI evolution because of its research, development, and investment potential, which shall be considered. Furthermore, the Government shall not only focus on public sector regulations, but it shall also focus on the regulations concerning the private sector regarding AI to create a balance. Pakistan would have to devise comprehensive and practical strategies to devise workable policies and solutions to these challenges for minimizing the risk and maximizing the return for the adequate capitalization of technological development with the help of AI.

3. Conclusion

To keep up pace with the global technological advancement while facing the challenges, it is crucial for Pakistan, that all the related entities shall be involved and cautious steps shall be taken

for the direction of these initiatives to reap the maximum benefit. If digital transformation is legitimately focused upon, it has a capacity to benefit Pakistan in terms of PKR9.7 trillion (USD59.7 billion) annual worth of monetary value by the year 2030.This would be fueled by the advancement in productivity and revenue along with cost savings and growth in GDP, resulting from the technological advancement. Sectors including food and agriculture; consumer, retail, hospitality plus training and education are supposed to be the main beneficiaries [45]. As Pakistan has ever increasing ties globally, facilitated by the China-Pakistan Economic Corridor (CPEC), it could utilize these connections for improvement in technological transformation. Pakistan is blessed with a pool of skilled workers, but needs to improve in the area of technologically sound workforce to synchronize with the increasing demands of the global market. Pakistan shall be on the track towards economic development by taking advantage of technology to the maximum extent. Pakistan shall be well armed on technological grounds as its economy and defense systems are principally reliant on its skills to be a section of the phenomenal revolution knocking our doorsteps. Pakistan should decrease its reliance on foreign technology and instead should try to become a prime player and producer of the technological systems which would ensure extraordinary economic returns and durable security.

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IMPLEMENTATION OF THE "PROTOTYPING" REQUIREMENTS ELICITATION TECHNIQUE FOR THE DEVELOPMENT OF A NATURAL LANGUAGE PROCESSING SYSTEM IN USER STORIES

Eidher Julián Cadavid [1], María Clara Gómez [2], Bell Manrique Losada [3]
[1,2,3] Universidad de Medellín
[1,2,3] Medellín, Colombia
[1] ecadavid641@soyudemedellin.edu.co, [2] mcgomez@udemedellin.edu.co,
[3] bmanrique@udemedellin.edu.co

Abstract: *NLP is a unit of knowledge of artificial intelligence that consists of the study and analysis of the linguistic aspects of a text through computer programs. In agile software development projects, the team's lack of understanding of user stories can lead to defects, delays, and rework. Most of the current studies on NLP in software engineering focus on the generation of models or diagrams and not on facilitating the understanding of user stories, such as useful information units to identify categories and syntactic units that facilitate the team recognizing possible artifacts to improve quality. Based on the above, it is proposed to design NLP for User Stories; a tool that extracts information from user stories in agile software projects, allowing the extracted entities to be linked to knowledge bases or software artifacts. This application will facilitate the understanding of user stories and will help to correctly meet the acceptance criteria, in such a way that opportunities are generated for the optimization of processes carried out daily in different contexts. The requirements elicitation of this prototype was carried out using the "prototyping" technique, through which the needs of potential users will be validated to optimize and evaluate the functional requirements.*

Keywords: user stories, Natural Language Processing, NLP, prototyping

1. Introduction

There is a wide variety of studies on natural language processing applied to the software development process; Among them, McCarthy's proposal stands out [1], who points out that Artificial Intelligence "is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence." In this context, it is understood that natural language processing is a unit of knowledge of artificial intelligence that "consists of the study and analysis of the linguistic aspects of a text through computer programs." [2].

Now, with the rise of agile methodologies like Scrum [3], the concept of user story appears [4] as a work unit, normally written by the product owner, which, being written in natural language, could be subject to natural language processing analysis to facilitate its understanding. Especially considering that, in agile software development projects, the unsatisfactory understanding of user stories can generate defects, delays, and rework throughout the development process.

In this way, Elallaoui, Nafil, and Touahni [5] propose a process to transform user stories into use cases, to facilitate the work, reducing the ambiguity in the requirements specifications. So that design models are automatically generated. Added to it, Robeer, Lucassen, Martijn, Van Der Werf, Dalpiaz, and Brinkkemper [6], suggest automatically deriving conceptual models from user stories to facilitate communication between those involved. Finally, Nasiri, Rhazali, Lahmer, and Chenfour [7], open the possibility of automatically transforming user stories into class diagrams to facilitate the design of analytical tasks, minimizing time and costs in agile projects.

Currently, there are natural language processing tools that use pre-trained or proprietary models to classify, extract and analyze texts [8]; however, their usefulness in natural language processing has been little explored; These tools applied to the user story review process would allow identifying elements such as entities, syntax, and categories, making it easier for the team not only to understand and identify possible artifacts of the development process but also to increase quality.

The implementation of a natural language processing system in user stories would improve the understanding of user stories to help correctly meet the acceptance criteria in the agile development process. To elicit the requirements of said application, the "prototyping" technique will be used, through which the needs of potential users will be validated to optimize and evaluate the functional requirements [9].

2. Theoretical Framework

2.1 Natural Language Processing

NLP "consists of the study and analysis of the linguistic aspects of a text through computer programs." [2]. In this order of ideas, NLP is an interdisciplinary field where artificial intelligence and linguistics converge, with all the complexity that this implies. As the linguist Noam Chomsky said [10] "A language is not just words. It's a culture, a tradition, a unification of a community, a whole history that creates what a community is. It's all embodied in a language". Thus, within NLP, we find different levels of analysis [2]:

- Morphological analysis: grammatical information is obtained.
- Syntactic analysis: grammatical coordination is checked.
- Semantic-pragmatic analysis: the meaning is ascertained.

2.1 User Stories

As O'Regan puts it [11] "A user story is a short simple description of a feature written from the viewpoint of the user of the system". A user story should have the following characteristics:

- Independent.
- Negotiable
- Valued
- Estimated
- Small
- Verifiable

"A user story may be a new feature or a modification to an existing feature" [11] whose main objective is to generate value for the business. They are normally written by the product owner and have the following format [12]: "As a [persona], I [want to], [so that]." Finally, we say that the story is complete when it meets the acceptance criteria.

2.2 Prototyping

Prototyping is a design method that provides a model of the result, known as a prototype [9]. This method allows for identifying requirements through a product demonstration. A prototype can be a model, a proof of concept, a simulation, or a working prototype, among others.

3. Methodology

The technique selected to elicit the requirements of the NLP for User Stories application was prototyping since this technique provides a visual representation that allows those involved to provide feedback early in the design process [9]. Considering that it is not a highly complex project, in terms of the number of functionalities, but it can become difficult to understand without visual aid, it is considered an appropriate technique to allow understanding by potential users.

Two exercises were carried out with potential users, where they were presented with a prototype model or diagram to contextualize the use of the application (Fig. 1).

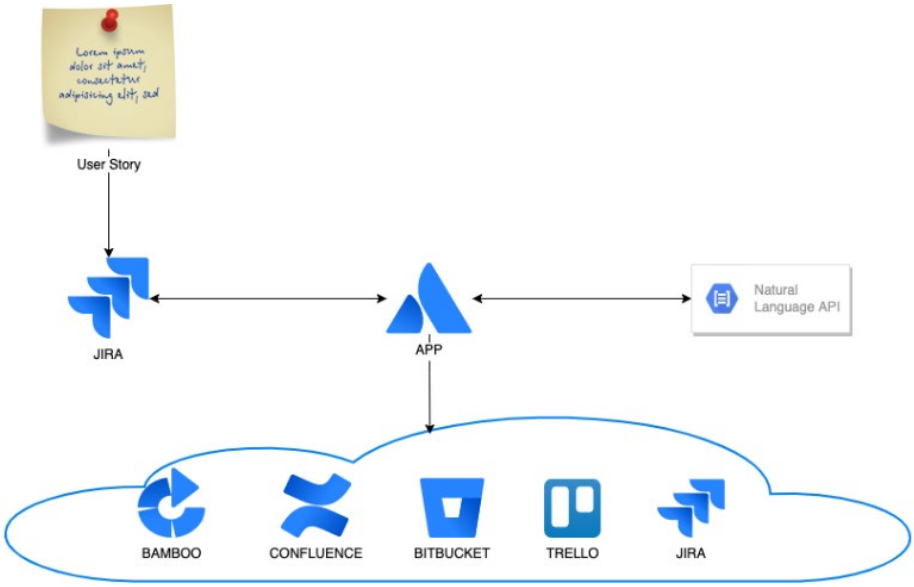

Fig. 1. Model prototype

Then each of the attendees was asked to write a user story (Fig. 2).

Fig. 2. Example user stories

Next, users were presented with a simulation prototype using a similar application that allows NLP to text using Google Cloud's Natural Language API[1] to extract color-discriminated entities and links to external resources. To do this, they were shown the result of processing their own user stories (Fig. 3).

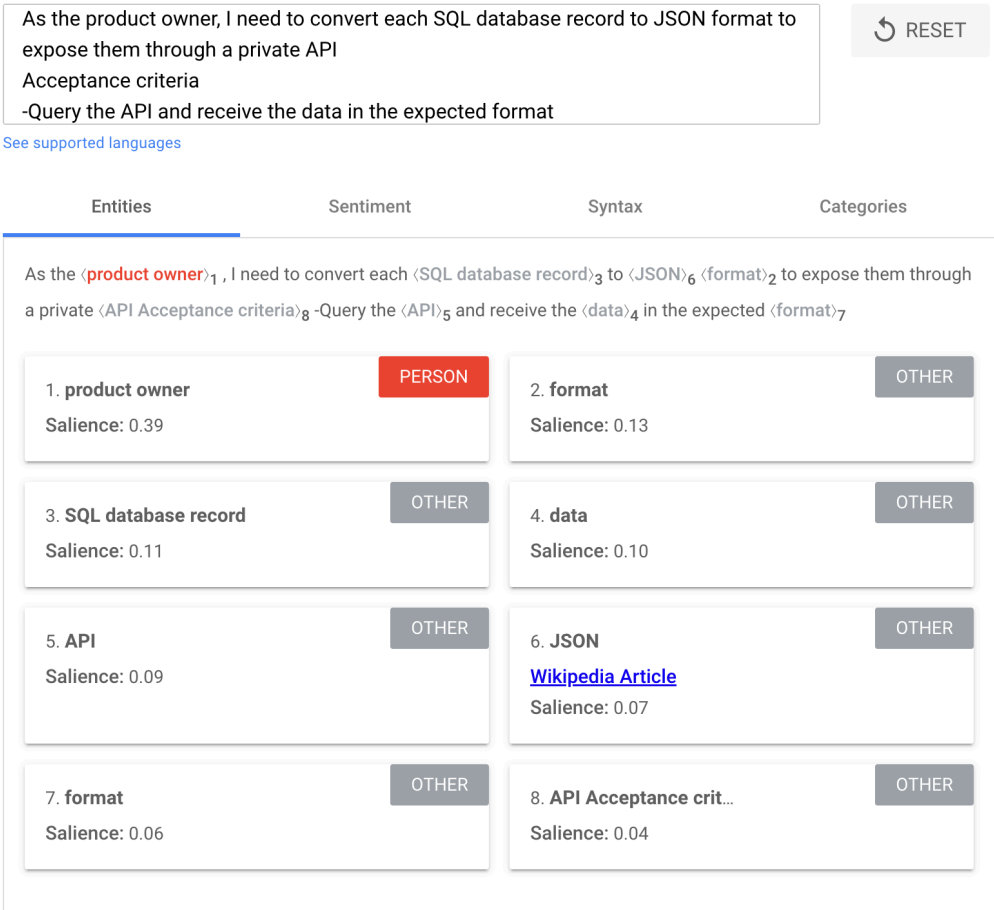

Fig. 3. Sample Application

Finally, their feedback was received, with which the following results are presented.

4. Results

From the exercises carried out with potential users, three main ideas or findings were identified, which are described in Table I:

TABLE I. Points of View of Potential Users

POV	User	Need	Vision
Andrés	Developer	Have a search engine for each knowledge base application	to be able to access the resources of the knowledge bases.
Mario	Developer	Show different possible sources related to entities	to improve the reliability of related sources.
Alberto	Developer	Validate legal restrictions to using external API	to be able to send confidential information to external sources.

[1] https://cloud.google.com/natural-language

Then, from those ideas, three user stories were generated (Fig. 4).

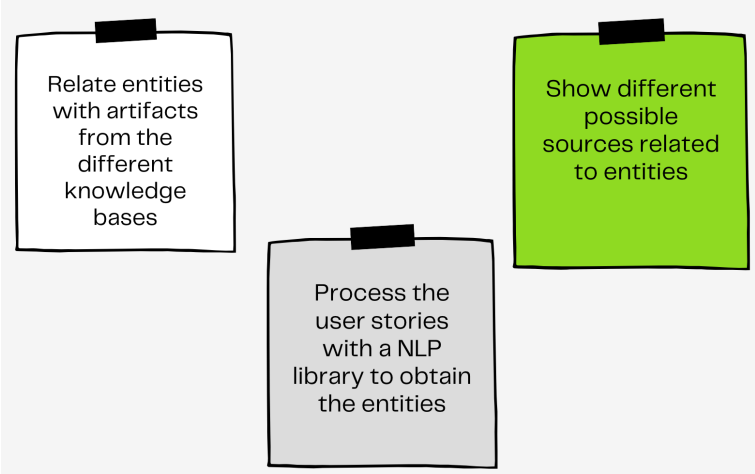

Fig. 4. User stories obtained from the prototyping technique

Additionally, a product vision board was developed that includes potential users, their needs, as well as the product features that will help meet them (Table II).

TABLE II. Product Vision Board

Name	**NLP for User Stories**	**Representative phase**	**Help the team understand user stories**
User group	**Needs**	**Product characteristics**	**Value**
Product Owner	That the team understands the user stories that it writes	Link the contents of the knowledge bases	Reduce socialization times of user stories.
Scrum Master	That the team wastes less time in understanding user stories and avoids reprocessing.	View processed user stories.	The team wastes less time on rework.
Developers	Easier understanding of user stories	Being able to navigate knowledge bases from user stories.	Help understand user stories.

Based on user feedback, an improved prototype of the app was generated using the Jira[2] interface (Fig. 5). In this interface, we can see a processed user story, with the identified entities colored, between angle brackets, and with a numerical subscript. Likewise, when clicking on each entity, a contextual menu is displayed that allows linking said entity with artifacts such as knowledge bases, viewing the links to the artifacts already linked by the user, and editing these links.

Finally, some lessons learned from the process were identified:

1. Generate a participatory environment, ask questions, and give confidence.
2. Include different roles or user profiles.
3. Have different levels of experience in potential users.

[2] https://www.atlassian.com/software/jira

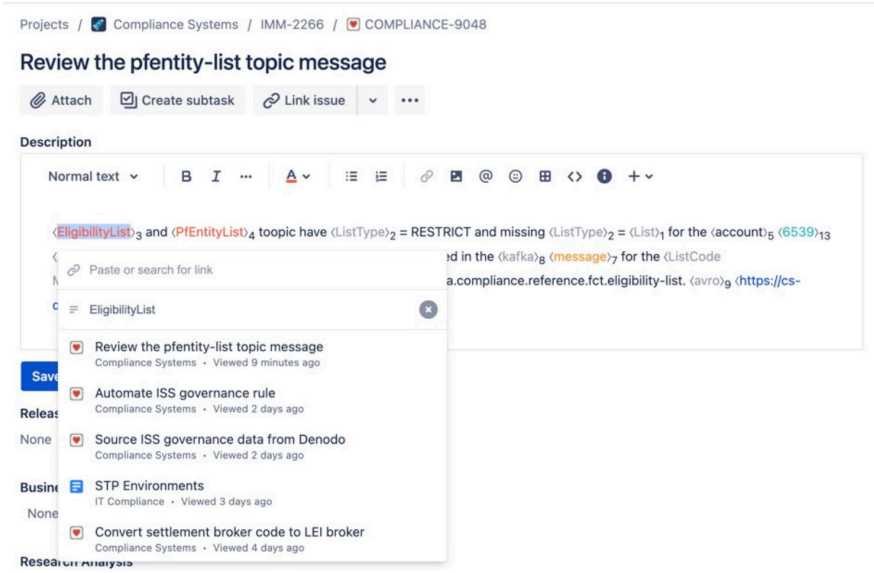

Fig. 5. Improved prototype based on feedback from potential users

5. Conclusion

- The application of the prototyping requirement elicitation technique allows those involved to easily understand small, and difficult to explain projects, from a functional point of view.
- The application of the prototyping requirements elicitation technique requires considering different roles and levels of experience to obtain adequate feedback.
- The application of the prototyping requirements elicitation technique provides a visual representation that encourages early and, therefore, less expensive feedback on the user needs.

6. Future Work

Delving into NLP in user stories could allow, not only a better understanding of its content for the development team, but also help to generate models, diagrams, and other software artifacts from the user stories, including, why not, code or functional prototypes. Likewise, the use of the prototyping requirements elicitation technique would allow obtaining the requirements for said applications using model prototypes, concept tests, simulations, etc., which would facilitate the understanding and obtaining feedback from potential users.

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TOWARDS THE FORMULATION OF A 'BEST PRACTICE' FRAMEWORK FOR BENEFITS REALIZATION AND MANAGEMENT OF E-LEARNING PROJECTS

Samuel Chikasha
Engineering Technology Education, KU Leuven
Leuven, Belgium
samuel.chikasha@kuleuven.be

Abstract: *With eLearning becoming a permanent feature of post covid19 era thus becoming an intensive area of investment in higher education, benefit realization and management is also becoming an area of discussion within educational research. This study investigates the status of eLearning benefit realization and management in African higher education. This study found that most universities do not have a formal complete benefit realization and management process that tracks the benefits from project approval up to post implementation stage. Although most institutions use perceived benefits to justify the projects, little effort is being given to follow up if the perceived benefits are being realized after the implementation. Discussions about the benefits of eLearning projects are done prior to implementation with the view of getting approvals. The majority of the universities do not track the proposed benefits to see if they are being realized after the implementation. Some key stakeholders like students and lecturers are not involved in evaluating eLearning projects.*

Keywords: eLearning, investments, benefits realization, benefits management

1. Introduction

During Covid19 pandemic and after has seen a lot of learning institutions embarking on several eLearning projects as they were adopting eLearning as a delivery approach [1]. This has led to eLearning becoming an intensive area of investment. This has been the trend in all areas of training be it universities, high schools or corporate organizations. While many institutions invest in eLearning, a notable insecurity about the educational value of eLearning remains. Ensuring the real return on one's eLearning investment requires not only that one dispels these myths, but also that one clarifies what can and should be expected [2]. In this study, we assess the status of benefit realization and management of eLearning investments in African higher education. This study is a first step to gain insights and starting a discussion on the theory of eLearning benefit realization and management. This study also looks at the applicability of the life cycle approach to benefit management in higher education.

1.1. Background to the Research Problem

Information technology IT has been so ubiquitous in business and entertainment, such that its application to education is almost seen as a natural course of its evolution. Indeed, since its inception, investments in IS/IT have increased significantly in every sector of the economy as organizations are forced to respond to emerging challenges, including the constant innovations in technology as well as the continuous changes to internal and external conditions [3]. In a survey, Gartner [4] estimates global expenditures of operating system software for the year 2010 to US$30.4 billion, up 7.8% from 2009. Another related survey found that global IT spending for 2010 reached US$S3.4 trillion, a 5.4% increase from the year 2009 estimates [4]. In the same study, Gartner also forecasts these expenditures to grow by 5.4 % to reach a staggering cap of US$ 3.6 trillion. Given these estimates, it is now evident that IT takes up a major slice of an organizational capital expenditure, a milestone reasserting its growing strategic importance within the enterprise as opposed to a burdening, cost-driven commodity [5].

Adopting IT in business promises, amongst others, increased efficiencies, performance improvements, and enhancements of competitiveness [6]. Similarly, its application in education, also known as eLearning, promises to enhance the quality of teaching and learning, improve access to knowledge, reduce operational cost, and increase profitability [7], [8]. If these benefits that people associate with eLearning are being realized then there is nothing that should really stop an increase in through-put at all levels of education. These assumed benefits have resulted in substantial amounts of money being spent on ICT in education. The underlying assumptions have seen IS/IT investments making significant inroads in education [7]. Academic institutions have been incurring significant expenses in a wide range of areas, such as administrative systems, course delivery software, learning management systems and network infrastructure in a broad effort to reap such benefits [9].

However, despite these increased investments coupled with the availability of a rich body of knowledge on benefits management and realization, the added value of IS/IT remains in dispute, suggesting that firms are still facing difficulties in realizing IS/IT benefits [10]. The same can apply to educational firms. Although the literature on benefits management and realization is extensive, with findings admitting the inadequate practices of benefits management in organizations as a major hindrance to benefits realization, very few published studies on benefits realization have been conducted in eLearning. In addition, existing studies on benefits management and realization are overwhelmingly on developed countries, contributing little knowledge concerning developing nations, especially those in Africa [3], [11], [12]. Thus, the goal of this study is to examine the current trend of benefits management and realization in academic institutions of southern African countries with respect to eLearning investments.

There was a massive introduction of eLearning in training and tertiary institutions due to the Covid19 pandemic, as well as techno positivist ideology. Techno positivist ideology is defined as a 'compulsive enthusiasm' about eLearning in higher education that is being created, propagated, and channeled repeatedly by the people who are set to gain without giving the educators the time and opportunity to explore the dangers and rewards of eLearning on teaching and learning [13].

Previous researchers who have studied eLearning have focused on eLearning methodologies tools. Most of these studies have pointed out that the usage of ICT in education should add value to the learning process. The questions to be asked are:

1. Of all the promised benefits, are educational institutions deriving these benefits from their eLearning investment?
2. What is the status of benefit realization and management on eLearning investments African higher education?
3. How can benefit realization frameworks be successfully implemented in an educational setup?

2. Statement of the Research Problem

Many institutions of higher education and corporate training are resorting to eLearning as a means of solving authentic learning and performance problems including solving the challenges that were brought about by the corona virus pandemic. Success in implementing eLearning is crucial because an unsuccessful effort to implement eLearning will be clearly reflected in terms of the return of investment [14]. There is a lack of research evidence as to the actual benefits these institutions are deriving from their investments. Researchers also pointed out some challenges in terms of usage of systems and tools that form part of eLearning. Govindasamy [14] pointed out that many features and tools of LMS are left unused. He attributed that to a

terrible waste of resources since these tools account for the cost of implementing eLearning. These issues leave one with questions as to whether there is any benefit realization planning being followed. There is a need to investigate whether the existing benefit realization frameworks are applicable to educational setup. There is a lot of rhetoric in the literature about eLearning (with all the promises) and no or limited informed stance towards the realization of promised benefits. Information systems and educational researchers must be given a chance to test and verify the validity of those promises using actual pedagogical principles. Where the existing benefit realization frameworks are not applicable alternative methods should be suggested.

