Professional and 21st Century Skills for Data Driven Digital Economy

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***Abstract*— Emerging data driven digital economy and Industry 4.0 transforms all sectors including industry, research and business. It requires new types of the general workforce and specialists that can effectively use digital and data technologies, variety of tools and global infrastructure services, and are capable for personal skills management and self-study. The paper provides an overview of the existing frameworks for competences, skills and qualifications that sets up a baseline for further research and definition of the skills for emerging data driven digital economy. The paper analyses the general profile of the modern agile data driven companies, their culture and required competences. The paper shares the experience of introducing professional and 21st Century skills in the bachelor and master courses. The project based learning model is proven to be effective in this cases combining the student initiative and self-organisation given the well defined course objectives and reporting requirements.**

Keywords- 21st Century Skills; Professional Skills: Agile Data Driven Enterprise; Technology Education; Software Engineering; Digital and Data Skills; DevOps; Design Thinking; Data Centric Thinking.

I. INTRODUCTION

The role of STEM skills and STEM education will increase and will drive strong demand in the job market. With the increased diversity of areas, where STEM skills are demanded, we'll see hyper-competitive demand for talents. The effective methods of delivering relevant education and training still to be found and adopted to different forms. The professional training and vocational education organisations will respond first and this will drive response from universities to include elements of 21st century skills into academic curricula, along with professional skills specified for different domains. This can be solved in two complementary ways: introducing courses focused on general professional skills to guide the students acquisition throughout the whole study, and introducing elements of design thinking and research methods in other courses.

An important driver of increasing demand for STEM competences is Industry 4.0 that will facilitate the further development of digital and data driven technologies and consequently the demand for digital and data driven skills, in particular those related Internet of Thing (IoT), Edge and Cloud Computing technologies, Big Data and Artificial Intelligence. Businesses and companies will need to adopt new way of agile and data driven operation. Companies recognize the importance of building new capacities for new emerging economy and the importance of training their employees for new skills and agile data driven culture.

The problem with the deficit of ICT specialists, digital skills and data literacy was addressed in the recent "2022 State of the Union Address by President von der Leyen" while announcing 2023 European Year of Skills [1]. The presentation has mentioned that one third of workers in Europe don\'t have sufficient digital skills, the goal is that 80% or worker have sufficient digital skills , and "there should be 20 million employed ICT specialists in the EU" [1]. The new initiative is based on ongoing initiatives such as European Skills Agenda (since 2020) [2] and Pact for Skills (started in 2021) [3]. Strong demand for ICT specialists in Europe building Digital Economy cannot be satisfied by the European Higher Education system and will require attracting more talents from outside of Europe offering advanced conditions for research and work as it is stressed in the recent EU science ministers conclusions on upgrades to European research infrastructures [4]. However, the solution should be found in addressing the problem wider than just increasing number of students, by rethinking the role of the 21st Century skills together with changing attitude to skills management by organizations and learners or workers themselves, educating and training leaders of the digital and transformation for their active role in organisations.

This paper provides a brief overview of the European landscape of initiatives and developments to address digital and data competences and skills in education and professional training. The paper is based on the long authors experience in developing effective curricula in Cloud Computing, Big Data and Data Science, DevOps and Software Engineering [5, 6, 7, 8]. The paper intends to provide necessary background and reference information for other educators, researcher and managers to develop their own curricula and skills management approach.

The remainder of the paper is organized as follows. Section II provides an overview of the existing frameworks for competences, skills, and qualifications; this also includes short information about the EDISON Data Science Framework that was instrumental in providing analysis in this paper. Section III provides an overview of the modern agile data driven companies, their culture and required competences. Section IV summarises the required skills for data driven digital economy. Section V discusses different roles in modern companies, in particular, how the qualification profile of a generalist can be defined. Section VI describes the authors' experience in implementing professional and 21st Century skills in bachelor and master courses. The paper concludes with a summary and future developments in section VIII.

II. Existing Frameworks for Competences, Skills, Qualifications

A. *European e-Competence Framework, ESCO, and other Standards*

The first and widely accepted definition of IT competences is documented in the European e-Competence Framework (e-CF) that has been developed and maintained by the IT Professionalism Europe (ITPE) network of stakeholders committed to the advancement of IT professionalism [9]. The e-CF provides "a reference of 41 competences as required and applied in an IT professional work context, using a common language for competences, skills, knowledge and proficiency levels" [