Without benefit realization and management, a lot of eLearning initiatives could be associated with wastage of resources as their implementations are not associated with the educational benefit. There is therefore need to assess the benefit realization and management of eLearning investments in education, especially in the African context. As eLearning is becoming a permanent feature of post covid19 education. There is also a need to check the applicability of existing benefits management frameworks to educational setup in the African context.

It is not clear how well educational institutions manage their eLearning expenditures or whether their technology spending impacts on organizational goals. Very few studies in information systems have focused on asking about the current state of IT benefits management in training institutions and organizations that are using eLearning systems. Information systems researchers have suggested the lifecycle approach to studying the information systems implementation [15], [1].

Research has called for a greater understanding of issues involved in the cost benefit analysis of information systems [16]. Berghout et al. [16] further pointed out that due to uncertainty around future business activities the resulting cash flows are also uncertain. This has made it more challenging to understand the nature of the costs and benefits of IS development and realization to improve resource allocation in organizations. This is the case even in tertiary institutions. The dynamics of IS projects have been reported to be associated with fluctuations in costs and benefits [16].

Since undertaking an IS project and change management initiatives require substantial amounts of time, money and other resources, justification is always needed by stakeholders. Although reasons vary, they usually allude to a host of business benefits in the form of competitive advantage or improved business performance at a broad societal level or within an organization [9], [17]. Each program undertaken typically entails the production of consecutive deliverables, which when combined lead up to the delivery of the technical solution. It is through these deliverables, that the potential benefits are realized. Yet, without a formal process to oversee this realization, organizations have no ways of ascertaining the outcomes of their IT projects and more importantly tracking where and how such outcomes have been achieved [10]. The net effect is such that decision-makers are unable to justify IT investments, causing further constraints on future IS/IT investments [10]. It is such concerns that have led to the development of an extensive body of knowledge on IS/IT investment management also known as benefits management [9]. The lifecycle approach has been suggested as an approach that could be used in the benefit management process.

Benefit management refers to a series of managerial activities designed to ensure that the intended benefits of project initiatives are realized [18]. These activities entail the identification, planning, structuring, and actual realization of the potential benefits associated with a project [18]. The goal is to help organizations address a broad range of key issues namely, avoid the loss of clearly achievable benefits, identify, track, and realize more extensive benefits, mitigate IT investments costs, cancel or redirect less important benefits, identify essential functionalities

with regards to organizational goals, refocusing the IT functionality on the core required to realize the benefits [19].

To this end several methodologies have been formulated which managers can use to define their benefit strategies between competing projects including roles, responsibilities, and what techniques or tools to use for tracking benefits throughout the lifecycles of IS/IT programs [21]. A good example is the Cranfield Process Model which consists of five stages namely, identify and structure benefits, plan benefits realization, execute the benefits realization plans, evaluate, and review results, and exploit further potential benefits [18]. The usage of these approaches in educational institutions is not well researched. Other benefit management methodologies identified in the literature also include Active Benefit Realization, DMR's Benefit Realization Model, Model of Benefits Realization, and IT Benefits Measurement process [10].

Despite the wide availability of these methodologies, some insights from the current literature into the extent of IT payoffs suggest that many IS/IT investments still fail to achieve their intended objectives. Even when realized, the benefits accrued are far below expectations [11]. The advent of IT in and around educational institutions can put these institutions in a far worse off position if benefit management and realization is not done followed. The techno-positivist ideology can make the situation in educational institutions even worse. For instance, Mandinach [20] found that several IT initiatives did not yield any significant business value. Also, a survey of firms in Southern Africa shows that 64% of organizations achieve targeted benefits across their project's portfolio only 25-75% of the time [18].

The reasons for the above are varied. To begin with, many firms find such methodologies expensive, burdensome and, as a result, tend to ignore the implementation of a formal process of benefits management [11]. Yet in other instances when a formal process is adopted, it is still not followed through rigorously [18]). Naidoo & Chikasha (2010) suggested that the integration of benefits management process in some instances is merely for political reasons or a ploy to secure signoffs.

While there is a plethora of appraisal techniques at the disposal of management and decision makers, most are deemed inadequate [3]. Indeed, return of investment, sales, market share, and net present value are commonly used appraisal metrics in the IS management literature [15], [21]. Yet they are limiting in the sense that they do not capture the full extent of benefits realized through IS/IT programs [22] Applying them in an educational setup could be a nightmare. Often IS/IT projects are qualitative, complex and affect firms at various levels [21]. Thus, using financial metrics may not capture this broader context [21],[22]. This is especially true of IT projects that typically involve the implementation of an enterprise management system (ERP) which tightly integrates with systems across functional divisions as well as those of external partners across the supply chain [21]. This description best fits also the way technology is being used in educational setups. Benefits such as improved customer satisfaction, enhanced suppliers' relationships, or even job satisfaction that one may derive from such IT investments are likely to emerge from across functional and external boundaries, making it too difficult to trace and estimate accurately in accounting terms [21]. This also applies to educational benefits that should be brought about by the implementation of eLearning. Another major limitation of these financial appraisal techniques is that they do not capture the intervening course of actions taken during the project lifecycle [22]

Post implementation reviews rarely take place in eLearning projects. Studies suggest that projects are often deemed to be complete upon delivery of the technical solution [18], [22]. However, unlike costs that usually incur immediately, the benefits of a project typically occur over time long after its deployment, with the extent of their realization subject to changing conditions [21]. This leaves organizations that do not have a well-defined structure through

which to manage this realization phase forfeiting a significant amount of their planned benefits [18]. This is the case with most universities and colleges which are moving from one system to the other in a short space of time. Without post implementation reviews, decision-makers are unable to ascertain the business areas and the mechanisms through which benefits accrue to the organization [3]. This is the same with eLearning implementation projects in training institutions.

While the literature on benefits management and realization for general IS/IT investments abounds, little research has been conducted with respect to eLearning investments in developing countries. Most studies that focus on the effectiveness of eLearning do not consider the issues of benefits management. For instance, Ruiz, Mintzer and Leipzig [24] in a literature review of IT investments in eLearning noted that previous studies on the topic were inadequately designed as they often lack the content quality, technological characteristics and types of eLearning intervention being analyzed. In addition, most studies focused on comparing eLearning to traditional approaches, thereby limiting the scope of benefits to access. This also suggests that the emphasis of examination is solely on technology. However, technology is merely a component of IS, that is, the underlying infrastructure with which other components interact to deliver specific benefits in each context. Thus, by overlooking this interplay between technology and these other components, many benefits are missed during an assessment [25]. Ruiz, et al (2006) also echoed the same view as they reveal in their analysis that most studies only assess three key aspects of eLearning initiatives, namely product utility, cost-effectiveness and learner satisfaction. However, eLearning entails a broader spectrum of issues that are critical to various stakeholders such as instructor's satisfaction, their roles and those of students, institutions or even third parties such as sponsors [25]. Accordingly, a meaningful evaluation should reflect this broader context. This study focuses mainly on the least covered elements which are the sponsors, teaching and learning goals. Sponsors should know the impact of their investments as well as how the benefits are managed. This leaves us with the question: *What is the current state cost benefit management of eLearning projects?*

Management of costs and benefits of IS consists of ad-hoc activities. Most of the projects are of a reactive nature with little interest in IT investment proposals [16]. They also argue that business cases are often incomplete, little attention is given to benefits, the assessment are found to be more on technical rather than on application and use, the evaluation is only done in the justification of the project with no follow-up. Senior management is also found to be absent from the evaluation of project proposals. Given this scenario cooperate organizations; one wonders what the situation is like for training institutions.

This study is based on the *resource-based theory of the firm*' [26], [27] which associates organizational investments interests with the assets and resources believed to be important in giving them a competitive advantage.

As this study focuses on benefits management and realization, some key concepts were looked at as defined by [26] these include benefits planning, delivery, and review. These concepts are important as we are going to look at the status of benefit realization. According to Ashurst & Doherty [25] *Benefits Planning* is defined as the process of identifying and enumerating the planned outcomes of a system development project and explicitly stipulating how they will be achieved'. Benefits Delivery is defined as 'the execution of the set of actions necessary to realize all of the benefits specified in the benefits plan'. Benefits Review is be defined as the 'process by which the success of the project in terms of benefit delivery is assessed; opportunities for the realization of further benefits are identified, lessons learned and opportunities for improvement in future projects are identified'. This is viewed as an opportunity for organizational learning, so that the organization's capability to succeed in the realization of benefits can be enhanced.

3. Research Goal and Objectives

With the focus on investigating the status of eLearning benefit realization and management in African higher education, this study also aims to assess whether educational institutions are following any benefit realization and management processes when carrying out their eLearning projects.

This study was guided by the following research questions:

RQ1: What is the current status of benefit realization and management of eLearning investments in academic institutions?

RQ2: Are academic institutions deriving intended benefits from the ICT investments?

4. Research Design and Methodology

This study followed a mixed method approach involving explorative design as well as quantitative and qualitative approaches involving key players in eLearning projects implementations. Twenty-seven (27) participants from nine (9) universities took partin in this study involving IT managers, IT directors and directors for centers for learning technologies. In some cases, heads of academic departments were also interviewed and heads for for centers for teaching and learning. A Positivist approach to research was followed in this study thus the study was based on knowledge gained from 'positive' verification of observable experience rather than introspection or intuition. Data was collected using a questionnaire and interviews.

4.1. Data Collection

The survey was based on a questionnaire derived from one by [3], it consisted of closed-ended and open-ended questions. Open-ended questions and follow up interviews provided opportunities for clarification, explanation, and justification [12]. To ensure content validity, the instrument was pre-tested by five university lectures. The participants were chosen 9 universities in Zimbabwe and South Africa. Complete anonymity to participants was achieved using pseudonyms to encourage participants to cooperate without fear, hesitation, bias or incentive for exaggeration and self-promotion. Questions used to collect data assessed if benefit realization was considered when projects were being proposed. Some asked if there was any form of project review that takes into benefit realization.

4.2. Data Analysis

All the participants who participated in this study were from big universities with more than 4000 students, with over 300 academic staff. Of the participant 80% had an IT background. Six five 65% percent felt that their institutions were investing too much in eLearning. Ninety-six percent 96% indicated that their universities had the same eLearning platform across all divisions.

Seventy seven percent indicated that their institutions had a systems development methodology they were following and a formal eLearning investment appraisal process. However only 18% indicated that they were having an eLearning benefit management methodology which was being followed. Further investigations and follow-up interviews revealed that benefits were discussed when systems are being proposed. Interviews also revealed that there is no effort to track whether promised benefits were being realized post implementation. Minimal effort was being put to get feedback from other stakeholders like students and lecturers. Only 12% reported that efforts to get feedback from the students and lecturers were being carried out with the view of trying to find out if the promised benefits are being met. Sixty- three percent 63% believed that their tangible benefits were being provided by eLearning. Ninety-four percent of the participants were confident that eLearning was delivering on the planned benefits. None of the participants indicated that there was evidence of benefits realization planning to determine the achieved benefits post implementation.

5. Conclusion

The results from this study show that most universities do not have a formal complete benefit realization and management process the tracks the benefits from project approval up to post implementation stage. Although most institutions use perceived benefits to justify the projects little effort is being given to follow up if the perceived benefits are being realized after the implementation. Discussion on benefits is done prior to implementation with the view of getting approvals. Some key stakeholders like students and lecturers are not involved

5.1. Significance of the Study

Knowing the status of benefit realization of eLearning investments will go a long way in creating a benefit realization oriented higher education, thus curbing the abuse of resources because of techno positivism through securing systems that provide benefits towards organizational goals. This will help the learners in a big way as technology introduced into their learning environment will be of benefit to their learning experience. Stakeholders will also benefit in that they will be assured of accountability in terms of resource usage in higher education.

The study will help to close the gap by providing evidence on the status of benefit realization and management of eLearning investments in the African context. This study will contribute in the development of a framework for benefits realization and management in eLearning initiatives in higher education.

5.2. Limitations of the Study

Caution should be taken not generalization of the findings to the whole Africa as the participants will be coming from Southern Africa and Zimbabwe.

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CLASSIFICATION OF BISCUIT DEFECT STATES AND FOREIGN OBJECTS USING CNN-BASED FEATURES

Yavuz Selim Taspinar
Doganhisar Vocational School, Selcuk University
Konya, Turkey
ytaspinar@selcuk.edu.tr

Abstract: *Damage to the products in industrial production, color change and foreign body mixing during packaging are the factors that reduce the quality, profitability and marketability of the products. Along with these, complaints from consumers are increasing. For these reasons, it is necessary to increase the quality of the products and to detect and separate foreign objects. The quality of food products such as biscuits is of great importance for producers and consumers. It is necessary to check the products quickly on the production line and to separate the problematic products and foreign materials. For these reasons, in this study, it is aimed to classify biscuits by image processing. In the dataset used in the study, there are a total of 4900 images in 4 classes (no defect, not complete, strange object and color defect). VGG16 deep learning architecture was used to extract the features of the images. 4096 features extracted from each image with VGG16 were classified by artificial neural network (ANN) and logistic regression (LR) methods. As a result of the classifications, 98% classification accuracy was achieved with the ANN model. 97.4% classification accuracy was achieved with the LR model. With the proposed method, it will be possible to automatically detect biscuit damages.*

Keywords: industry biscuit, CNN, classification, feature extraction, product defect

1. Introduction

Ensuring the quality and safety of food products in the industry plays an important role. Products may be damaged during production. It is also possible for foreign objects to mix with the products along the production line. Mixed foreign materials and faulty products are at the forefront of complaints made to manufacturers [1]. Detection of foreign objects and detection of damage to products increase consumer satisfaction [2]. There are many studies in the literature carried out with different methods for the detection of foreign drawings and the detection of product damage. Kwon et al. detected foreign bodies mixed with products using X-ray images. They classified foreign bodies and products by using the contrast differences in X-ray images. They extracted the features of the images and classified them using the Gaussian method. They classified foreign bodies with 98% classification success [3]. Sugiyama et al. detected foreign bodies mixed with blueberries on Near Infrared (NIR) spectral images. They performed the detection of foreign bodies by making use of foreign bodies and blueberries appearing in different contrasts in the 1268 and 1317 nm wavelenght range [4]. Senni et al. used the non-destructive thermography method to detect damage and foreign bodies in biscuits. Classification processes were carried out using the thermograms taken from the infrared camera. They tried the proposed method on the production line and achieved high success [5]. Trafialek et al. investigated the causes of foreign bodies mixed with the products on the production line. They determined that foreign objects were mixed with the products during the process of taking the raw materials to the facility and packaging the products. They suggested that the products with the highest risk of foreign body contamination are buckwheat, brown flax, muesli and prunes [2]. The damages of the products can be caused by the machines on the production line, the processes during the packaging. Crush and fracture may occur [6]. Nashat et al. proposed a machine vision-based method for automatic detection of cracks on biscuits. The features of cracked and non-cracked biscuit images were extracted and classified using the SVM algorithm. They detected the cracks on the biscuits with 97% classification success with their proposed method [7]. Various methods have been used to

detect cracks, colors, textures and backgrounds (foreign body) on biscuits. Morphological features of biscuit images [8], edge detection [9], wavelet analysis [10] are some of them. Tsai et al. performed crack detection using diffusion and fourier-based methods [11]. Nashat et al. investigated the irregularities such as damage and discoloration of bakery products of various colors, shapes and sizes. They suggested that with artificial intelligence systems, product defects can be detected more quickly without the need for human power [12]. Du et al. conducted research on improving food quality by detecting problems using camera, ultrasound, magnetic resonance and computed tomography. They suggested that the defects of the products can be detected automatically with image processing techniques by using color, size, texture and shape properties [13].

Mistakes in biscuits and foreign objects mixed in between the biscuits can be harmful to health as well as harming the producer and the consumer. In this study, the detection of foreign objects in the images, the damage detection of the biscuits and the detection of discoloration were carried out by using biscuit images. For this purpose, a dataset containing 4900 biscuit images in four classes was used. The following operations were performed to classify the images.

- VGG16 pre-trained CNN architecture is used to extract the deep features of the images.
- By retraining the VGG16 pre-trained model with the images in the dataset, 4096 deep features were obtained for each image.
- Obtained features are given as input to ANN and LR algorithms.
- The classification performances of the obtained models were compared.
-

The rest of the study is organized as follows; In the second part, the dataset and methods used in the study are explained. In the third chapter, extraction of image features and classification results of models are explained. The final section, Conclusion, contains the conclusions and recommendations of the study.

2. Materials and Methods

In this section, the dataset used in the study, the methods used in feature extraction and classification, and the methods used in the performance evaluation of the models are explained.

2.1 Industry Biscuit Dataset (IBD)

IBD was taken from kaggle.com for use in the study [14]. In the dataset consisting of four classes, there are images of different states of biscuits. Classes are no defect, not complete, strange object, color defect. Image examples of each class are given in Fig. 1.

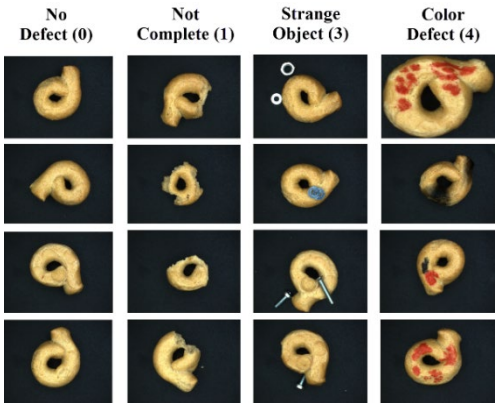

Fig. 1. Images of each class

Each class has a different number of images. Since the large number of images will have a positive effect on the training of machine learning models, data augmentation has been applied. The data is augmented by rotating each image by 90°. 4900 images were obtained by applying augmentation to 1225 original images. The number of original data and the number of augmented data according to each class are given in Table 1.

TABLE I. Number of Images in IBD

	Original	Augmented
No Defect	474	1896
Not Complete	465	1860
Strange Object	158	631
Color Defect	128	513
TOTAL	1225	4900

2.2 Convolutional Neural Network (CNN)

CNN is a deep learning algorithm generally used in image processing algorithms. Since it does not require data preprocessing steps, it is frequently preferred recently [15]. It can make classification by extracting the features of the images through the layers it contains [16]. There are convolution, pooling, activation and fully connected layers. The Convolution layer is the layer where feature extraction is done on the image. It provides the capture of certain features by applying filters to the pixels in the images [17]. In the meantime, different filters can be used. Blur, edge, contrast filters are examples of these filters. Feature maps are obtained from these layers [18]. Non-linear activation functions are used to provide better learning of feature map values by the network. The pooling layer is used to reduce the size of feature maps. In this way, the workforce is reduced and the focus is on important features instead of unnecessary features. In the fully connected layer, flatten features are taken as input. Classical neural networks work with the logic of operation [19].

2.3 Feature Extraction With VGG16

In addition to being able to make classification with CNN architectures, feature extraction can also be done from images. It can be used by taking flatten feature maps from the fully connected layer input. The fully connected layer has the same system as classical artificial neural networks [20]. The difference in features obtained using the feature extraction capabilities of the CNN architecture can be used in machine learning models. In this way, different results can be obtained with different classification models. Different classification models may have different training and testing times. In this way, options can arise for the selection of the optimum classification model. In this study, VGG16, one of the CNN architectures frequently used in the literature, was used to extract features from the images. Instead of training the VGG16 model from scratch using our own images, the pre-trained VGG16 was used. Models previously trained with large datasets can extract features from new images much more successfully, thanks to their feature extraction capabilities [21]. A different number of image features can be obtained from each CNN architecture. 4096 image features are obtained for each image from the VGG16 model used in this study.

2.4 Artificial Neural Network (ANN)

An artificial neural network is a neural network made up of nodes that mimics the human brain. Neurons are interconnected. These nodes interacting with each other form the basis of the learning process. Each input to the nodes goes through different processes before being forwarded to other

nodes. As the inputs pass through the nodes, they pass through non-linear activation functions and are adjusted to be inputs to other nodes. The learning process is carried out with the weights between the nodes. In each iteration, these weights are updated and the target error rate is tried to be minimized. An artificial neural network generally consists of three layers. The nodes in the input, hidden and output layers are determined according to the targeted model. The number of input nodes is the number of features, and the number of output nodes is the number of classes in the dataset. The number of neurons in the hidden layer is determined as the optimum number for the highest classification success [22]. The general representation of the neural network structure used in the study is shown in Fig. 2.

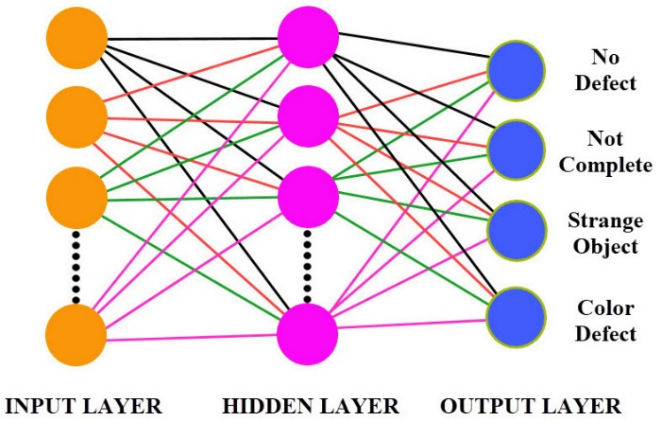

Fig. 2. ANN structure used in the study

2.5 Logistic Regression (LR)

LR is a machine learning method often used in classification problems. The biggest difference with linear regression is the lines they use in classification. Linear regression uses Least Squares to draw the optimum line, while logistic regression uses Maximum Likehood. It uses the sigmoid function while classifying. The logistic regression method is easy to implement and interpret. It performs quite well if the dataset is linearly separable. Overfitting is rare. However, as the dataset grows, the probability of overfitting increases [23]. The general structure of the logistic regression method used in the study is shown in Fig. 3.

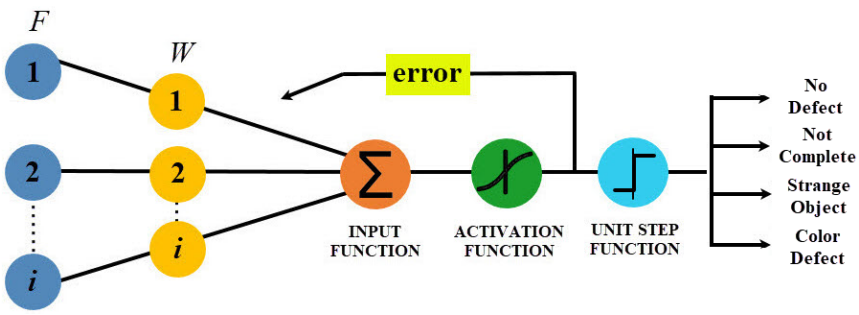

Fig. 3. LR structure used in the study

2.6 Confusion Matrix and Performance Evaluation Metrics

The complexity matrix is the table used to evaluate the performance of classification models. There are 4 values for each class on the table. These are TP (True Positive), TN (True Negative), FP (False Positive) and FN (False Negative) values [24]. The 4-class confusion matrix used in the study is shown in Table II and the calculation of the values is shown in Table III.

TABLE II. Four Class Confusion Matrix

ACTUAL	PREDICTED			
	No Defect	Not Complete	Strange Object	Color Defect
No Defect	T_1	F_{12}	F_{13}	F_{14}
Not Complete	F_{21}	T_2	F_{23}	F_{24}
Strange Object	F_{31}	F_{32}	T_3	F_{34}
Color Defect	F_{41}	F_{42}	F_{43}	T_4

TABLE III. Calculation of TP, TN, FP and FN Values According to Classes

No Defect	Not Complete	Strange Object	Color Defect
$TP_1=T_1$	$TP_2=T_2$	$TP_3=T_3$	$TP_4=T_4$
$TN_1=T_2+T_3+T_4+F_{23}+F_{24}+F_{32}+F_{34}+F_{42}+F_{44}$	$TN_2=T_1+T_3+T_4+F_{34}+F_{43}+F_{13}+F_{14}+F_{31}+F_{41}$	$TN_3=T_1+T_2+T_4+F_{12}+F_{21}+F_{14}+F_{24}+F_{41}+F_{42}$	$TN_4=T_1+T_2+T_3+F_{12}+F_{13}+F_{23}+F_{21}+F_{31}+F_{32}$
$FP_1=F_{21}+F_{31}+F_{41}$	$FP_2=F_{12}+F_{32}+F_{42}$	$FP_3=F_{13}+F_{23}+F_{43}$	$FP4=F_{14}+F_{24}+F_{34}$
$FN_1=F_{12}+F_{13}+F_{14}$	$FN_2=F_{21}+F_{23}+F_{24}$	$FN_3=F_{31}+F_{32}+F_{34}$	$FN4=F_{41}+F_{42}+F_{43}$

Performance metrics of classification models can be calculated by using the values on the confusion matrix. The formulas of the Accuracy (ACC), Precision (PRE), Recall (RCL) and F-1 Score (FSC) metrics that are frequently used in the literature are shown in Table VI.

TABLE IV. Performance Metrics

Metrics	**Equation**
Accuracy	$\frac{TP+TN}{TP+TN+FP+FN}$
Precision	$\frac{TP}{TP+FP}$
Recall	$\frac{TP}{TP+FN}$
F-1 Score	$2*\frac{Precision*Recall}{Precision+Recall}$

ROC curves are used to summarize the performance of classification models. ROC is generated based on Sensitivity / Specificity values. The area under the ROC curve, AUC (Area Under Curve), shows how well a value can be distinguished between classes.

3. Experimental Results

A computer with Intel i5 10200H 2.4 GHz processor, 24 GB RAM, and GTX 1650Ti graphic card was used for the extraction and classification of Industry Biscuit Dataset features containing 4900 images. The pre-trained VGG16 model was used to extract the image features. For each image in the dataset, 4096 features were obtained. The obtained image features were given as input to the ANN and LR models and their training was carried out. Cross validation method was used for training and testing processes. With this method, instead of testing only a part of the dataset, it is ensured that every part of the dataset is tested. In the cross validation method, training and testing processes were carried out so that the dataset was divided into 10 equal parts. Each

time, 9 parts of the dataset were used for training and one part was used for testing. The feature extraction and classification processes from the images in the study are shown in Fig. 4.

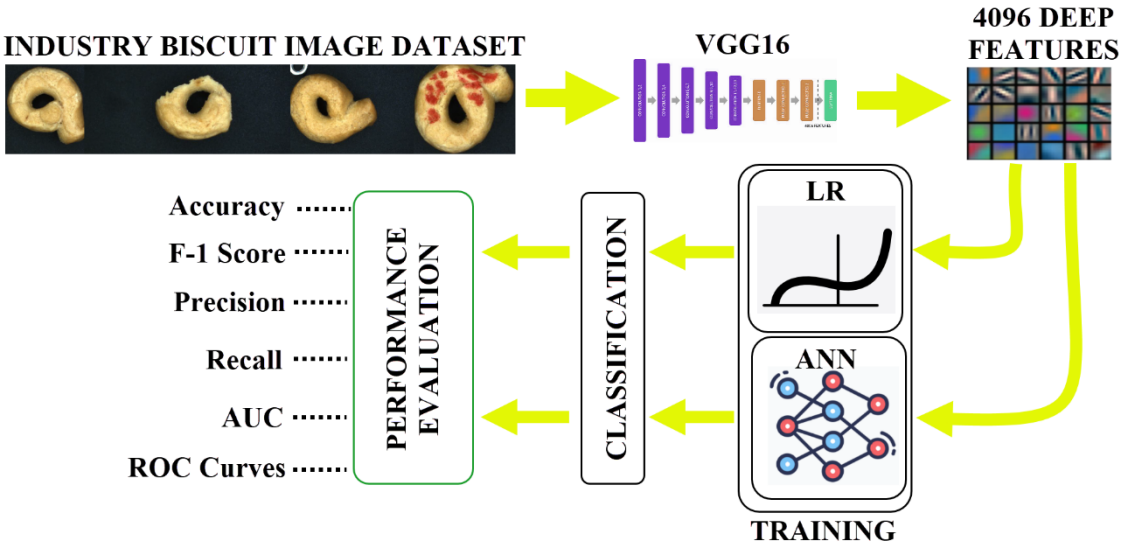

Fig. 4. Flow chart of the study

4096 features obtained for each image from the VGG16 model are given as input to the ANN and LR models. The training parameters of the ANN model are 100 hidden layers, 200 iterations, ReLu (Rectified Linear Unit) activation function and Adam optimizer. In the training of the LR model, the regularization type is determined as Ridge (L2). As a result of the tests of the models, confusion matrices were obtained. The confusion matrix obtained from the ANN model in Fig. 5 and from the LR model in Fig. 6 is shown.

Actual \ Predicted	0	1	2	3	∑
0	1881	11	3	1	1896
1	24	1828	5	3	1860
2	18	12	599	2	631
3	15	4	2	492	513
∑	1938	1855	609	498	4900

Fig. 5. Confusion matrix of ANN

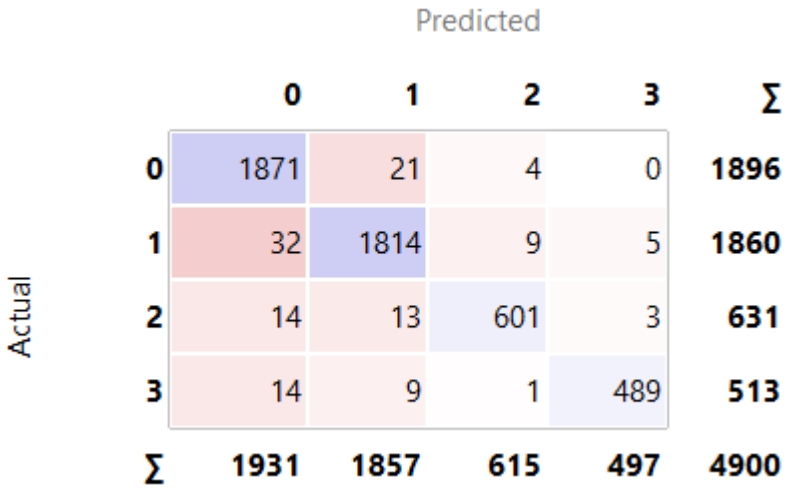

Fig. 6. Confusion matrix of LR

According to the confusion matrix of the ANN model in Fig. 5, it is seen that the class classified with the least error is the No Defect class. Considering the number of data, it can be said that the most mistakes were made in the Strange Object class. According to the confusion matrix of the LR model in Fig. 6, it can be said that the class classified with the most errors according to the number of data is Not Complete. The performance metrics of the models were calculated using the data in the confusion matrices. Obtained performance metrics are shown in Table V.

TABLE V. Performance Metrics of ANN and LR Models

	ANN	**LR**
Accuracy	0.980	0.974
Precision	0.980	0.975
Recall	0.980	0.974
F-1 Score	0.980	0.974
AUC	0.998	0.998

Table V shows that the classification success of the ANN model is higher. Precision, recall and F-1 Score values are also seen to be higher in the ANN model. The AUC value is equal in both models. ROC curves of the models are given in Fig. 7.

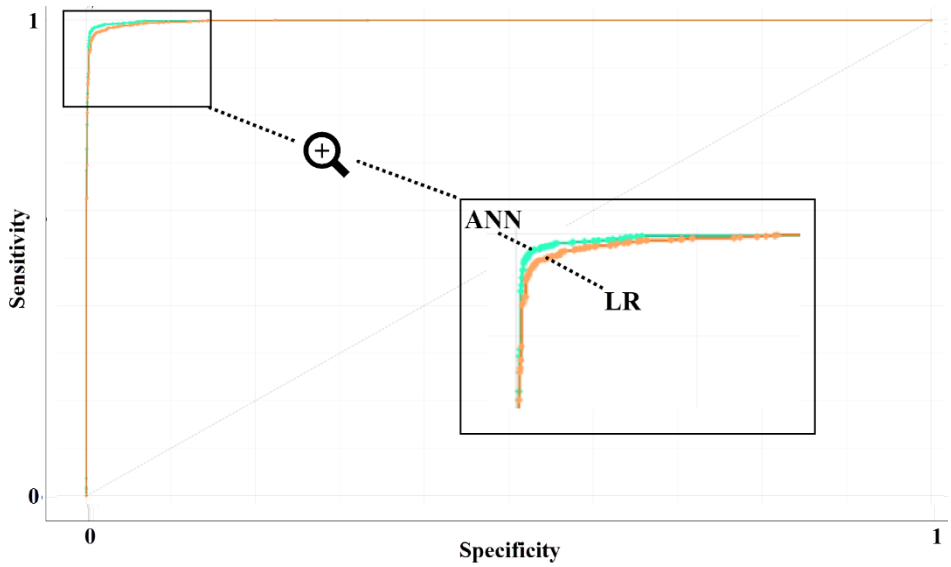

Fig. 7. ROC curves of ANN (green line) and LR (orange line)

According to Fig. 7, it is seen that both models learned the data successfully. The training and testing times of the models may differ. The training and testing times of the models are given in Table VI.

TABLE VI. Train and Test Time for ANN and LR

	ANN	LR
Train Time (sec.)	337.992	851.025
Test Time (sec.)	8.722	4.858

According to Table IV, the training time of the ANN model is lower than that of the LR model. The LR model performed the training process 2.5 times longer. When the test times are examined, it is seen that the LR model performs the test operations in 50% less time than the ANN model.

4. Conclusions

In this study, no defect, not complete, strange object, color defect states of biscuit grains were classified. Industry Biscuit Dataset containing a total of 4900 images was used in 4 classes. The VGG16 CNN pre-trained model was used to extract the features of the images. For each image, 4096 features were extracted with the VGG16 model. Extracted features were classified with ANN and LR models. Performance metrics of the models were calculated with the help of confusion matrices obtained as a result of classifications. The ANN model classified the images with a classification success of 98% and the LR model with a classification success of 97.4%. The precision, recall and F-1 Score metrics of the ANN model are 0.98. The precision, recall and F-1 Score metrics of the LR model are 0.975, 0.974 and 0.974, respectively. The AUC values of the ANN and LR models are 0.998. The performance metrics of the ANN model are higher than that of the LR model. The classification success of the proposed methods is at a level that can be used in the classification of biscuit states. It is thought that higher classification success can be achieved with other feature extraction and classification algorithms. In future studies, the

detection of defects in different food products and the detection of foreign objects in these products will be made. In order to carry out these studies, we are working on creating a dataset.

5. Funding

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6. Acknowledgement

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IMPACTS OF DIGITAL TRANSFORMATION IN EDUCATION SYSTEM DURING COVID-19: A REVIEW ON BANGLADESH

Noshin Islam Anika
Faculty of Computer Science, Dortmund University of Applied Sciences and Arts
Dortmund, Germany
noshin.anika001@stud.fh-dortmund.de

Abstract: *This paper reviews the state of education during the Covid-19 pandemic and how Bangladesh overcame all obstacles. The Covid-19 pandemic shook the world and has destroyed the lives of many. But it could have been followed by an even more substantial problem, educational recession. In this paper, the author presents the impact of Covid-19 on the education system of Bangladesh and how digital transformation helped to face the pandemic in the Education sector of Bangladesh. It shows the importance of the digitalization of education to overcome similar global crises. As it currently stands, many do not have access to the proper technology and environment needed to establish the digitalization of education. They have fallen behind compared to those fortunate enough to have these facilities. The author has tried to express why the digitalization of education and the facilities to organize it should be accessible to all.*

Keywords: digital transformation, digitalization, e-learning, research, training, digital tools, education

1. Introduction

A prosperous nation can be built on the foundation of education. Digital transformation can play a significant role in the education system. So, the Bangladesh government is now focusing on digitalizing the education system. As an example, textbooks and teacher training manuals for 1st to 10th-grade students can be accessed via www.ebook.gov.bd. Twenty-five hundred public and private educational institutions have received computers and multimedia projectors to enhance classroom teaching. [1] Currently, most learning styles are converted into digital education like e-learning programs. It is also extended through social networks such as Facebook and YouTube. This paper has been written about the impacts of digital transformation on the education system in Bangladesh.

The goal of the paper is to explain Bangladesh's education system and, after digitalization, how Bangladesh improves its education system. Bangladesh is comparatively not as good as developed countries like Germany, America, Australia, and Canada. Bangladesh's government is improving its education system by bringing the internet into the palm of everyone's hands. They utilized social media platforms as an e-learning program as most tend to waste their time on them. During the pandemic, the government used online services like Zoom, Google Meet, Hangouts, and Google Classrooms to and was able to ensure the students did not fall behind.

2. Previous Scenario of Bangladesh

Bangladesh began its journey in 1971, following the Liberation War. In Bangladesh, the literacy rate was around 17.61% for all ages. Parents would more readily send their children to work than to school. Bangladeshi leaders put a heavy focus on the development of their Education System. Slowly but surely, things began to improve. However, the literacy rate was still significantly low among females due to the patriarchal nature of Bangladeshi society. [2] Most parents believe that their daughters are a burden to the family and hence prefer to marry them as soon as feasible. So far, the Government-sanctioned education campaigns like free primary education, scholarships,

and specifically female scholarships played a vital role in developing the education system. Bangladesh has successfully raised its literacy rate to 74.9%, with the female literacy rate being above 50% in most scenarios. [2]

3. Bangladesh Education System

Bangladesh offers three streams of education such as Bangla medium, English medium, and Madrasa. Students have the option of obtaining education in either English or Bangla at all levels of school. Private schools generally employ English-based instructional materials, whereas government-sponsored schools use Bangla. These explanations are provided below -

3.1. Bangla Medium

The Bangla Medium education system was developed during the British period. The Bangladeshi government has developed it into the form it is today. There are three levels of education: primary level is for five years; secondary is for five years, and higher secondary is for two years. [2] After gradually traversing through classes one to five, the students must go through the PECE (Primary Education Completion Examination) exam. They may only move to the next stage after successfully passing this exam. Similar exams are held for the following levels as well; the JSC (Junior School Certificate) exam in class eight, the SSC (Secondary School Certificate) exam in class 10, and the HSC (Higher Secondary Certificate) in class 12. After completing the second board examination JSC exam, students must select between Science, Commerce, Arts, and Humanities as their future choice fields. Their curriculum is then modified accordingly. Science is by far the most popular choice. It allows the students to choose almost any profession they want in the future. The engineering and medical sector is locked out for students of other fields unless they studied a subject of science. [2] The government has adequately trained teachers and supplies the students with the books this curriculum follows, free of charge. Furthermore, the government has made primary and secondary education free and mandatory for all children. The government also offers various kinds of scholarships to attract the young generation. The majority of the Bangladeshi populace is from middle-to low-income families. Therefore, the Bangla medium curriculum is the most popular mode of education among the general public. There is a heavy influence of Bangladeshi culture, literature, and history in this stream of education.

3.2. English Medium

English medium is usually meant only for the children of the upper elite in Bangladesh due to the high tuition. [2] The curriculum has an international teaching style, following Edexcel, Cambridge of the UK, and other countries. There is a heavy focus on English instead of their mother tongue, Bangla. All of their textbooks are in English except in Bangla and Arabic. English medium is also divided into three levels: primary, secondary, and higher secondary. However, they have only two public exams. After class 10, the students sit for their O-Levels exam. They sit for their A-Levels after class 12. Due to a shortage of skilled teachers, the Bangladesh education board doesn't handle these exams. The British Council conducts its exams. [2] Their education system is designed to prepare the students for the international market of jobs.

3.3. Madrasa

Children from mostly lower socio-economic backgrounds go to Madrasas for formal education. Also, parents who want their children to receive a conservative religious form of education send their children to Madrasas. Imams educate them under the guidance of the religious texts of the Quran. [2] Financed by public donations, they provide the children with food, shelter, and education in different scientific fields. Many brilliant minds have arisen from Madrasas, who, in

turn, assume the role of future teachers. [2] The education levels of Madrasas are the same as that of Bangla Medium.

Students of all three streams then get enrolled in universities or vocational training institutes for higher education. Bangladeshi Universities are full of well-trained faculties. However, there are just an overwhelming number of students. So, the faculties can't tend to all their needs. It has resulted in Bangladeshi universities not being able to break the glass ceiling of the international university rankings. Still, Bangladeshi Universities have been developing over time. They have made significant progress in the last couple of years. The future of Bangladeshi education seems bright.

4. Digital Transformation Impacts

Bangladesh launched its vision 2021 project back in 2010. The project entailed establishing a Digital Bangladesh by the year 2021. They wanted to accomplish this goal by providing its citizen with electricity and technology and by developing human resources. [3] Since then, the government has successfully supplied 99.5% of the country with a steady flow of electricity. The government has established multiple cell towers. These provide mobile network coverage to most regions of the country. Most developed schools, colleges, and universities have begun to include digital technologies as teaching equipment. And at this point, finding someone whose family doesn't own a digital device is difficult. The government had realized the importance of digitalizing the education system to keep up with the times. The world had shifted to a global village, with everyone connected at all times. [3] All the information in the world is present at a moment's notice. To prepare for the future, steady progress toward an ideal Digital Bangladesh was being made despite its socioeconomic condition. But then, in 2020, the pandemic broke out, which halted the education sector for not just Bangladesh but the entire world. The Digital Transformation of the education system of Bangladesh may have turned out to be a blessing in disguise, as it has had a significant impact on all aspects of education. Students of all levels participated in their regular classes through online meeting platforms like Zoom and Google Meet. Digital classrooms were made in Google Classrooms, Facebook, or other online portals for class announcements and resource sharing. A student would be able to attend these classes through any device with an internet connection from the comfort of their homes. Teachers conducted their classes through their computers. They used digital copies of books on screen and, if needed, used graphics tablets in place of a whiteboard to carry out their lessons. Online classes were more advantageous in some ways, as interested students would be able to go back and watch the recorded classes. The government broadcasted lectures on various primary education topics on the national television network. Respected teachers from all schools and colleges made an appearance on the show to take classes. However, the high cost of digital devices turned off many families from online classes. And several families could not afford a television. It resulted in a massive number of children dropping out. Even among those that did not drop out, around 50% of students did not bother watching. The rest could not access the television broadcasts. [4] Teachers would not be able to help their students individually online. Despite all that, the government was successful in continuing educational activities even in such dire times. From the pandemic, we can realize that the digitalization of education should be the obvious way forward. If another pandemic like the coronavirus arose, we would be able to combat it. [5] Digitalization of education would shift the lives of those involved in many ways. These kinds of shifts affected all the different levels of education.

4.1. Impacts on Primary Level

The primary education of Bangladesh hadn't been fully digitally transformed before the pandemic. Teachers use overhead projectors and PowerPoint slides to aid their lectures which saved time. Students are shown educational videos on the topics they're studying that day.

Websites are used to provide a more interactive education for the students. But that was about it for digital transformation in primary education. Printed books were still prevalent. After the pandemic, however, it is a different story. A government decision has been made to close all educational institutions until further notice in an effort to curb the spread of the covid-19 virus. [6] It forced a significant change in the primary level of education. Young students had to become more proficient in using online software like Zoom, Google Meet, Google Classrooms, etc. [6] Teachers tried their best to hold on to the attention span of the young students. But as they failed, they increased the amount of homework and assignments. Since primary children were not familiar with digital devices, it was difficult to implement online classes for them. Parents were also reluctant to hand over a digital device unsupervised, to their kids. In the end, they allowed their children access to digital devices to attend these classes. It allowed them to become more familiar with such technologies.

4.2. Impacts on Secondary & Higher Secondary Level

In this stage of education, digital technologies are introduced to the students. Students, by this stage, usually know how to operate a computer. If they do not, they are shown the basics of a computer. Many schools provide the students with a computer lab to tinker with as they please. Class assignments often require digital devices. It helps the students become more familiar with them. Students are encouraged to surf the internet for educational purposes. The government had already been working to provide internet connections throughout the country. They also run a seminar to train the teachers to become familiar with digital devices and implement them in their lessons. They implement technologies in their lectures, such as online tests, group work, and assignments. Students are only now introduced to the digitalization of education, so at this stage, they are simply becoming more and more familiar with them. In the later stages, students become proficient at using digital devices and the teachers are right there with them. As a result, during the pandemic, implementing the online classes for this stage of education was simpler and quicker. They were able to quickly become familiar with all the different software and online services like Zoom, Google Meet, Google Classroom, Kishore Batayan, and other similar online portals, etc. [6] By the time they graduate from college, they are fairly skilled in using a computer. They are also familiar with the computer enough to be able to learn any new software fairly quickly. And from there on, the students are free to pursue their passion further during university.

4.3. Impacts on Graduate Level

In this stage of education, Student can choose their department as well as university. For example, those who took science in their secondary and higher secondary level can study engineering, medical, or honors in any of the science subjects such as physics, chemistry, biology, etc. For getting admitted into a public and private university one student have to sit for an exam to qualify. Students can also go to polytechnical institutes after completing the higher secondary level. Human capital is the most important component in digital transformation because it is through it that digitalization will be established and carried out properly. By updating the curriculum, attracting and involving quality staff, improving facilities, allocating budget, and so on, Bangladesh generates adequate human capital through science, technology, and research-based technical and modern education. Most notable initiatives include the development of old institutes and the creation of new ones with contemporary facilities. Among the educational institutions are universities, research institutes, polytechnic schools, and vocational training centers. [3] Presently on reference on Table I, the country has 53 educational institutions, including 19 science and technical universities, 49 polytechnics, and 37 vocational training institutes, with more than 300,000 graduates working in administrative, educational, industrial, financial, commercial, and entrepreneurial fields. [3]

TABLE I. Bangladesh Education Sector Scenario from 2009 to 2021 [3]

Year	2009	2012	2015	2018	2021
No. of University	29	32	35	43	53
No. of Science and Technology University	11	13	14	15	19
No. of Polytechnical institutes	49	49	49	49	49
Literacy rate	55%	57.86%	73.91%		76%
Budget in education (Billion $)	5.1	5.4	5.8	6.5	8.5

Source: Bangladesh University Grant Commission 2021

5. Consequences of Covid Period on Educational Structure

Bangladesh was on track to incorporating digital technologies in its education. The covid period forced the education sector to go all-in on it. Due to the pandemic, all educational institutes in the country were closed for nearly a year. An education gap can take its toll on the students. There are several past examples. After the Australian bushfires in 2009, the students failed to recover from it. They were behind academically for multiple generations of students that followed them. [5] The lack of digitalization of the Bangladeshi education sector showed itself. The government was unable to hold any of the public exams. As a result, those students moved on to the later stage without sitting for the exams. Their results were assessed based on their previous exams and assignments. If the government had incorporated digital technologies in the education sector, they could have organized the exams online. Regular classes of the students also took a big hit. The government did broadcast educational lectures on the national television network. But a significant portion of students did not have access to a television or did not bother watching. Many schools and colleges attempted to conduct their classes online. However, students from lower socioeconomic backgrounds could not join these classes because of not have access to any digital technology or a stable internet connection. It was difficult for their parents to support them during the pandemic since a lot of them lost their jobs or could leave the house to earn money. It resulted in many students dropping out. [5] Students from middle or higher-income families were able to attend these online classes. But several students had trouble sitting through hours of lectures in front of a monitor. They either could not pay attention to their classes or were busy with household chores. The teachers could not hold on to the attention span of their students online. It resulted in the teachers trying to get their students to learn by themselves by overloading them with homework and assignments. It either drove children away from studying entirely or added extra pressure alongside the pandemic. The pandemic had a mental toll on the students as well. With the looming threat of covid over their and their loved ones‘ shoulder, students found it difficult to focus on their studies. [5] There is a silver lining, however. After the pandemic, the government realized how ill-prepared they were to handle such situations. Now, they are preparing for any other crises like the pandemic by incorporating digital technology in education by 2025. The lesson was learned a bit too late, however. We can see that the lack of the digitalization of education affected all students. They affected them differently based on where they lived. Online classes present numerous challenges to students. Pupils say that power outages, load shedding, and unstable internet connections adversely affect their potential to focus online. Online classes are not being attended regularly by students due to problems with electricity and the internet. During an online lesson, Fig. 1 depicts the proportion of responses to various difficulties. [7]

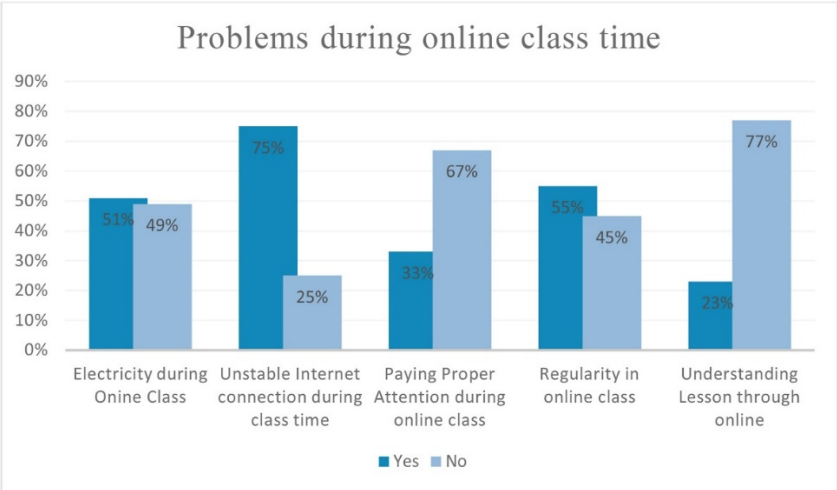

Fig. 1. Students‘ problems during online class time during the Covid period [7]

5.1. Rural-Focused Area

In rural villages, the economy of most households is at the lower end. There are often more than eight people in a family. It doesn’t make for a proper environment for a student. Most families have only one television in the house or none at all. So, several students could not watch the television broadcasts of the lectures. Most families don’t own a digital device. Even if they could afford a smartphone or a computer, students would be unable to attend online classes for various factors. Lack of stable electricity and internet connection, high cost of mobile data, lack of stable mobile data connection at their home, household chores, fieldwork, inexperience, etc, to name a few. The students from families with higher incomes were capable of attending online classes. However, the mindset toward online classes was not good. Most schools and colleges in rural areas were not well equipped to handle this situation. So, they didn’t arrange any online classes. In other cases, the quality of education online wasn’t up to the standard. So, many students didn’t bother sitting for hours in front of the computer. Parents were only beginning to change their mindset about the importance of educating their children. But the economic backlash of the pandemic forced lower-income families to send their children to earn money or force them to sit for marriage. All of this resulted in a massive portion of rural students dropping out. The progress made in education over the years, before the pandemic, took a big hit. Most rural students would have suffered the same fate since this happened because of their socioeconomic condition. But if digitalization of education had already been implemented, a lot of the rural students could have been helped. They could have continued their education as they would already be familiar with the digital technologies and attend their classes properly.

5.2. City-Focused Area

In the city, it is a different story. In the urban area, most families from both higher and lower-income families have access to a digital device, stable internet connection, and electricity. But, lower-income families still suffered economically. Due to the lockdown, families with a day-to-day income source could not earn money. Many families lost their jobs. Similar economic crises were common among lower-income families. So, most of them sent their children to work instead of pursuing their education. Students of middle-income or higher-income families could attend online classes, and most of them did. But the education system of our schools and college were ill-prepared to handle such a situation. Schools and colleges did not incorporate digital technology into their education yet. So, some never arranged any online classes. Those that did took some time to get everything together. The teachers were not ready to handle going online, so the quality

of education went down. All this turned off some students from attending the online classes. In case some interested students required assistance, teachers could not provide that assistance online as they were not trained to do so. In 68% of all cases, students did not have immediate access to a guardian who could help them in such matters either. [4] As a result, even though most had the time, environment, and capability, most students would rather spend their time doing something else. If digitalization of education was already in effect, and teachers were given proper training on using them, the situation could have been different. Luckily, the government has realized its shortcomings. In order to prevent similar crises, the government is planning to digitalize education by 2025.

6. Comparison Between the Education System of Bangladesh and Germany

Bangladesh was already incorporating digital technologies into its education system, even before the pandemic. Bangladesh's education system has already implemented virtual classrooms and the use of online services such as Google Docs and other technology to assist pupils. However, during the lockdown, the rate of digitalization of education accelerated substantially, allowing students to complete their studies. But compared to other developed nations, for example, Germany, Bangladesh's provision of quality education is still lagging. Germany's educational system is incredible. In comparison, Bangladesh's educational system is in poor shape. The ability of students to read is an essential indication of educational excellence. All subsequent learning is built on the foundation of reading. The majority of Bangladeshi children struggle to read. [8] On the other hand, most of the top German universities are tuition-free. So, coming to Germany for Higher education is an easy decision for Bangladeshi students. Germany focuses on academic, curricular, organizational, and structural advances in digital education rather than only technical innovations. They contribute to the enhancement of higher education instruction by using digital media. They wisely implemented this throughout the Covid period. They organized online classes for international pupils from various countries. They also transform current physical learning environments and construct new virtual learning environments. Universities have a variety of digital teaching and learning technology, but they are deficient in terms of structural and strategic advancement. Integrating digital media such as virtual seminars, online tests, and professional networks into teaching and learning is a complex negotiation process in most German universities. [9]

7. Conclusion

In this paper, it was attempted to visualize the impacts of digital transformation on the education system of Bangladesh. If Bangladesh can attain the level of digitalization of education like that of developed countries like Germany, Australia, and Canada, then maybe more Bangladeshi students will be more willing to pursue their higher education in their own country and do well. Education is the foundation of the backbone of a nation. If the education sector of Bangladesh is well developed, then Bangladesh as a nation can achieve new heights on the global stage. But it appears to be quite impractical in its current state.

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KNOWLEDGE MANAGEMENT PRACTICES IN SOFTWARE DEVELOPMENT ORGANIZATIONS: TRANSFORMING FROM TRADITIONAL TO AGILE

Meghna Negi [1], Rahnuma Tarannum [2], Mahsa Moradipour [3], Vu Hoang Long Doan [4], Zekarias Fikadu Tiruneh [5]

[1,4,5] Faculty of Computer Science, [2,3] Faculty of Business Studies
Dortmund University of Applied Sciences and Arts Dortmund, Germany
[1] meghna.negi001@stud.fh-dortmund.de, [2] rahnuma.tarannum001@stud.fh-dortmund.de,
[3] mahsa.moradipour007@stud.fh-dortmund.de, [4] vu.doan001@stud.fh-dortmund.de,
[5] zekarias.tiruneh001@stud.fh-dortmund.de

Abstract: *Software development organizations, which are adapting to agile processes face several challenges regarding knowledge management in organizational as well as cultural aspects. This study aims to analyze the organization's need for transformation to agile project management and the challenges they encounter. The goal of this paper is to propose a process framework with suggested practices that can be introduced to cultivate agile approaches.*

Keywords: knowledge management, traditional project management, agile project management, software development, transformation

1. Introduction

Project management (PM) methodologies have been adopted by organizations just half a century ago. The value of undertaking such methodologies in software development organizations has been realized in the period of early 1990 as it resulted in being more efficient in terms of planning, time and cost management and maintaining the quality of products [1]. Almost at the same time, pioneers in the software development community realize the importance of software process improvement (SPI). Consequently, they felt the need for management set up through which new and updated software process knowledge could be learned, used, and adapted for development. It promotes knowledge management (KM) in organizations. Fusion and retrieval of knowledge play a vital role in software development [2].

Ambience-dependent, dynamic and social synergy are the main aspects of KM. It can be split into two parts: explicit- which is conventional and systematic language and expressed in form of analytical values; tacit- highly personal information indulging the intuitions and instinct[3]. KM has always been a demanding issue in many organizations in terms of sustainability. Fabrication of knowledge in an organization depends on 4 knowledge processes that represent social and cultural attributes. These are Knowledge creation (KC), Knowledge storage and retrieval (KS), Knowledge transferring or sharing (KT) and Knowledge application (KA). Controlling resources of knowledge can be increased by following those processes. In the field of software development, utilizing knowledge assets is an essential part to form end software products. Subsequently, the employees and stakeholders need to have a clear view of the knowledge process maintained in the organization [4].

KM is essential for the smooth running of any organization but with the agile organization, the role of KM increases even more. When an organization adopts agile methodology, they aim at improving the efficiency along with a good quality of output, to achieve this goal, an efficient KM framework should be adopted by the organization. Effective KM can also help in reducing costs and increasing productivity.

Two decades after the incarnation of the agile manifesto, a group of frontier settlers of software experts formally recommended adopting the agile approach instead of following traditional PM.

It inaugurates a new era of PM approaches in software development organizations through adding new values which concentrate on individuals and interaction inclusive of customer collaboration, well-developed software and enactment of changes [5].

The paper was based on selective literature review. The search was conducted with the search strings, knowledge management in traditional management, knowledge management in agile management, challenges in traditional management, practices in agile management. Google Scholar was the database used for finding the relevant literature.

The research target of this paper is threefold: i) Analyze KM processes and practices in traditional and agile software development organizations, ii) Summarize the cause behind transforming towards agile and challenges faced by those organizations and iii) Propose a process framework and practices required to adapt during the transformation.

2. Knowledge Management in Traditional Organizations

For more than 40 years, software developers have been extensively and successfully using Traditional PM methods [5]. In this approach, the focus is to follow pre-defined plans and documentation holding the characteristics of ascertaining predictability, stability and high assurance in case of development [6]. Applying a single methodology in different projects has been stated as the robustness of this methodology. But along the time this thought was proved to be wrong as a single framed approach designed by traditional PM became invalid for different circumstances [7].

Though KM involves both tacit and explicit knowledge, software development organizations, following traditional PM, mainly focus on explicit knowledge and heavy documentation. The positive fact behind this is that the developers possess a clear idea about their workflows, related technologies and interfaces which release the time pressure for project managers. On the other hand, sharing and reusing this process knowledge becomes difficult for them due to the requirements of extensive documentation [4]. Updating codes and activities in different programming languages becomes a daily challenge in this type of project because of not having a proper configuration management process. This leads the developer to gradually become habituated to solitary programming [6].

Lack of transparency can lead to ineffective knowledge management in an organization. In traditional PM, transparency is considered a secondary value. The way of knowledge and information sharing among stakeholders and employees through traditional forms of communication like meetings, notices, formal reports of projects; reduces transparency [8]. On account of transparency insufficiency, many software organizations hold the factual example of being objecting to changes and deficiency in external and internal customer collaboration [5]. The Traditional PM approach initiates an irrepressible environment because of shortcomings in proper knowledge sharing which ends in customer dissatisfaction and customer value deterioration in successive periods of projects [9].

In traditional PM, project monitoring and reporting are done based on gathering recent status and keeping track of the project reports and results. No organized approach is available for predicting and preventing the problems. Based on the knowledge and experience of the project leaders, the problems are addressed but only when they appear. This is one of the causes of failure in traditional IT projects [10]. To stand against this failure, one of the most likely suggestions for traditional software organizations is to use the lesson learned documents that includes elaborated activities throughout the project along with the factors that came as a hindrance. Though some of them have this practice, it does not become effective by means of traditional communication management. They document the lesson learned during the projects but never involve the

previous projects documents before planning for the upcoming projects together [11]. In some traditional organizations, it is also seen to seek justifications from the developers for their performed task which led to problems instead of discussing how it can be rectified for present and future projects [6].

Despite all these factors, the traditional PM approach is appreciable for those organizations which are big, devotedly standard oriented and regular adaptation with changes are not necessary for the path of development [12].

3. Knowledge Management in Agile Organizations

Agile software development values interactions and collaborations between individuals more than process and tools, as well as "working software over comprehensive documentation" [13]. Thus, in contrast with traditional software development which focuses on explicit knowledge, knowledge in agile software development is usually shared in form of tacit knowledge [4], [14].

According to Olsen [15], learning processes can be of two types: single or double looped. The organization has some set of rules and processes that they abide by, in a single loop, if the organization encounters any error, the error is rectified but the cause of the error is not tracked. Errors are corrected based on the existing rules. On the other hand, in a double loop learning process, in case of any error, the error is corrected, the cause of the error is identified, and the existing organizational rules are modified accordingly. To incorporate agility in an organization it's important to take up a double-looped learning process [15].

Oliva and Kotabe [16] interviewed various start-ups founder following the agile method of development and came across the top practices that have been taken up by the start-ups for KM. These practices involved "internal meetings" during the definition and dissemination process, "Assessment of market or experts" during the acquisition process, and "Validation with clients" along with "Consultation with mentors" during the definition process [16].

Razzak and Šmite [17], in their paper, interviewed different agile teams of varying sizes. Authors found out five types of KM strategies that were being followed in the agile teams: System, Cartographic, Engineering, Organizational and Spatial. In System, domain-specific knowledge is codified and stored in the repositories for sharing within a team and in the case of distributed agile teams, these repositories can help in knowledge sharing between global teams. Cartographic strategy refers to sharing of knowledge by the experienced member/s of the team to get the urgent query get solved quickly instead of searching through the documentation. Engineering strategy involves knowledge coordination among teams using shared databases about coding guidelines, review processes, the process of tools installation and usage, etc. In Organizational strategy, knowledge sharing through communication is achieved. It adopts a networking approach where certain communities like Wikis and Forum are used for knowledge sharing. For implementing Spatial strategy, organizations provide employees with conference rooms, areas for drinking coffee, and having lunch together so that team members can share knowledge in informal ways. This strategy helps to capture tacit knowledge [17].

A KM strategy for agile software development framework was formulated by [4]. The Authors created a strategy for three layers of organization: Strategic, Product Portfolio, Project layer. In the Strategic layer, the organization decides the competitive advantage and the new infrastructure and technologies that will be required to achieve it. They did not find any KM practices in this layer as agile teams are isolated from the remaining organization; hence, KM practices can work well inside the boundaries of the team. In the Product Portfolio layer, the decisions regarding resource allocation and competence building are taken. Two KM practices were observed in this layer. One was the implementation of the personalization strategy, which

includes, developing innovative ideas through interaction between members from different teams with the help of the organization's infrastructure. The other was the implementation of a codification strategy involving the creation of Wiki-based tools for documentation and knowledge sharing. In the Project layer, planning of development iterations takes place according to the decisions taken in the product portfolio layer. This layer involves several KM practices categorized into Personalization and codification strategy. Personalization strategy has practices that promote KC, KT, and KA processes. KC process encourages socialization through communities of practices, innovation boards, and pair programming. Also, interaction with customers is a KM practice used for knowledge creation. For KT in personalization strategy, communication channels like video conferencing or telephone calls can be used in distributed teams. Another practice for KT in globally distributed teams can be the movement of members in between various sites. While in local teams it can be practiced by face-to-face meetings, seminars, etc. Only one KA practice was found in personalization strategy, sprint review, where current sprint can be reviewed, and shortcomings can be considered for upcoming sprints. Codification strategy promotes KS, KT, and KA. KT practices in the Codification strategy involve the documentation of all the good and bad experiences of the current project that is reviewed in the presence of stakeholders or documented experience which supports the planning of future projects. Companies keep track of all the information like project documents, technical details of the project, etc., and share it with the team. KS practice in codification is to create a database that can be used by teams to store information and knowledge. Issues can also be reported and the feedback for the solution can be taken. The database can also be maintained for storing good practices and lessons learned. One practice was found for KA, an organization was using a wiki-based tool to reuse the knowledge documented, in future projects [4].

4. Transformation from Traditional to Agile

Many firms and organizations are transitioning from traditional PM approaches to Agile, regardless of industry, country, size, or culture. These firms have been managing the production and development of their products and services by utilizing professional project management theories and practices. Traditional PM systems such as Waterfall, Critical Path, Six Sigma, and others were employed by most firms in the past. Agile techniques, on the other hand, have become an enticing alternative for firms seeking to enhance their performance as a result of the world's increasingly rapid changes and the creation and development of new technology. Today's economy and market, as well as client demands, evolve at such a rapid pace. The agile approach accepts change and adapts swiftly to it, which is extremely valuable and even required when dealing with volatile market situations. Agile was originally created for small, single-team projects and was first used in the IT business, particularly in the IT software development domain. Their demonstrated and projected benefits, however, have made them appealing outside of this framework, particularly for larger projects and in larger firms [18].

The transformation that is flexible encompasses not only software development processes and tools but also a new way of thinking and a desire to solve problems as quickly as feasible. Many businesses are still using outdated development methods, which has a negative impact on the organization's speed and flexibility to change. In the previous 30 years, agile methodologies have improved software engineering success rates, quality, and IT team capabilities, motivation, and productivity. Companies are frequently confronted with unanticipated market developments, requiring them to reduce the time it takes to deploy software products and be more responsive to client requests. Agile development approaches are particularly beneficial in these instances because they can respond to changing market conditions. Other business models are less open, creative, cooperative, and efficient than agile transformation. Implementing agile approaches entails prioritizing and managing the definition of requirements within a team working on an IT project through the SDLC (Software Development Life Cycle) [5]. Because the cost of agile

transformation in terms of money, resources, disturbing work routines, and development quality can be enormous, it's critical to address KM issues head-on to reduce the chance of a failed transfer. Organizational learning culture, continuous learning process, information repositories, training sessions and workshops, the community of practice, and management assistance in terms of coaching and mentoring are a few crucial KM parts of the transformation [19].

4.1 Challenges Posed by Agile Transformation:

Over the past two decades, the adoption of agile has grown rapidly [20]. During the 2000s, a limited number of studies and calls for more research on a scaled agile transformation started to appear, as enterprises moved towards large-scale agile adoption [21]. Moving agile to large-scale contexts presents a complex set of challenges [22]. In 2015, scholars began to study this phenomenon in greater depth [20]. Due to the few related studies that have been published before 2016 and meet our inclusion criteria available, we explain the number of common challenges that have been reported by prior studies and summarize the rest of the Ranked challenges in Table 1.

- Challenge 1: Resistance to change:

In general, human beings once do not have good reasons and understanding find it difficult to adapt themselves to change. Even organizations with a flexible culture will struggle to get buy-in for a change. Although some people may not be able to adapt to a new way of working, it should be expected that some will never adjust. Therefore, the most significant reason that may lead to wasting time and productivity could be objections to change. There are a vast number of reasons for change resistance, for example, employees worried agile might bring new roles and responsibilities. Furthermore, due to the increased level of interaction within the project team and between the various stakeholders, the people felt that they were being monitored more [23]. Another reason why the team did not want to change to agile development is transparency, they believe that agile increases transparency [22].

- Challenge 2: Coordination/Communication:

Since the agile method requires coordinating multiple agile teams that work on the same product [24], employees should work in multi-team environments, interfacing between teams could be sometimes problematic. Moreover, as some organizations created the teams base on an autonomous model, the teams do not have strike balance between their own goals and the organization, and they often prefer to focus on their own goals [23].

- Challenge 3: Requirements engineering:

Many teams experienced the loss of quality during an agile transformation [22]. Studies reported that in agile methodology high- level requirements management is largely missing. Requirements usually are created by several stakeholder groups and the development team finds it difficult to keep in touch with all of them [23].

TABLE I. Proposed Categorization of Challenges of Agile Transformation from [23], [25].

	Challenges	Description
1	Lack of Investment	- Lack of coaching - Lack of training - Too high Workload - Old commitments kept - Challenges in rearranging physical spaces
2	Agile difficult to implement	- Misunderstanding agile concepts - Lack of guidance from literature - Agile customized poorly - Reverting to the old way of working - Excessive enthusiasm

	Challenges	Description
3	Different approaches emerge in a multi-team environment	- Interpretation of agile differs between teams - Using old and new approaches side by side
4	Hierarchical management and organizational boundaries	- Middle managers' role in agile unclear - Management in waterfall mode - Keeping the old bureaucracy - Internal silos kept
5	Quality assurance challenges	- Accommodating non-functional testing - Lack of automated testing - Requirement's ambiguity affects QA
6	Integrating non-development functions	- Other functions unwilling to change - Challenges in adjusting to incremental delivery pace - Challenges in adjusting product launch activities - Rewarding model not teamwork centric
7	Culture Challenges	- Inappropriate leadership dynamics - Incompatible social structures
8	Motivation Challenges (KT)	- Missing agile mindset - Fear of consequences

5. Transforming Process Conceptualization

The transformation from traditional to agile PM also requires a transformation in the KM practices to incorporate the dynamic capabilities of agile. This section consists of a proposed process framework along with the recommended practices for each process that can be used while switching over to agile project management. The processes included are Knowledge Creation, Knowledge Storage, Knowledge Transfer, and Knowledge Application in this specific order. The pictorial presentation of our proposed process framework is shown in Fig. 1. The process framework developed also includes practices suggested by [4].

5.1 Knowledge Creation

Customer interaction along with proper communication with stakeholders can be an essential practice for knowledge building. While taking up a new, up-and-coming topic there can be a lack of knowledge within the whole team or sometimes the whole organization. Organizations can then take assistance from external sources in the form of trainings, and seminars for KC. Instead of following a single-loop process during solving any occurred problem, organizations have to give focus on the double-loop process. It will help them not only to solve the problem but also keep a trace of the root causes of the occurrence of the problem. Initiating inter-organizational open conferences for the developers can bring a chance of pair programming which will lay the first stone towards creating new knowledge by expanding social interaction. One of the significant benefits of sprint planning is that it allows the team to understand the structure and goals of the project. Moreover, these practices help the agile team to gain knowledge about the product and requirements of the development task. Some of the major practices of the scrum also help in the generation of product knowledge [26].

5.2 Knowledge Storage

The documents of past projects Sprint Retrospective can be used as a KS for upcoming projects to know about past experiences they encountered and how they went through it. Wiki-based tools can help in storing and documentation knowledge gained, lessons learned, etc. in a way that knowledge is easily available to the member in need of it. Organizations can benefit from Content repository software such as Zendesk, Document360 and Zoho Desk for soft style recording or they can use hardstyle one like external or internal hard in order to store the knowledge. Sprint Planning involves documentation of the knowledge regarding the current

sprint. This knowledge can then be used by the team members throughout the sprint to carry out assigned tasks.

5.3 Knowledge Transfer

The companies that employees engage in internal training are investing in the future of the organization because internal training is one of the cost-effective methods for knowledge transfer. In addition, it also increases the employee's engagement and motivation. Pair programming, done during the open conference, can also be a medium of transferring knowledge among the developers. The creation of online forums within an organization can help in sharing of knowledge between various teams. A team having expertise in a particular domain can help another team in need by posting answers to the query on the forum. The agile practice supports starting the day with daily scrum which brings the opportunity to have a look at the current status of the project work fly. The new adapting team can include senior colleagues who have expertise in the agile processes. It can be a guide to find the problems and overcome them during adaption. Wiki-based tools along with other tools like GitHub, Confluence, JIRA, etc. can help in efficient knowledge flow. Since scrum helps organizations to improve sharing and transferring knowledge about projects and domains. Sprint planning can play a vital role regarding this matter. More spaces such as coffee places, canteens, conference rooms should be provided as they provide a free and informal way of knowledge flow between members and within an organization. Though agile does not suggest many documentations, thinking about the transforming period, the organizations can keep practicing delivering updates about new and interesting pieces of information through Newsletters. To keep pace with the changes it can be shared each month, or the team can decide themselves when they need to share. At the end of each project, sharing an informative and creative piece of the Newsletter can make other employees interested in the project work adapting to agile.

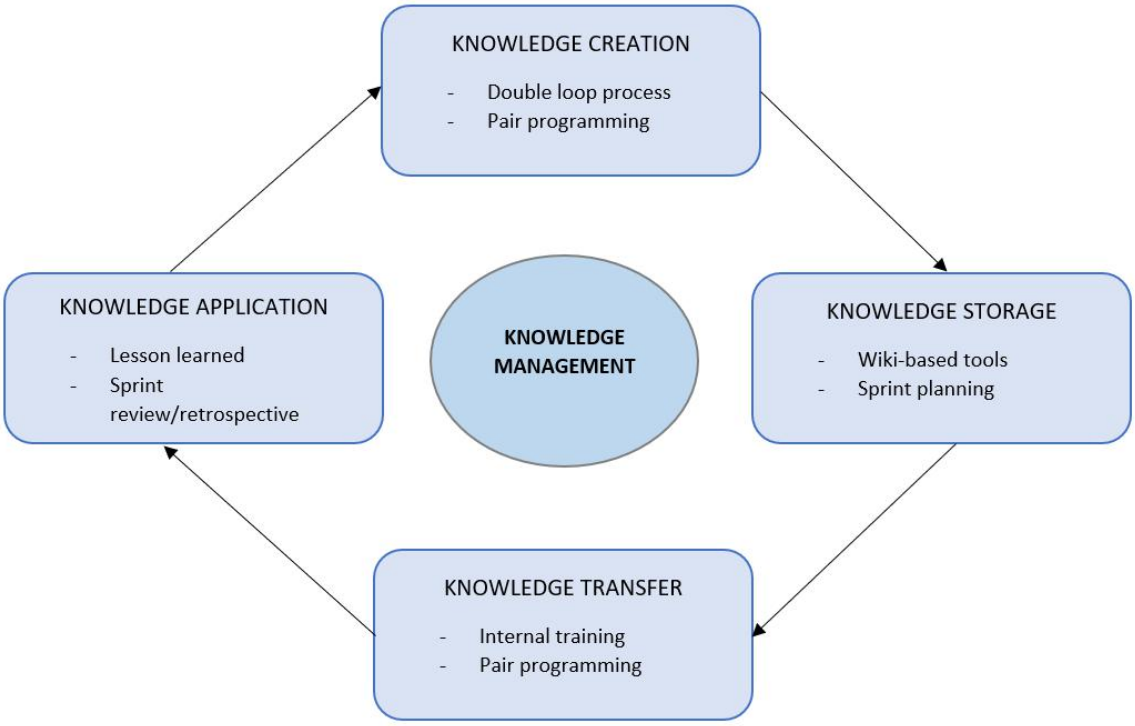

Fig. 1. Proposed Framework for Transformation from Traditional to Agile

5.4 Knowledge Application

In order to endure the competitive advantage through improvements, the implementation of lessons learned has been suggested as a good practice. Through compiling and sharing lessons learned from the project, the teams who will work in the upcoming projects get the convenience to apply methods and techniques which was undoubtedly successful and can take preventive actions towards similar problems if they face any. Sprint review and sprint retrospective is a good chance to evaluate the gap of achievements and expectations. It could help teams and companies to apply the knowledge acquired from previous sprints and assess the efficiency of knowledge they have applied so far [4].

6. Discussion and Conclusion

This review extends the literature on knowledge management and organizational transform to agility. We established in this assessment that effective knowledge management is a crucial precursor and coordinator of a successful IT Agile transition. Organizational culture, workshops, training, coaching, and Agile experts are just a few of the significant parts of knowledge management that need to be considered, according to the problems, challenges, and valuable considerations described in this work.

The agile transformation deployment process is a complicated, evolutionary, and long-term method of introducing changes in order to increase organizational agility and, as a result, gain a powerful instrument to outperform competitors in a dynamic and unpredictable marketplace [19]. The adoption of agile PM could be a catalyst for overall company development, which is defined as an organizational learning process that propels businesses to a stronger position in a competitive business environment.

Agile is the wave of the future. The increased rate of change, as well as the need for diverse departments to be able to cope with those changes swiftly, need the use of a new PM strategy. Even if the switch to Agile isn't easy and won't happen overnight, the mindset of accepting change and responding quickly to it is already in place. Change is the golden rule for any organization's survival, and it is at the heart of adopting and extensively implementing the agile process.

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A TECHNOLOGY OF INTERACTIVE LEARNING "DIGITAL PROFESSOR". CASE STUDY

Nataliia Yehorchenkova[1], Oleksii Yehorchenkov[2]

[1]Project Management Department, Kyiv National University of Construction and Architecture
[2]Technology Management Department, Taras Shevchenko National University of Kyiv
[1,2] Kyiv, Ukraine
[1]realnata@ukr.net, [2]alexee@ukr.net

Abstract: *Global trends in many areas of human activity are aimed at the transition to digital transformation. The transformation of modern business requires changes in the learning process of higher education. Based on this, among the main trends in the development of the educational process is the use of interactive teaching methods and technologies, which are designed to create comfortable learning conditions in which each student feels his success and intellectual ability. Interactive methods fascinate listeners, arouse their interest and motivation, teach them to think and act independently. The analysis revealed that one of the popular areas of interactive technologies is the use of chatbots, which in the educational process of higher education is a promising trend in terms of digital transformation, but currently the use of these technologies is not widespread. Popular chatbots used in the educational process of higher education institutions are shown. The article proposes to consider an interactive learning technology that is based on the telegram chatbot "Digital Professor". The aim of the article is to demonstrate the structure and basic principles of using a technology of interactive learning "Digital Professor". The technology "Digital Professor" is designed to improve the learning process in higher education. The structure and interface of technology of interactive learning "Digital professor" are shown, as well as its following features: Learning Management System, assessment and assistance. The prospect for further research is to expand the capabilities of technology "Digital Professor", namely the addition of technologies of neurolinguistic programming and artificial intelligence.*

Keywords: interactive learning technologies, chatbot, higher education institution, information technologies

1. Introduction

Global trends in many areas of human activity are aimed at the transition to digital transformation. Examples of digital transformation are virtual offices, e-currencies, online payments, digital services and more. The transformation of modern business requires changes in the learning process in higher education institutions (HEI).

As a result, the traditional teaching methods used by teachers 10 or more years ago are not enough today. This is due to the fact that today's students can be classified as "Generation Z".

Students of this generation are sociable and active, but prefer communications, mainly in mobile applications. They absorb different information better than their predecessors, learn quickly and willingly, especially if the knowledge allows them to acquire new skills, but at the same time, not prone to memorization, hoping to use technology at any time.

The vast majority of information they receive from Internet resources. Due to the fact that they do not see the point of studying at school (or university), they may not acquire basic knowledge and skills. Everything they learn through the internet is usually situational.

Despite this, Generation Z is creative and multitasking; appreciate things that can be immediately tried in practice and much worse perception of "pure" theory, detached from life; do not like monotony, appreciate diversity, are able to quickly switch attention, and therefore ready for a variety of work, but setting goals for them should be clear and understandable, because it directly affects the effectiveness of their work.

Due to the peculiarities of thinking, the representatives of this generation better master the knowledge in the form of games, and rules, formulas, etc. they are easier to perceive in the form of infographics, which they understand [1].
Based on this, among the main trends in the transformation of the educational process is the use of interactive teaching methods, which are designed to create a comfortable learning environment in which each student feels his success and intellectual ability [2].
Problems that can be solved simultaneously:

- development of communicative skills;
- emotional contact between listeners;
- learn to work in a team, listen to the opinion of your friend;
- relieves the nervous load of students, gives the opportunity to change the forms of their activities, to switch attention to the key issues of the topic [3].

Interactive methods fascinate listeners, arouse their interest and motivation, teach them to think and act independently.
On the other hand, using of interactive technology methods can help teachers
The authors propose to consider the technology "Digital Professor", which is designed to improve the educational process in HEI's.
Based on this the paper's purpose is presentation of the structure and basic principles of using technology of interactive learning "Digital Professor", which is designed to improve the educational process in HEIs.
Objectives of the paper:

- to analyze modern trends of educational processes of HEI;
- to present structure, interface and possibilities of the technology "Digital Professor";
- to show results of practical implementation of the technology "Digital Professor".

2. The Previous Research Materials

Such interactive methods as trainings, situational tasks, master classes and others help to form the professional potential of future professionals [4]. The new educational paradigm today is smart learning based on smart devices and intelligent technologies [5]-[6]. As discovered and thoroughly studied over the last decade, such technologies can be implemented and used to help students learn. Smart technologies are used to provide flexibility in learning. They can be used as media or tools for access to learning content [7], inquiries, communication and collaboration, design [8], expression [9] and evaluation [10] in smart technologies.
Today, many big names are using artificial intelligence (AI) chatbots to improve customer service and attract more and more audiences to stay relevant and visible. In addition to business, other sectors also use chatbots, including schools and HEIs.
Authors of the article «Why is Education Industry opting for AI Chatbots? How Are They Benefiting It?" [11] argue that the perceived benefits of implementing chatbots for education are far-reaching. The introduction of artificial intelligence in classrooms has been overshadowed by other enterprises, mainly due to the somewhat slower adaptation and perception of the education sector to newly introduced technologies.
But now more and more administrations and faculty are recognizing this cost-effective but valuable way to keep their students informed and streamline processes more effectively.
What has helped them the most is the fact that the younger generation is quickly learning and adopting new technologies in line with the latest trends, we are seeing a significant shift from single-purpose websites and applications to social networks and messaging platforms such as WhatsApp and Facebook. Messenger is more than just sending and receiving messages.
As technology expert Kyle Matthews explains: "Children grow up with tablets in their hands, so teaching them new technologies and programs will only prepare them for the wider world. Not to mention that technology can greatly facilitate the work of teachers "
As for how - there are several platforms on the market for creating chatbots that offer educational bots that are designed to attract students and provide short and fast but valuable information.

These platforms are integrated into Facebook, Twitter, Skype and other social networking applications to make learning as fun and exciting as possible for students and at the same time eliminate the need to switch between dozens of online portals and e-mail accounts.
Students can simply interact with the chatbot on their platform and get an instant response from it! 6 reasons to create a chatbot for the education industry: chatbot is a learning tool; chatbot increases student engagement; chatbot provides smart feedback; chatbot provides instant assistance to students; chatbot provides better support to students; the positive impact of online education.
From the analysis it can be concluded that the use of chatbots in the educational process of HEIs is a promising area given the digital transformation, but currently the use of these technologies is not widespread.

3. The Technology of Interactive Learning "Digital Professor"

The authors of the article have developed an technology "Digital Professor", which works with the telegram chatbot @digitalprofessor_bot. The structure of technology "Digital Professor" is presented at Fig. 1, the interface - at Fig. 2 and Fig. 3.
Technology "Digital Professor" has the following capabilities: Learning Management System (LMS), Evaluation and Assistance.

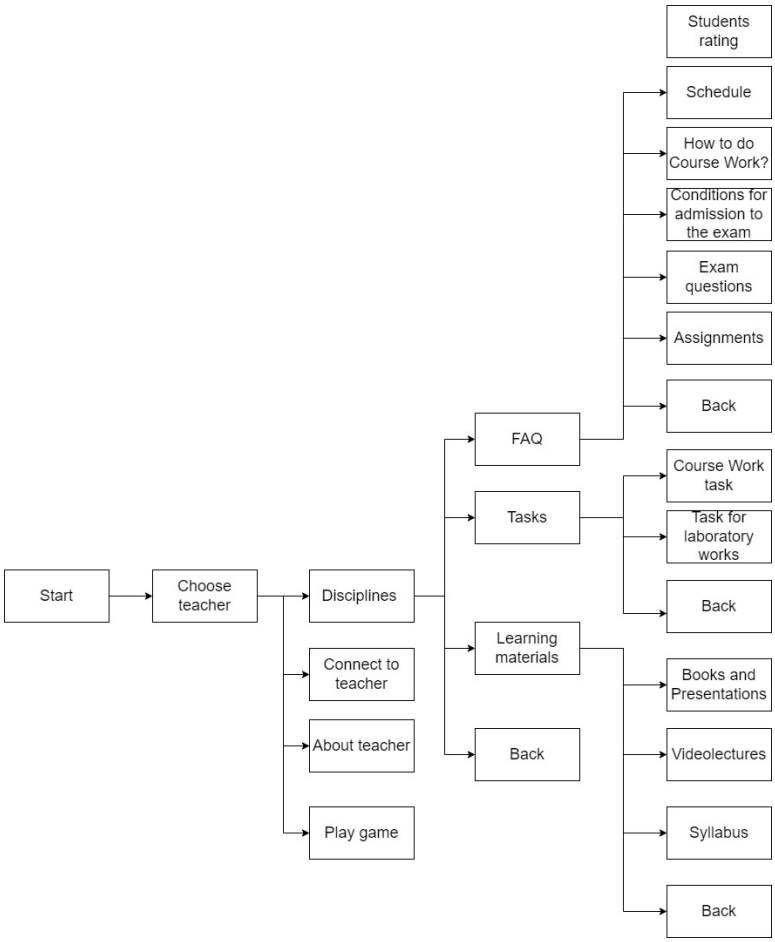

Fig. 1. The structure of the technology of interactive learning «Digital professor»

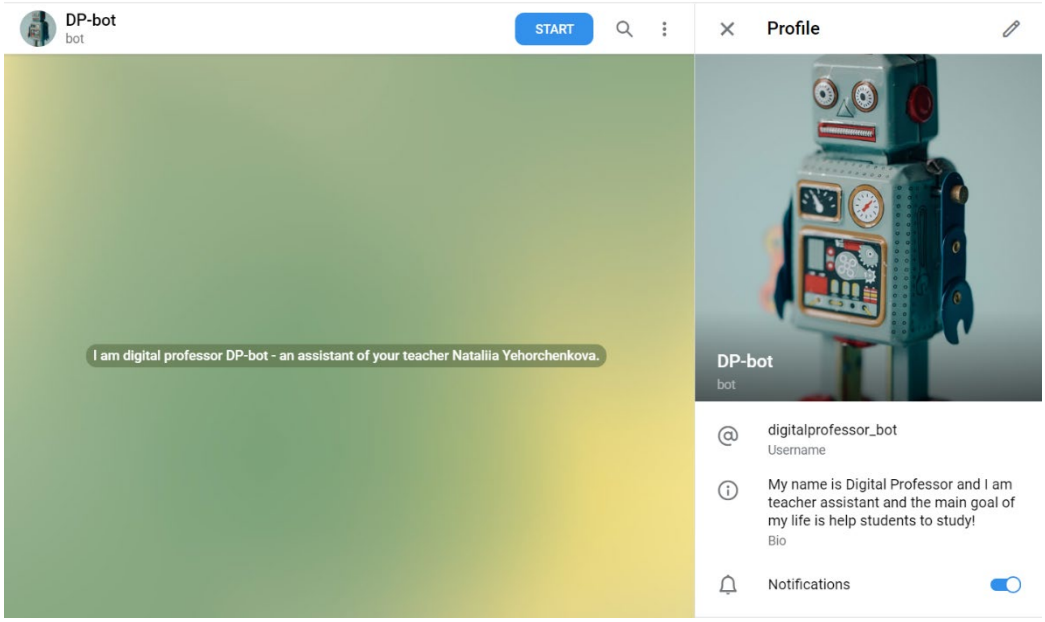

Fig. 2. The main page of the technology of interactive learning «Digital professor»

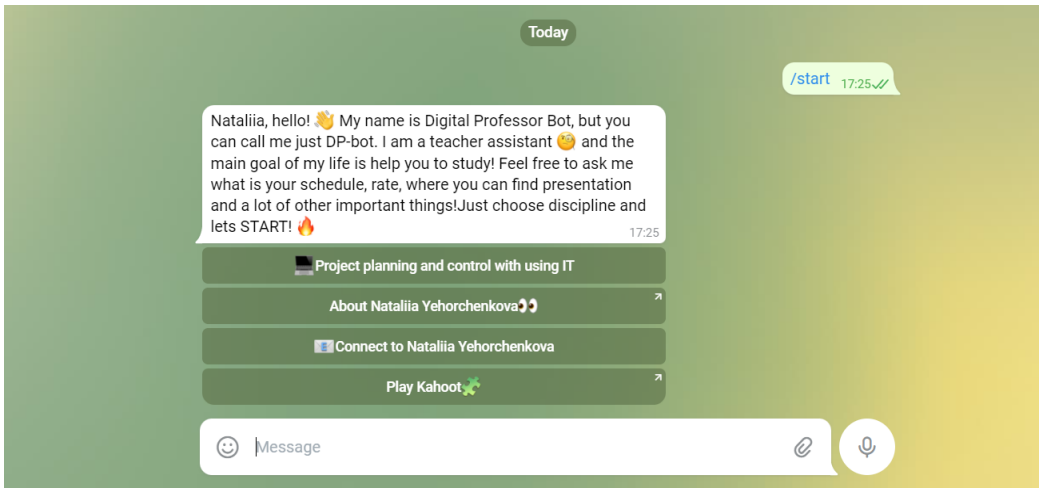

Fig. 3. The main menu of the technology of interactive learning «Digital professor»

Let's consider the possibilities of technology "Digital Professor" in more detail.

3.1. Learning Management System

A learning management system (LMS) is a software application for the administration, documentation, tracking, reporting, automation, and delivery of educational courses, training programs, or learning and development programs. The learning management system concept emerged directly from e-Learning. Learning management systems make up the largest segment of the learning system market [12].

Technology "Digital Professor" performs such LMS functions as:

- Providing access to educational materials.
- Assign laboratory and practical tasks.
- Providing access to video lectures.
- Providing students with access to educational games.

The main advantage of "Digital professor" over popular LMS (for example, Moodle) is easy and constant access to educational materials of the discipline both from a mobile device and from a personal computer.

3.2. Evaluation

Evaluation means the implementation of the "Digital Professor" of the following functions:

- conducting and evaluating test tasks;
- verification of completed practical and laboratory tasks.

3.3. Assistance

Assistance in the "Digital Professor" is implemented through the functions:

- Providing answers to frequently asked questions.
- Presentation of student rating.
- Dissemination of news on the discipline.
- Send reminders.
- Connection with teacher.

Based on the above, it should be noted the following advantages of "Digital Professor" over existing information technology training:

- Quick and constant access to discipline materials, tasks, rankings, exam questions, etc. both from a smartphone and a personal computer.
- Easy communication with the teacher.
- Exemption of the teacher from routine work, which is associated with the constant provision of answers to typical questions for students.
- Gamification of the educational process.

4. Results and Conclusion

The paper considers the use of interactive technologies in the educational process of higher educational institutions. The analysis showed that today in HEIs mainly use such interactive methods as training, situational tasks, workshops, press conferences, testing, case studies, game learning, round tables, multimedia lectures and workshops, e-learning edition. Also, a new educational paradigm today is smart learning based on smart devices and intelligent technologies. One such smart technology is a chatbot, which makes learning as fun and exciting as possible for students, while eliminating the need to switch between dozens of online portals and email accounts. The authors have developed the technology of interactive learning “Digital Professor", which works on the basis of the telegram chatbot @digitalprofessor_bot. After the introduction of technology "Digital Professor" in the educational process, a survey was conducted among students who positively assessed the use of the chatbot during the study of the discipline.

The prospect for further research is to expand the capabilities of technology "Digital Professor", namely the addition of technologies of neurolinguistic programming and artificial intelligence.

From authors’ point of view Digital Professor is excellent product for university teachers who want get away with wasting their time on routine work and who want take responsibility for creation work like us.

And, in the end, I’d have to say that Digital Professor has a big potential in the future:

- to send off news and ads to students;
- to check student’s assignments;
- to be used like Learning Management system;
- to communicate with students via Al technologies instead of teachers themselves.

I believe that teachers at the same time will:

- do creative tasks;
- study;
- do research;
- take part in conferences and international projects;
- do paperwork;

- spend time with family and do hobby.

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INTRUSION DETECTION SYSTEM IN CONTROLLER AREA NETWORK COMMUNICATION PROTOCOL IN VEHICLES

Meghna Negi
[1] *Faculty of Computer Science, Dortmund University of Applied Sciences and Arts*
Dortmund, Germany
meghna.negi001@stud.fh-dortmund.de

Abstract: *The last few decades have seen the evolution of a vehicle from a mechanical device to an electronic, software-intensive system. With the increase in the number of Electrical Control Units being used in the vehicle, the need for protocols to facilitate the communication between them has become a necessity. With ongoing development, communication is not just restricted within a vehicle but has also been extended to other vehicles. This has resulted in the need for security measures to ensure the safe transmission of data within vehicles as well as inter vehicles. This paper discusses the Controller Area Network communication protocol which is being used in the automotive domain, the most common security threats, and the Intrusion Detection System to combat the threats. The goal of the paper is to observe the trend being followed in Intrusion Detection systems and to analyse the trend.*

Keywords: controller area network, communication protocol, automobile, security threats, security mechanisms, intrusion detection system, literature review

1. Introduction

Initially automobiles were a mechanical device but slowly they started to be transformed into an electronic device due to stricter rules regarding emissions and for the better engine efficiency. Hence, the need for communication protocol to communicate between various Electronic Control units (ECUs), which is efficient as well as fast came up. Various communication protocols like FlexRay, Local Interconnect Network (LIN), Controller Area Network (CAN) and Media Oriented System Transport (MOST) came into existence and started being used in automobiles. Out of this CAN protocol is being largely used in automobile sector as it provides speedy and efficient transmission of small data [1]. Also, protocols like FlexRay have high production costs which are not favourable for low or mid-end vehicles whereas CAN protocol is cost effective and has proved to be a reliable mode for transmission of data in vehicles for years now [2].

CAN protocol was designed by Bosch in 1983, it is a robust serial communication bus. CAN connects various nodes particularly ECUs with the help of twisted wires. These are differentially balanced signalled wires as they have same amount of current flowing but in opposite directions, which makes CAN highly immune to noise, fault tolerant and have reduced electromagnetic interference. These differentially balanced signalled wires are known as CAN-H and CAN-L. The data transmission happens over the CAN-Bus where the transmitted Bits can either be dominant or recessive. The dominant bits are preferred over the recessive bits for arbitration. In dominant state, CAN-H can go up to 5V while CAN-L is grounded. In recessive state, both CAN-H and CAN-L are at 2.5V. Like TCP, UDP and any other protocols, CAN has a data frame with a standard format. The data frames in CAN has an identifier, the lower the number in the identifier field, highest is the priority of that data frame. The identifier helps in prioritisation of data frame in order to avoid collision between the messages on the Bus [1]-[3]. Since all the ECUs in the vehicle communicate using the same CAN-Bus as shown in Fig.1. In the Fig.1, The Engine ECU, Steering ECU, Wheels ECU, Active safety unit, airbags etc. all are using the same CAN-Bus. While the message from the infotainment system may not cause any critical, life-threatening situation, the message from Engine ECU if delayed might end up in crashing of the vehicle which

can have life threatening consequences. So, the need to prioritise messages from critical ECU is achieved using the identifier [4].

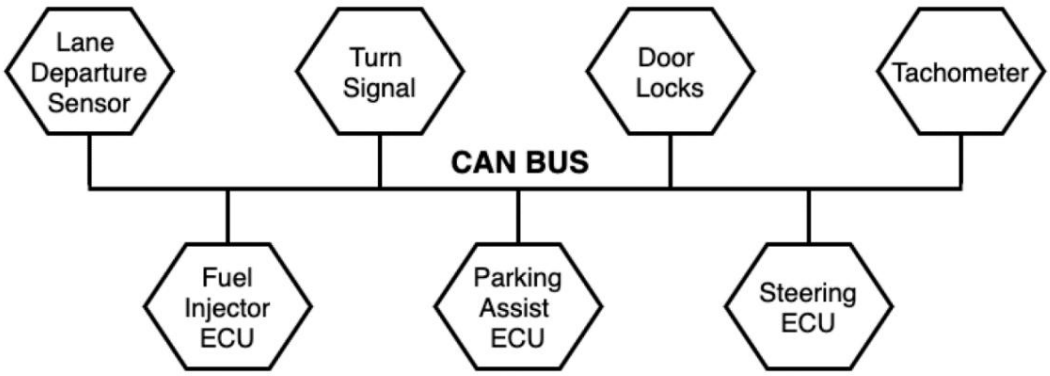

Fig. 1. ECU connection in CAN-Bus [4]

Other primary component of the CAN data frame is Data Length Code (DLC), it tells the length of the data to be transmitted. DLC tells the receiving node how many bytes of the data the node should be expecting to receive. This field consists of 4 bits. Another field is the data to be transmitted. This follows the DLC in the frame and can contain 0 to 8 bytes of information. In Extended frame, the identifier bits increase from 11 bits to 29 bits. Data up to 64 bytes can be transmitted using Extended CAN frame as compared to 64 bits of data in Standard frame. Extended CAN frames or CAN-FD additionally have CRC check field as shown in Fig.2 [2],[3],[5].

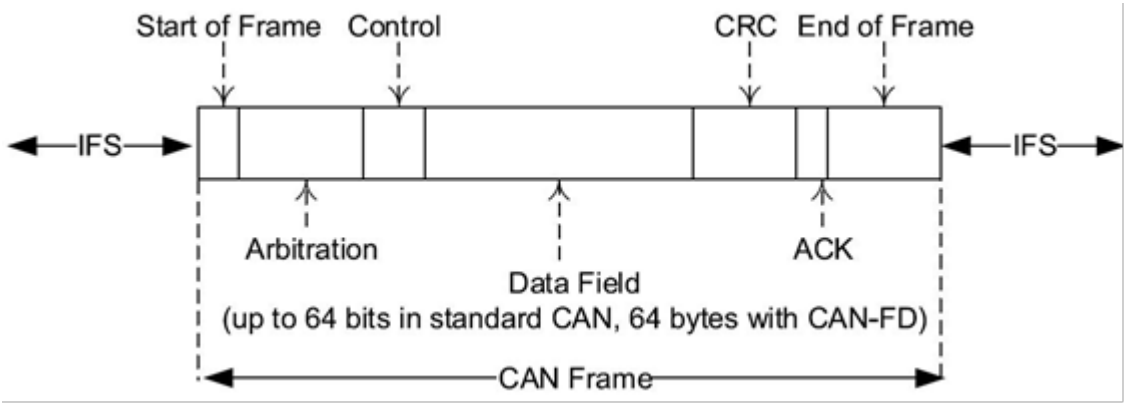

Fig. 2. CAN Frame structure [2]

From the Structure of CAN frame it is visible that the CAN protocol lacks any security mechanism to combat the cyber threats which are getting more and more frequent in the recent times. Though inclusion of Cyclic Redundancy Check (CRC) field in CAN-FD or Extended CAN frames gave CAN some capabilities to detect the change in transmitted bits but it is not sufficient to tackle the advanced security threats that are present in current scenario. In 2015, few researchers demonstrated the attack on the Jeep Cherokee by sending the crafted messages. With these messages they were able to alter the functionality of the critical components like braking system. The steering wheel also turned 180 degrees while passengers were inside the car [6]. The alterations of the safety critical messages like these can result in loss of lives.

The idea of Intrusion Detection System (IDS) is to prevent the intended attacks on the vehicle by monitoring and analysing the real-time data and detecting if any possible threat is present. The algorithms used for detection can be based on signature-based, machine learning based anomaly, specification based etc. Each of these detection approaches have their own set of pros and cons. IDS generally have three layers, first layer is responsible for the reception of the message coming through the communication channel. Second layer is responsible to analyse those messages and to determine if any anomaly is present with the help of comparison with the training data. Third and the last layer is to execute an alert action in case of an anomaly detection. Fig.3 is a graphical representation of the high-level architecture of an IDS.

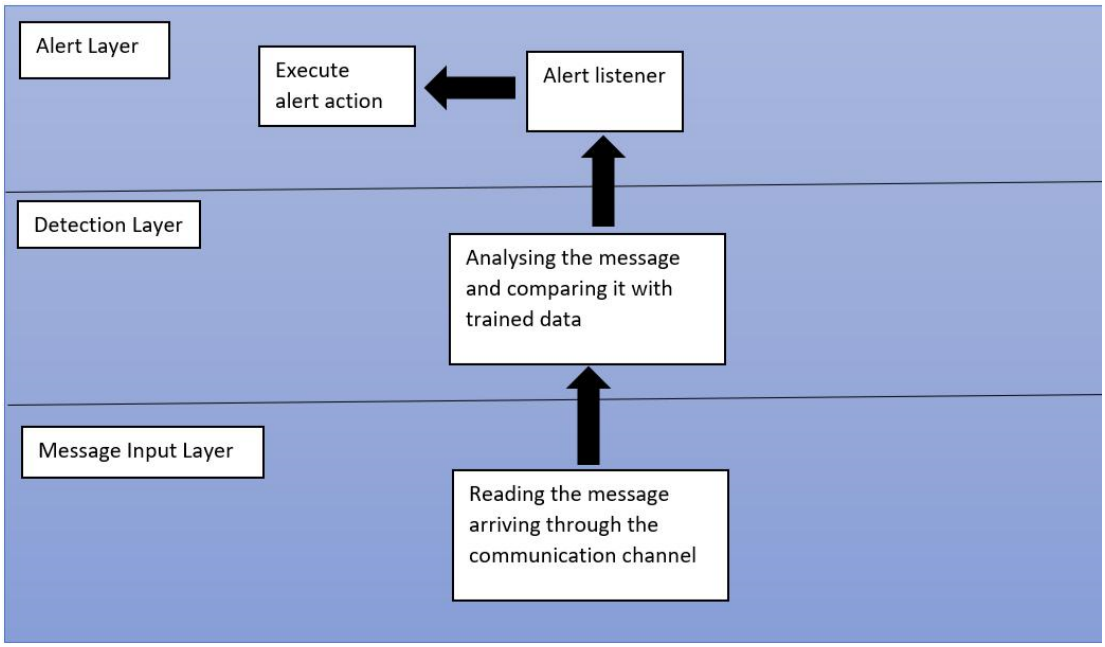

Fig. 3. High-level architecture of an IDS used in CAN

The vehicle security is extremely necessary as when compromised it can result in the loss of life or can make a person severely injured. The following sections will discuss about the common threats and will also discuss the state of art of the intrusion detection system in CAN communication protocol, their categories and the change in the trend of proposed IDSs from signature and specification-based to hybrid and machine learning-based. Concluding the paper with the reason for the shift in trend.

2. Literature Review

For the literature review, search for relevant literature was conducted with search strings such as Security issues in CAN bus, Security in communication in the Controller Area Network, Intrusion Detection System in CAN bus. The databases that were used to conduct the search were Google Scholar and Springer. Many articles were found which dealt with proposed IDSs as security mechanisms for Controller Area Network but while going through the chosen papers there felt a need to go through papers which dealt with specific category of an IDS such as Signature-based, Machine learning-based etc.

In the second iteration, the search focused on the papers that dealt with different categories of intrusion detection system for CAN communication protocol. The search strings used for the second iteration were signature based IDS CAN bus, deep neural network IDS for CAN. After going through them, these articles selected during second iteration were also included to conduct

the literature review. This literature review is organized in the following two sections: *Common Security Threats*, to know how effective proposed Intrusion Detection System is, it is important to know what are the security threats that are most common when it comes to CAN protocol, and *Intrusion Detection System*, in this section we will review the implementation of the proposed IDS, whether it is based on machine learning or on signature or any other method.

2.1 Common Security Threats

In CAN, all the nodes receive the information as it broadcasts the information and the nodes finding the information relevant accepts the data. If anyone gets the access to the CAN bus, they will be able to read all the data on the CAN-Bus thus, resulting into security failure [1]. CAN lacks authentication mechanisms for messages which makes it impossible to know or verify the sender of the message. CAN protocol is unable to distinguish between a legitimate and malicious ECU. Attacker can exploit this to send replay messages or spoof messages [1], [3]. CAN does not provide any encryption of messages since ECU does not have high computational capacity to implement any robust cryptographic algorithm. Hackers can exploit this vulnerability to listen to the traffic in the network [3]. The CAN Bus is vulnerable to a Denial-of-Service attack (DoS), intruder can send multiple messages with high priority which can make the network congested and can delay the transmission of critical messages. In replay attack, the same message is replayed or resent rapidly [1], [3]. A compromised ECU connected to CAN-Bus can impact the critical functionalities of the vehicle. This compromised ECU can shut down an ECU and mimic it by sending forged payload to alter the vehicle functionality [7]. By sniffing the operations in network an intruder can execute a replay attack. In Injection attack, the structure of an ECU is imitated, and the messages are injected randomly into the network to disrupt its normal functioning [8]. In fuzzy attack, an intruder injects the spoof message of different IDs into the network. The nodes or ECUs connected to the network then receive many random messages which may result in the malfunctioning of the vehicle [8]. In this attack, hacker or intruder drops one or more messages which can be observed by the arrival time and the frequency of the message. This attack also involves the change in content of the frame or message [9].

2.2 Intrusion Detection System

TABLE I. Categorical Division of IDS

Authors of the paper	**IDS Category**	**Year**
S. Jin, J.G. Chung, and Y. Xu. [9]	Signature-based	2021
H.M Song, H.R. Kim, and H.K. Kim. [10]	Signature-based	2016
H. Olufowobi, C. Young, J. Zambreno, and G. Bloom. [11]	Specification-based	2019
H. Olufowobi et. al. [8]	Anomaly-based	2019
R.U.D. Refat, A.A. Elkhail, and H. Malik. [13]	Hybrid-based	2022
M. Weber, S. Klug, E. Sax, and B. Zimmer. [12]	Hybrid-based	2019
A. Taylor, N. Japkowicz, and S. Leblanc. [14]	Anomaly-based	2015
M. Müter, and N. Asaj. [15]	Anomaly-based	2011
M. Gmiden, M.H. Gmiden, and H. Trabelsi. [16]	Anomaly-based	2016
M.J. Kang, and J.W. Kang. [17]	Machine learning-based	2016
H.M. Song, J. Woo, and H.K. Kim. [18]	Machine learning-based	2020
O. Avatefipour et. al. [19]	Machine learning-based	2019
G. Loukas et. Al. [20]	Machine learning-based	2017
M. Kneib, and C. Huth. [21]	Machine learning-based	2018

Intrusion Detection System can be classified into various categories based on the approach adopted to detect an event of attack. This section is organized into the categories that the IDSs in review belong to. Below Table 1 shows the IDS with corresponding category and year.

The share of papers falling under category of signature, specification, anomaly were grouped together, and the papers falling under hybrid and machine learning category were considered as one group.

2.2.1 Signature-based IDS

Song, Kim, and Kim came up with an IDS which can detect both known attacks signature as well as anomalous attacks. When a new message arrives, proposed IDS checks the CAN ID and computes the time interval. If time interval is shorter than the usual, the IDS identifies it as an injected message. In this IDS, the message is considered as injected if the time interval is below half of that during normal. In particular, if the consecutive latest message have time interval less than 0.2 ms then DoS attack is increased by 1. IDS identifies the event as DoS attack if the threshold. On an average, maximum time interval is 0.5 ms and minimum time interval is 0.14 ms. Some normal messages can also arrive before 0.2ms. Therefore, threshold is decided to declare an event as DoS attack to reduce false positive ratio [10].

Jin, Chung, and Xu proposed IDS was based on five selected signatures- ID, time interval, correlation, context changing amplitude and value range. Detection in case of signature ID, white list was used. For context changing amplitude and value range the data was collected from the real scenarios and a threshold was decided based on the real scenarios. For correlation between the different signal's calculation was done using Pearson coefficient. For detecting traffic related anomaly signature time interval was used as most of the times the arrival of message is based on the transmission period of the message and the worst-case response time. Time interval signature can be used to detect the injection attack or drop attack [9].

2.2.2 Specification-based IDS

Specification based detection based on the specification which tells the behaviour of the system [11],[12]. SAIDuCANT is a supervised learning approach where the IDS is trained to distinguish between normal and anomalous behaviour. In training phase, the IDS collects the CAN traces and extracts the real-time parameters as specification. In detection phase, it checks the behaviour of each message whether they are compliant to the specification extracted during training phase or not. A message is identified as anomaly or injected if its completion time violates the acceptable interval as defined by the specification. The history of each message's priority, transmission time, data payload and interference and blocking of the message that can cause delay between the release and the transmission of the message. This solution was proposed to combat masquerade, replay or injection attacks [11].

2.2.3 Hybrid-based IDS

Hybrid based IDS are combination of various IDS techniques [12]. Refat, Elkhail, and Malik suggested an IDS within an embedded software in ECU which is a hybrid of specification-based anomaly detection together in sequence with machine learning algorithm. This IDS architecture has few stages. Initially specification-based checks are performed as first stage with a restriction that the checks shall completely be extracted from the communication matrix of a standard format. This is known as static checks. Second stage involves machine learning checks. The static check forwards selected data such as signal value to the learning checks, which is the second stage. Then

the feature extraction blocks does processing and create a feature which acts as an input to the machine learning algorithms [13].

Lokman, Othman, and Abu-Bakar proposed an IDS which can determine the message injection event by detecting in anomaly in a block of CAN message taken as input. This IDS first form classifiers known as weak classifiers by dividing attack free CAN bus messages into k-graphs. Afterwards, each of the weak classifiers takes the unknown CAN bus message or test graph by comparing it with the attack free graph. If it matches with the benign or attack free graph it is considered as normal message. Final decision on whether a message is normal, or anomaly is decided based on voting from k weak classifiers. If more than 50% weak classifiers detects message to be normal, then the system considers the message to be normal [6].

2.2.4 Anomaly-based IDS

Anomaly based systems observes the real time data and checks it with the normal scenario, in case of deviation crossing a threshold mark the alarm is raised [12]. Anomaly-based IDS which was proposed by Olufowobi et. al, used rate at which an instance of message is released or transmitted as feature to detect an injection attack. Normally, each message on the bus has regular frequency but when an attack takes place then this rate becomes more than double of the average rate. In case of abnormal event, the algorithm detects the shift in the mean and terminates, followed by signalling the alarm. This IDS uses CUSUM algorithm for detecting irregular pattern which can result in change in observation [8].

Taylor, Japkowicz, and Leblanc's anomaly-based IDS calculated the statistics of the ongoing traffic in network and compared it to the previously observed and stored data [14]. Müter, and Asaj proposed an entropy-based anomaly detection system. Entropy is a measure of a coincidence in a given dataset [15]. More the coincidence, more is the entropy. When CAN bus is under attack the entropy will increase which normally is lower. This deviation in entropy can tell if the vehicle is under attack or not. Gmiden, Gmiden, and Trabelsi also used the time interval to detect anomaly between an authorised ECU and compromised ECU [16].

Lokman, Othman, and Abu-Bakar proposed an IDS which can determine the message injection event by detecting in anomaly in a block of CAN message taken as input. This IDS first form classifiers known as weak classifiers by dividing attack free CAN bus messages into k-graphs. Afterwards, each of the weak classifiers takes the unknown CAN bus message or test graph by comparing it with the attack free graph. If it matches with the benign or attack free graph it is considered as normal message. Final decision on whether a message is normal, or anomaly is decided based on voting from k weak classifiers. If more than 50% weak classifiers detects message to be normal, then the system considers the message to be normal [6].

2.2.4 Machine Learning-based IDS

Kang and Kang suggested a machine learning based IDS which could detect the malicious data packets injected in the system. It consisted of two parts similar to all machine learning based IDS: training and detection. Training is time consuming hence, it is performed offline. Processing of CAN packets happens during training to extract features. CAN packets have a binary label, normal packet, or an attack packet. DNN structure is used to train the features. Same features are extracted in the real time scenario for a CAN packet and DNN structure based on training determines whether packet is normal or is an attack packet [17].

Song, Woo, and Kim used Deep Convolutional Neural Network for intrusion detection. The DCNN learns the network traffic instead of using hand designed features. This method gave very

less false negatives as compared to previously proposed IDS based on convolutional neural network [18].

Avatefipour et al. came up with an intrusion detection system based on the CAN bus traffic. After analysing several traces, they found that every message ID is followed by some reoccurring message ID subset. During training phase CAN bus traffic is logged from a normal vehicle in order to generate all possible transitions between consecutive IDs. Model obtained after training phase is then used to detect anomalous behaviour in the CAN traffic. This IDS used Support Vector Machine training algorithm to train the data [19].

Loukas et al. used RNN based deep learning architecture enhanced by LSTM. They used the data collected while launching an attack against the vehicle and appending the label with the series of features. This data obtained from pre-processing phase was then split into training and validation set. RNN algorithm is used to create detection model by feeding training dataset to it and then the detection model is validated with the help of validation set. After learning phase, final classifier is used for real-time testing [20].

Kneib and Huth proposed an IDS using fingerprints of an ECU. For such system, first a way to determine the source of the receiving frame was designed. For ECU fingerprinting, first the analog signal of the received frame is recorded and after pre-processing, best features are extracted. Finding the origin of a message is a classification problem, thus authors decided to go with logistic regression classification algorithm. For detection of intrusion, the trained classifier from the previous step estimates the probability of each ECU when a message is received. The ECU with highest probability is considered to be as the source but if that ECU cannot send the frame with the given ID, then an attack is detected [21].

3. Conclusion

In the previous section, we saw various categories of Intrusion Detection System, this section will discuss the pros and cons of these different IDSs.

The trends in the IDS show that in the past there was an inclination towards lightweight IDS. Signature, specification, and anomaly-based IDS are usually lightweight IDS as they do not require high computation power or time. Signature-based IDS have edge over cloud-based solution as communication between cloud and vehicles should be reliable and secure. In places like tunnels, there is a chance that the connection between cloud and vehicle can be disrupted. But Signature- based IDS can only detect the unknown attacks and not the new unknown ones which even tough is cost efficient but can still cause security breach [6],[9],[10].

In the recent years, the inclination has shifted towards hybrid and machine learning based IDS. All the other methods adopted supervised or semi-supervised learning and used labeled data while training. In real world scenarios if data other than the ones used while trainings were encountered, the system cannot detect that event of attack. In the past, the requirement for high computation power and the high cost of resources made researchers chose lightweight IDSs over these powerful machine learning-based IDS [6], [17]-[21]. [21]'s solution had an edge over other deep learning systems as it addresses the issue of detection latency causing by high processing needs using cloud-based computational offloading.

Hybrid systems mostly are using a lightweight approach for the starting checks and for creating input for the second system which in many cases is a machine learning model. It is proving to be an improvement over the simple lightweight IDS [6],[12]-[13]. Fig.4 shows the graphical representation of the main differences between these categories of IDSs in discussion.

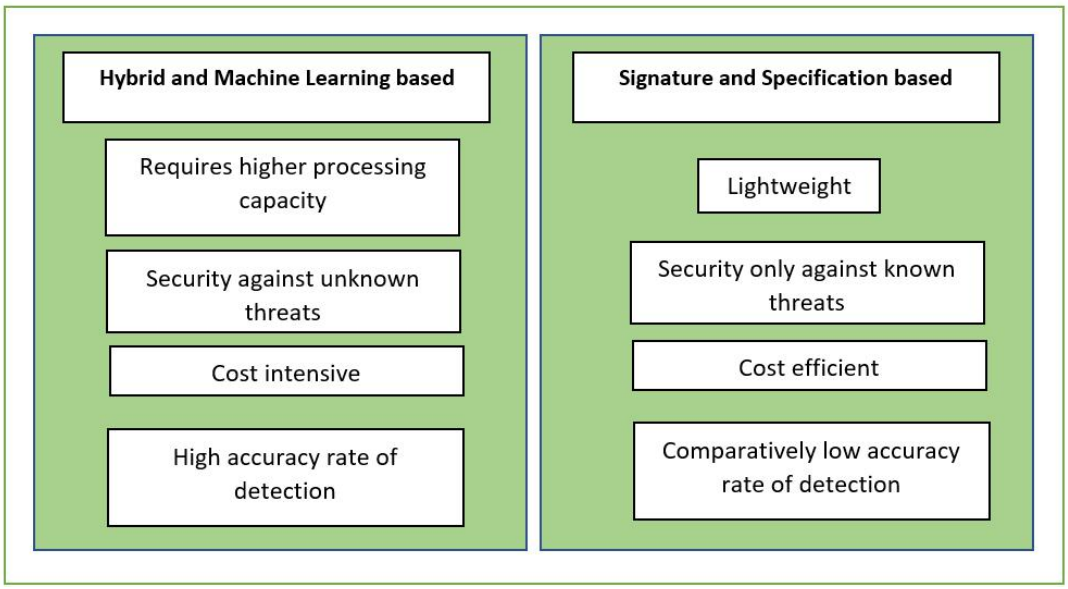

Fig. 4. Differences between the different IDS categories

From the Table I, before 2017 the IDSs which did not require complex calculations were being preferred. The trend observed in past five years, researchers are coming up with more Hybrid and Machine learning oriented IDS because of their capability to even combat the unknown intrusion attempts for quite an extent.

CAN is being prominently used in vehicles because of its ability to have fast and efficient transmission of data. When CAN was developed, the cyber threats were very limited and thus, was not much of a concern. Now, after nearly four decades of its existence with technical advancements, the security concerns have increased rapidly. The surge in the cases of security breach in the online world has make it a necessity to have strong security mechanisms, especially for vehicles as a little compromise in security can have fatal consequences. Over last few decades various techniques to detect an event of intrusion have been developed but the changing trend in last few years indicate that the maximum level of security has become the priority during these developments. The IDS which can protect the vehicle against many known as well as unknown threats are being developed by the researchers. Future research can address the need of the system which can protect the system as well as have very less impact on the speed of transmission data. The most efficient solution in this field would be an IDS which can be implemented in mid and low-end vehicles along with the high-end vehicles.

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CONTENT MANAGEMENT SYSTEM FOR REMOTE LABORATORY DEVELOPMENT

Olena Tereshchenko [1], Aleksandr Sokolyanskii [2], Anzhelika Parkhomenko [3]
[1,2,3] Software Tools Department, National University Zaporizhzhia Polytechnic
[1,2,3] Zaporizhzhia, Ukraine
[1] lacrima.mosa.1989@gmail.com, [2]30000-0002-3623-9019, [3]0000-0002-6008-1610

Abstract: *The paper presents the results of reuse methodology study and the creation based on it a content management system to accelerate the process of developing new remote laboratories, which are an effective tool for distance learning.*

Keywords: remote laboratory, reuse methodology, content management system, experiment queue

1. Introduction

Today, there are a significant number of remote laboratories (RL), the use of which has become especially popular in contest of the distance learning during the pandemic. However, the development of new RL remains an urgent task, as new areas of study are constantly emerging. Creating RL from scratch is a very complex and careful process that requires large financial and time costs. Unfortunately, there are no uniform standards and approaches in the field of RL development, and different developers implement their own decisions on the organization of user interaction with a set of experiments. At the same time, there are several examples of the application of reuse methodology and ready-made components that can increase the efficiency of the RL development process. In particular, the developers of iLab Shared Architecture, WebLab-Deusto, Labshare Sahara offer their experience in this area [1] - [3]. Solutions that are suitable for reuse, allow to replicate and implement individual parts of the system without spending time on their development [4]. The main concept of modular RL is the transformation of laboratories into modular components in order to facilitate maintenance, reuse and interchangeability of software components [5]. The goal of this work is research and development of online Content Management System (CMS) OpenLab, which will help to effectively create new RL based on ready-made modules.

2. Concept of CMS OpenLab

Based on the analysis of the RL RELDES architecture [6], several basic modules were identified, which will form the basis of the CMS: broadcast / stream of video - saving streams from video cameras connected to the RL in different ways (physical connection or through a network); queue management system - creating new queues and managing existing ones; experiment content management and experiment execution (Fig. 1).

With the developed CMS, the developer / administrator of the RL will be able to perform actions on the following objects: Users, Cameras, Queues, Information, Experiments. It will allow to easily create a page with a new experiment, describe and provide all the necessary information about it, add the ability to broadcast a video of the experiment on the page and activate the queue to perform it. The Use case diagram is presented in Fig. 2.

The process of creating an experiment web page will be to fill in the following forms: Name, Description, Queue Use, Video stream Use, Experiment Template.

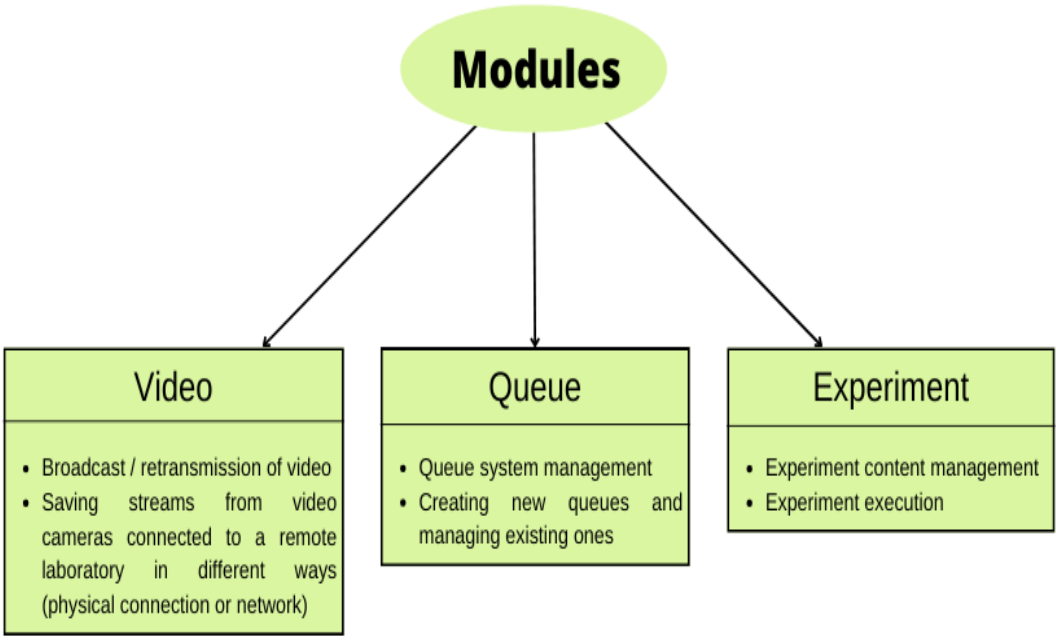

Fig. 1 Modules and their functionality

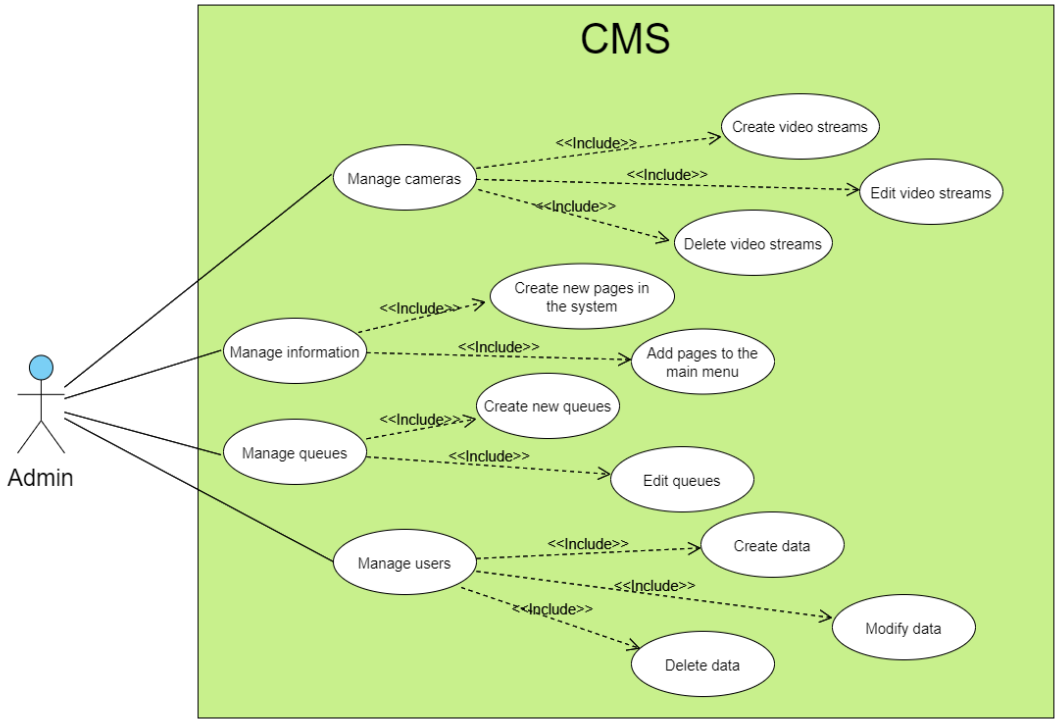

Fig. 2 Use case diagram for CMS

On the Users page, the administrator will be able to manage information about RL users, namely to create / modify / delete data about them.

On the Cameras page, the administrator will be able to create / edit / delete new video streams that will be available for use on pages with experiment.

On the Information page, the administrator will be able to create new pages in the system and add them to the main menu, which will be available for viewing by the average user.

The Queues page will allow to edit or create new queues, which can also be used to create a new experiment.

For the correct organization of access to the laboratory equipment, it is necessary to provide multiple access, therefore, a queue system must be implemented on the server side, which allows the user to gain access to equipment. Studies have shown that there are two types of queuing: pre-booked and online. The developed module allows to add a user to the experiment queue, to monitor its status and to remove the user from the queue after the experiment is completed. The developed module allows users to rationally use the allotted time for performing experiments, and can also be used by developers when adding a new experiment.

The structure of the experiment page template is presented in Fig. 3. The system administrator gets the opportunity to fill experiments without the need to write code, so it speeds up the process of creating or maintaining a laboratory.

Adding experiment components to the experiment creation/editing page allows to use data from other systems, such as openHAB. For example, if there is a connected and already configured sensor in the openHAB system, it is possible to use its value using the API. This example will allow to display data from other systems without adding logic to the system being created, using only the existing component: <ol-reader name = "component_name" />.

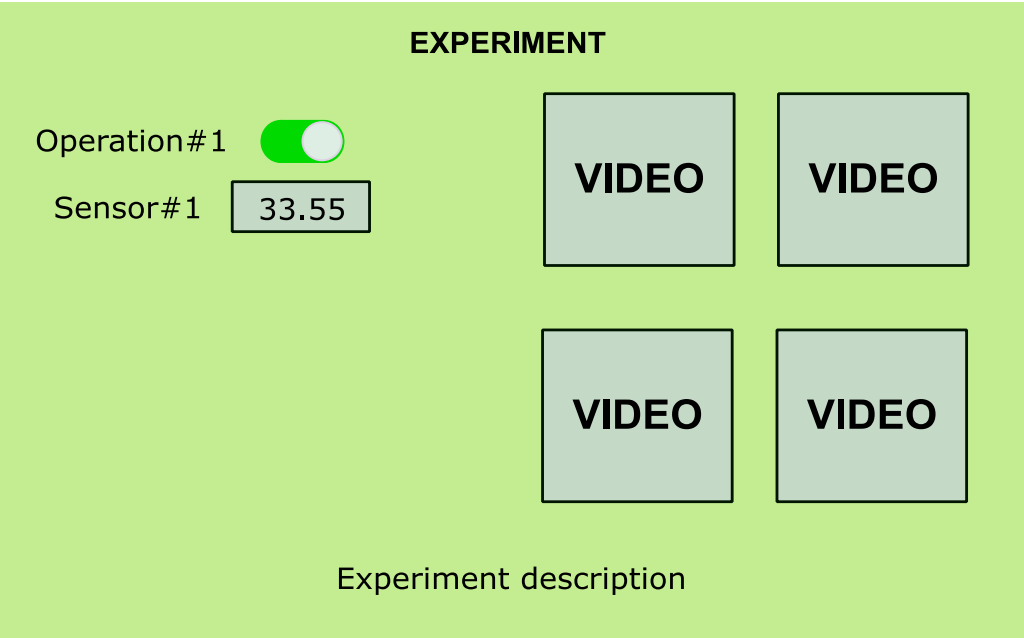

Fig. 3 Experiment page template structure

3. Conclusion

Reusable solutions have recently become increasingly popular in various fields. This methodology has many advantages, the most important of which are saving time and money.

The application of the developed CMS will accelerate the creation of new and provide support for existing RL and can be the basis for further development of a unified method of RL

development to improve the quality of such projects and reduce the time and cost of their development.

At the moment, the actual task is to develop a system interface, the main requirements for which are convenience and understandability. In the future, it is necessary to expand the functionality of CMS by adding new functions to the selected modules.

4. Acknowledgement

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COGNITIVE READINESS COMPETENCE: ENHANCING VALUE CHAIN CAPABILITIES

Chinwi Mgbere [1], Rebecca Winston [2], Ivano Di Filippo [3]

[1] Office of the vice president for Medicine., AOE Nazarbayev University
[2] Winston Strategic Management Consulting, [3] Italian Institute of Project Management (ISIPM)
[1] Nur-Sultan, Kazakhstan, [2] Idaho, United States, [3] Roma, Italy
[1] chinwi.mgbere@nu.edu.kz, [2] rebeccawinston@yahoo.com, [3] ivano.difilippo@genialsoftware.it

Abstract: *Cognitive readiness posits optimal behaviour performance as a critical factor in the ability of project managers and team members to process project information or cues, which could be activating event, project or program situational information or interaction, in a complex, unpredictable environment and enhance decision-making ability throughout the project life cycle. Furthermore, through mindfulness, the project manager and team members would need to train a complement of intelligence: analytical, creative and practical, to interpret cues and make the right choice required in a project environment rich in change. This paper suggests tools to shift behavior change around leadership behaviors and practice in projects and demonstrates a practical example of its beneficial effects in the Nazarbayev University case study.*

Keywords: cognitive readiness, competence, mindfulness, decision-making, project teams, value chain

1. Introduction

This study is introductory and in further contribution to an earlier paper – CoRDiT model [1], in a series, aimed to recognize how the cognitive value chain acts as a driver of successful project outcome; to develop truly resilient and responsive value chain capabilities, underpinned by cognitive, data-led decision-making that senses and reacts to risk and disruption before it impacts the planned value of the project. Delays at any decision point, such as proceed, cancel, revise scope/cost/schedule/quality, design/construct/ commission, install and test, throughout the phases of the project life cycle have ripple effects throughout the value chain, resulting in cost overruns, missed opportunities and diminished value of the project for stakeholders [2].

The goal of this paper is to demonstrate practical examples in the field of how the project team acts in cognitive readiness mode to achieve high performance; through mindfulness developed mental "flow". Mind flow - a state where the performer losses control of time or the "zone". The term "flow" is the ability to enter an optimal mental state, in which expanded competencies can be expressed in their entirety through maximum performance [3].

The beliefs and convictions held by senior executives on this topic represent a bias toward mindfulness and perhaps training of these soft skills can demonstrate the lack of a broader understanding; secondly, the assumption that academics very rarely have the experience and tools to shift executive behavior change around leadership behavior and personal practice [3]. Within the framework of this study, cognitive readiness competence behavior that enhances value chain capabilities is addressed as will be further explained.

2. Cognitive Readiness Competence Framework

2.1 Tangible Value to the Cognitive Calue Chain

Cognitive readiness of the project management team can help break through challenges to radically improve and power the cognitive value chain by continually analyzing situational data/information, determining optimal outcomes, and *automatically executing rapid and accurate responses/behaviors* and *decisions* (adapted:[4]).

Another tangible value to the cognitive value chain can be to take away all the "weak links of a chain", renew them with a new vital energy of intrinsic motivation like new positive stimuli; diffuse this to countless decision makers (responsible for one phase, or one aspect of one phase, or the entire project) by the use of cognitive positive attractors. The cognitive project manager's

direct behavior produces an optimal flow state in the team. He precisely has to act, to show the desired behavior because team members will just mirror this behavior from him (adapted: [2]). It can be suggested that this, in return, could enhance the ability of decision-makers; how they handle biases rooted in the mind when confronted with real-time proliferation of data and information.

[7] argue that cognitive biases could have efficient practical implications for areas including clinical judgment, entrepreneurship, finance, and management [8]. These ideas could be explored through numerous real-life case studies such as the Nazarbayev University (NU) project [9].

2.2 REBT Framework

Insights for the cognitive readiness competence framework come from the work [3] and the Rational Emotive Behavioral Therapy (REBT) framework [10]. The REBT framework states that humans have both innate rational (meaning self-help, social help, and constructiveness) and irrational (meaning self-destructive, socially disadvantageous, and useless) tendencies and inclinations.

As shown in the A-B-C-D-E-F model of psychological impairment and change (REBT method) (Fig.1), people construct emotional difficulties, such as self-blame, self-pity, clinical anger, resentment, guilt, shame, depression, and anxiety, to a large extent consciously and unconsciously. As well as behavioral tendencies such as procrastination, compulsiveness, avoidance, addiction, and withdrawal through their irrational and self-destructive thinking, emotions, and behaviors

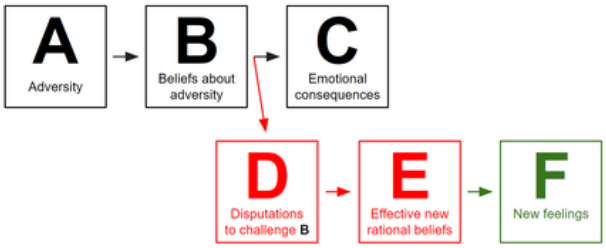

Fig.1. A-B-C-D-E-F model of psychological disturbance and change (REBT Method – Albert Ellis) [10]

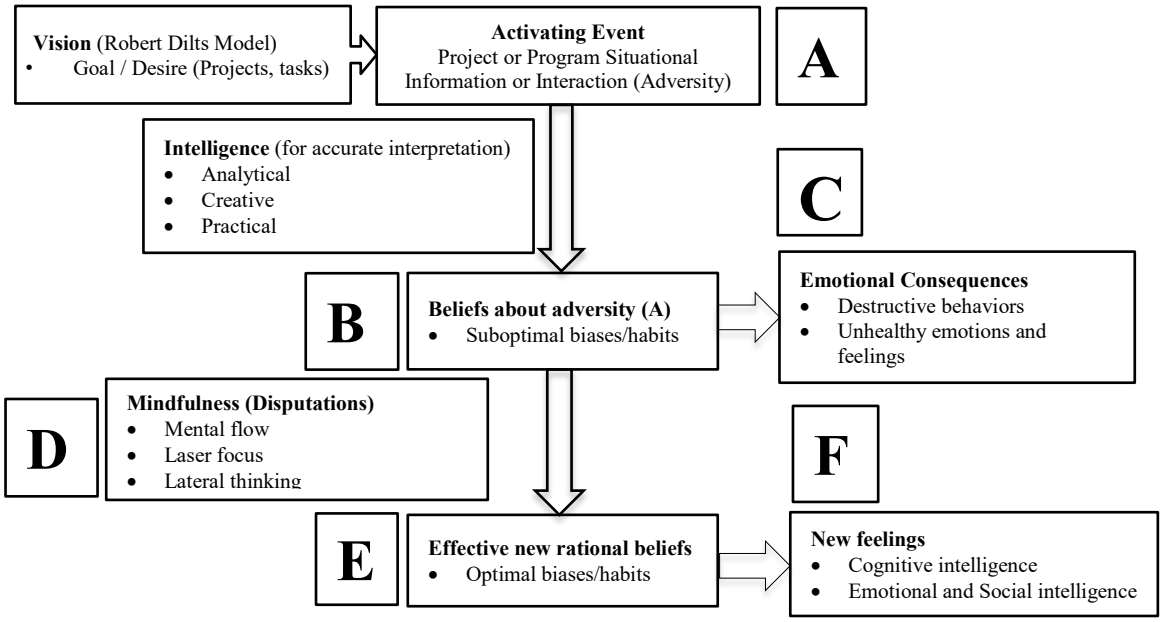

Fig.2. Adapted: REBT framework

2.3 Robert Dilts Model

Fig.3.Robert Dilts model

There are six levels (See Robert Dilts model, Fig.3):

- At the top, we have a **vision** which is a goal/ desire that team members want to see in reality. For example, the project manager or team member achieving a certain level of proficiency in skill translated over to results, acquiring certain intellectual goals like knowledge. Having certain experiences and ability; acquiring certain competence as a result of combining the knowledge, skill and ability.
- Two, **identity,** which is the self-image team members look to be, to bring forth a vision or set goals. Good questions to ask are: where am I? who am I with? what am I doing? what do I love to do? what am I inherently good at? what are things I am not good at but have to do? Aligning project goals and personal development goals of the project manager and team members may provide answers to these questions.
- Three, **values** and **beliefs** that give the team member clues as to what his/her **identity** is (what he/she believes in and understands himself/herself). These are some core beliefs that the team member wants to identify with; that are some suggestions upon reflection on his/her identity. The person that is at the vision or identified goals. Through the perspective of understanding, the project manager or team member can then change whatever belief that seems to be misaligned over to the vision and identity via the mindfulness (subconscious mind) work or self-talk or working with a mentor and change that identity (programming) around if needed. See REBT framework, Fig 2 (B)
- Four, **capabilities,** which are skills required to achieve certain goals. The project team may want to develop certain skills. For example, to develop innovative leadership competence skills, and productivity skills.
- Five, **behaviors,** the things that project team members want to do; that are ideal **behaviors**. Behaviors provide important **insights**. When team members set a goal or a vision and commit to it, they can see consistency or lack of consistency via behaviors, congruence or lack of congruence. Thus, behavior provides valuable insightful data for optimization.
- Six, **environments** team members want to be in ideal environments that encourage their vision. Better understand what the environments are revealing about team members in relation to behaviors, values and beliefs, and identity. For example, focusing on a task at a time till completion and doing it from a place of mental flow; maintaining a higher degree of focus and possessing a greater sense of mindfulness, which could provide valuable insightful data for optimization. Relevant questions include: what kind of **information** are we consuming? what is **stimulating and interesting** to us? what do we desire? what is interesting for us?

Applying the Robert Dilts model and REBT framework for developing cognitive readiness competence through mindfulness could lead to enhanced value chain capability of team members. Disputation (D) of existing belief system (with suboptimal habits) allows careful, open attitude, with divergent, convergent and lateral thinking. The effect is new feelings – see Fig 2 (F) with enhanced cognitive, emotional and social intelligence. This in turn would enable a more accurate interpretation of the activating event (A) through enhanced analytical, creative and practical intelligence.

Experiential and analytical understanding is required to fully engage multiple intelligences to perform optimally. It is the overall resulting set of intelligence that translates into the ability to act to solve problems or successfully accomplish project goals. [3] – [5].

2.4 Mindfulness

Mindfulness is the foundation for creating emotional and social intelligence and stimulating cognitive intelligence. [3], [6]

- Awareness of the team is aimed at **empowering** the team to be active and attentive in the present while performing an activity or a task at hand; seeing it to completion to reveal certain aspect of the existing belief system that could require reconsideration.
- Over time, this daily practice becomes a learning that tends to improve automatically in a progressive manner and eventually require less effort (become **automatic or autotelic**). [6]
- This could allow the project team to cultivate a higher quality of the mind (team mind flow working together as a whole); get into the flow and maintain the flow during the work or interactions (experience a greater attentiveness to the present and the present activities and other stakeholders involved in the activities) to better interpret suggested cues (adversity) from the activating event, situational information/interaction (see REBT framework, Fig 2) and effortlessly (automatically) make optimal choices.

For example, mitigate the effects of frequently occurring unpredictable and unexpected events like “scope creep” and change request - evolving customer needs that result in continuous change requests that impact the achievement of the objectives of the project and program components. In collaboration with stakeholders, the project manager should question the value added by such a proposed change.

3. Conclusion

The insight explained in this study is based on the practical implementation by the project manager and team members of the Nazarbayev University (NU) project. The NU project illustrates real value and benefit this proposition could deliver, such as achieving one of the strategic goals of Nazarbayev University - to build a leading Research University; *to give Kazakhstan and the world top-level scientists, academics, leaders and entrepreneurs. NU aims to be a model for higher education reform and modern research in Kazakhstan and establish Nur-Sultan as an international research and innovation center. The goal of the Republic of Kazakhstan is "train specialists to fill the needs of the country in transforming the economy to market economy and to build international relations"* (Presidential Decree,1993). An example is the Nazarbayev University Medical School (NUSOM), embedded within several hospitals, is a model for training medical practitioners; it won the IPMA project excellence award in the Big-size project category in 2017 [11].

In conclusion, elements of cognitive readiness competence demonstrated on the NU project enabled the achievement of a higher-level of awareness that influenced the behavior and attitude of the project delivery team. These ideas should be explored through numerous real-life case studies such as the Nazarbayev University project.

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RESEARCH OF THE ROBOTIC PLATFORM IROBOT CREATE 2

Daryna Moshynets[1], Mariia Tiahunova[2], Halyna Kyrychek[3]
[1,2,3]Computer systems and networks department, National University Zaporizhzhia Polytechnic
[1,2,3]Zaporizhzhia, Ukraine
[1]reif785@gmail.com (0000-0002-7743-3985), [2]mary.tyagunova@gmail.com (0000-0002-9166-5897),
[3]kirgal08@gmail.com (0000-0002-0405-7122)

Abstract: *The article explores the capabilities of the robotic platform iRobot Create 2 by developing a mobile application to interact with this platform and using a mini-computer Raspberry Pi.*

Keywords: robot vacuum cleaner, iRobot Create 2, Raspberry PI, mobile application

1. Introduction

Now, robotics is rapidly being introduced into people's daily lives. The number and popularity of home helper robots is growing rapidly, due to the increase in the functions provided by the robots. Most robotic home helpers are entertaining, while another group of robots is designed to free person from doing household chores. Much attention is paid to the creation of mobile robots that are used at home or in situations where human presence is dangerous and optional.

2. Research of the Robotic Platform

The robotic platform should be able to control the functions of the robot vacuum cleaner through an application in the smartphone, which is always nearby and allows you to access the software product from anywhere. Functionally, the home helper consists of several devices, the functional diagram is shown in (Fig 1).

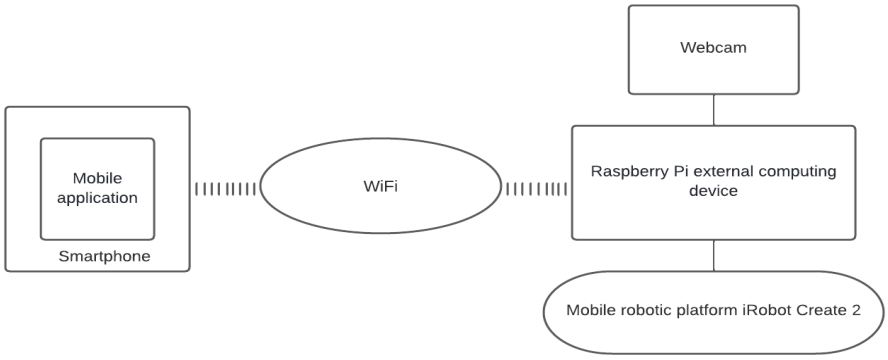

Fig. 1. Functional diagram

Mobile robotic platform iRobot Create 2 is equipped with a built-in computer "command module" that is used to execute the programmed control commands. The platform provides an opportunity to reprogram the principles of control and behavior of the mobile robot, what is indispensable for the developer. The robot can be operated by an external computer, which overcomes the problems associated with limited computing power and limited storage of the "command module".

The home assistant based on the mobile robotic platform iRobot Create 2 [1] is a device for cleaning the floor in the house, equipped with a camera that allows you to implement functionality based on intellectual activity using artificial intelligence [2]. The camera allows to

capture real-time images by capturing objects encountered in the path of the vacuum cleaner. The robot itself carries out the process of movement through the control of motion sensors. Access to robot functions is provided through a software interface for controlling, monitoring the behavior of the device and an its open interface. Open interface iRobot Create 2 (OI) [3] allows you to manipulate the behavior of iRobot Create and read its sensors with a number of different commands.

The robotic platform will be controlled by transferring the control command from the mini-computer to the robot vacuum cleaner via the software interface [4]. The control command is selected by the user in the mobile application, the smartphone transmits the selected command via Wi-Fi to Raspbery Pi. Raspberry Pi sends commands to the serial port of the robot vacuum cleaner. Taking them the robot executes the appropriate commands. For easy control of the robot, the user is provided with real-time broadcast from the webcam, it will understand what the robot sees and control it when it is not in sight. Upon receiving a request to return the system from the user, the external computing device generates return data stored in its internal memory and responds to the client's request by first converting it to a format supported for large data transmission over Wi-Fi.

The mobile application should also provide interfaces for interaction with security and object recognition systems. Video transmitter transmits the image to a Raspberry Pi mini-computer, which uses an YOLO object recognition model to process images and recognize a human image on it. If there is no human silhouette in the image, the next card from the webcam is sent to the neural network for processing. If according to the results of recognition the neural network identifies the presence of a person in the image, the silhouette of the person is highlighted, the image is recorded in a database with the time when the photo was taken. Then the next frame is transmitted to the neural network. The algorithm is executed until it is stopped by the user.

3. Conclusion

Robots allows you to automate and increase productivity by performing monotonous, harmful and dangerous to human health work. They are adapted to recognize objects, repeat simple human movements, coordinate with other robots and other. The iRobot Create platform is designed for robot developers, allows you to program the behavior of the robot without worrying about its mechanical characteristics, and it can be reprogrammed for any necessary equipment, which covers a wide range to study robotics.

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CONCEPTUAL MODEL OF FORMING THE VISUAL INFORMATION STRUCTURES OF AUGMENTED REALITY

Ivan Kit [1], Khrystyna Lipianina-Honcharenko [1], Jurgen Sieck [2], Anatoliy Sachenko [1]

[1]West Ukrainian National University

[2] University of Applied Sciences for Technology and Economics

[1]Ternopil, Ukraine, [2]Berlin, Germany

[1] 0000-0002-4526-0020, [2] 0000-0002-2441-6292, [3]juergen.sieck@htw-berlin.de,

[4] 0000-0002-0907-3682

Abstract: *Augmented reality is becoming more widespread every year. The use of augmented reality does not stop at any one sector of people's lives but is smoothly used in almost all aspects of life from gaming to medical areas. This article is about building a conceptual model for the formation of visual information structures of augmented reality. In addition, in the article is set out the views of further research in the field of computer vision and augmented reality.*

1. Introduction

Augmented reality is a way to combine the real world with the digital, namely, the addition of the real world with digital information (objects, elements). The first use of augmented reality in the future AR took place by the US Army, and now AR is used by almost every person from simple ARmasks on Instagram, Snapchat to huge art installations, and simple non-secret games in AR to huge pokemonGo projects that have shaken up the mobile gaming industry.

If we consider AR technology in the real life of people, then it should be as convenient as possible. Such circumstance stipulates the development of a conceptual model for forming the visual information structures of augmented reality, and the further design of the correspondent intelligent method. Based on last one a mobile application can be developed to search the information about any object based on AR technology.

This work is structured in the following way. Section 2 examines the related works. Section 3 presents the conceptual model for forming the visual information structures of augmented reality. Section 4 summaries obtained results.

2. Related Work

In article [2], the process of marker identification is formed as a problem of classification, which was achieved with the help of convolutional neural networks (CNN). The effectiveness of the marker identification process using CNN is verified by comparing its identification accuracy with the reference vector classifier (SVM). CNN token identification shows better accuracy than SVM. The disadvantage of this article is that authors conducted the learning process on the same type of graphic structures.

In article [3], a method of incorporating the machine learning to detect and track the augmented reality marker targets using deep neural networks is described. The deep neural network module YOLOv3 is used as the main object detection model and ARKit as the main software tool for prototyping. The main limitation of this work is the hardware of mobile devices and using the small pool of recognized objects.

In work [4], an interactive textbook with a multimeter using deep learning and augmented reality was developed, and AR textbooks for studying types of equipment are designed.

The work [5] describes the combination of convolutional neural networks with the XGBOOST algorithm in integrated learning to compensate the lack of information about features caused by a traditional neural network.

The above-mentioned works mostly analyze the software component of the tasks and don't disclose the forming procedure of visual information structures.

In this regard, the purpose of this paper is to develop the conceptual model of forming the visual information structures of augmented reality for further research in the field.

3. Proposed Conceptual Model

There are two main types of augmented reality, namely AR based on markers and without marker. In turn, the AR without marker is divided into three types (Fig.1) [1]. A peculiarity is, if the AR, based on markers, is viewed then a trigger or marker to start showing the added object is required. However, if the scanner is turned away from the trigger, the augmented object disappears.

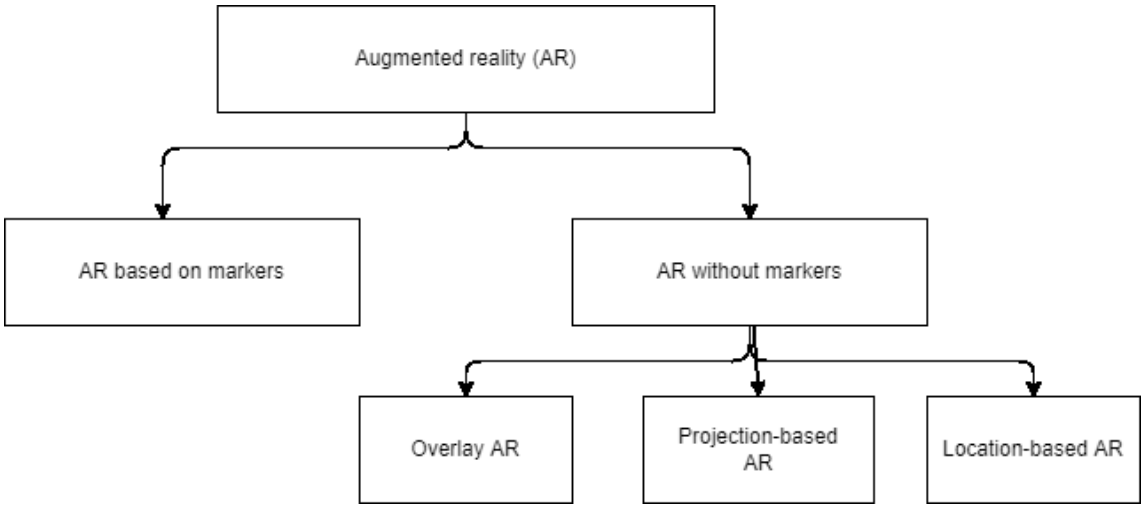

Fig. 1. Types of augmented reality

Based on the above, it is better to use a marker that can be any object with a very well-defined design or structure (texture). Therefore, authors proposed a conceptual model (Fig.2) which allows to form an appropriate marker.

The first stage (Block 1) of the conceptual model is to obtain a stable video data stream from the camera of the device used by the user.

Next, the scene is scanned in order (Block 2). This process is based on the device's understanding of the environment where it is located, namely obtaining the GPS coordinates of the device, the data of the built-in lidar sensor and other peripheral sensors.

Detection of objects (Block 3) and their localization (Block 4) is carried out in the following stages. This allows to know the exact number of objects in the resulting image faster to draw a boundary frame around them. This means that the number of coordinates to be output is not constant. If there are 2 objects in the image, we need 8 coordinates.

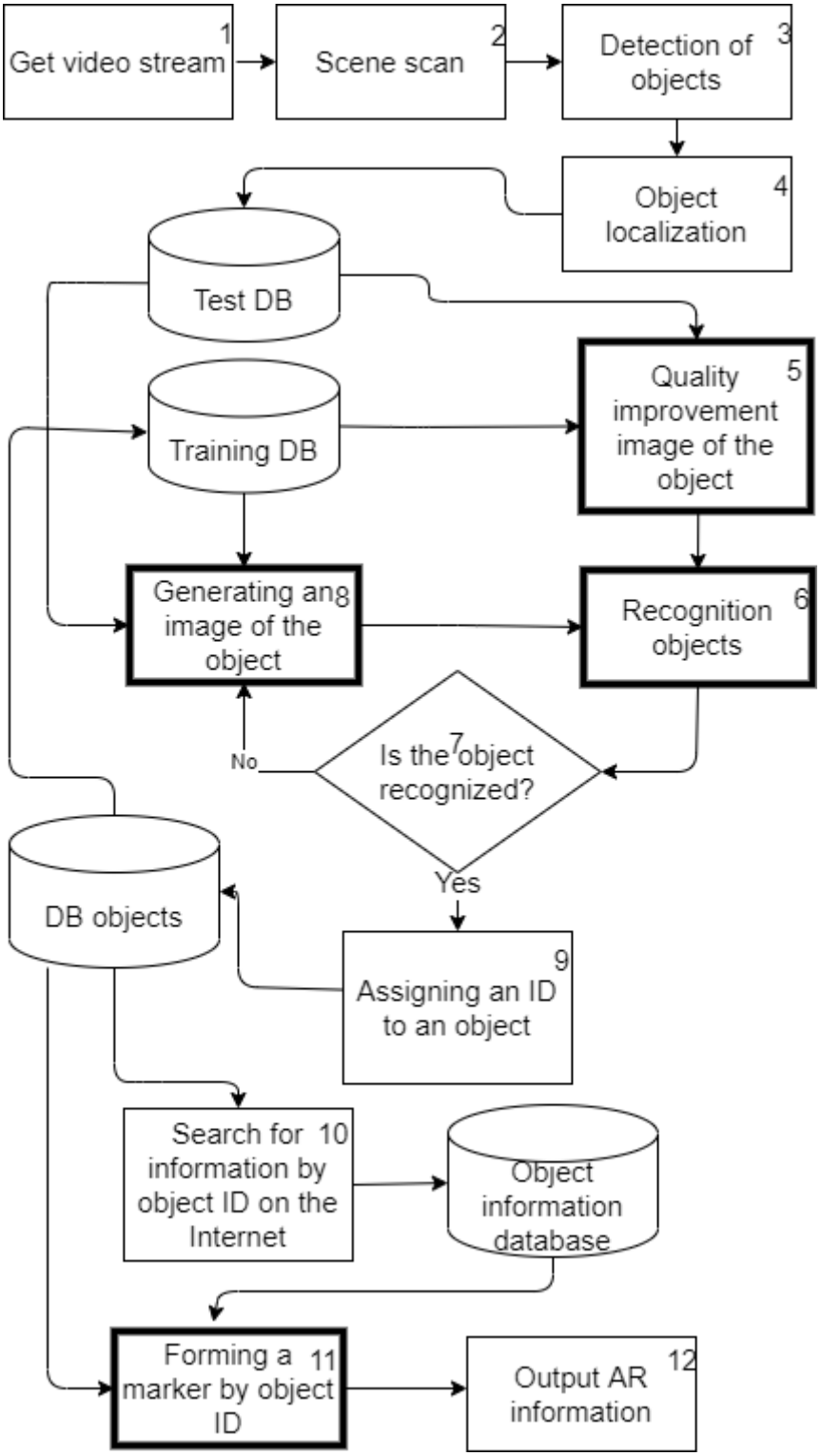

Fig. 2. Conceptual Model of Forming the Visual Information Structures of Augmented Reality

One of the key ideas of traditional computer vision is the proposal of regions. A set of windows is created that probably contain the object using classic CV algorithms, such as shape edge detection, and only these windows are applied to CNN. Each of these segments containing the object is stored in the test database.

The next step (Block 5) is to increase the resolution of the image of the object using intelligent methods [6]. Resolution Enhancement is the process of restoring an image to high resolution (HR) based on a low-resolution image (LR). The image may have a "lower resolution" due to lower spatial resolution (i.e. size) or due to deterioration (e.g. blur), so a link to HR and LR images can be indicated.

After the image resolution is increased, object recognition is performed (Block 6). Object recognition is a computer vision technique used to identify objects in images or videos. Object recognition is a key result of deep learning and machine learning algorithms. When we watch a photo or video, we can easily to spot people, objects, scenes and visual details. The goal is to teach a computer to do what is natural to humans: to gain an understanding of what an image contains. A variety of approaches can be used to recognize objects. Recently, machine learning and deep learning methods have become popular approaches to object recognition. Both techniques learn to identify objects in images, but they differ in their performance.

Next, check whether the object is recognized correctly or not (Block 7). If the object is not recognized due to the fact that the object is not completely in the frame or was partially rotated from the camera, then the image of the object is generated (Block 8), this requires the connection of the training sample. After generation, we return to recognition (Block 6).

Each object is assigned an ID (Block 9) to make it easier to work with them. All objects are written to database objects. Searching for information on the ID of the object on the Internet (Block 10) is needed to find a correct information about these objects.

Before the completion of the model is the formation of a marker type as Vuforia (Block 11). Then it is the construction of AR dependencies (Block 12).

The scope of applying the developed method is wide enough, for example, it should be supermarkets, tourism etc.

4. Conclusions

The authors proposed the conceptual model that can be adapted to different tasks. The paper demonstrates a combination of augmented reality and artificial intelligence. The use of artificial intelligence enables to find markers and recognize objects using the Augmented Reality.

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Contact
europim@fh-dortmund.de

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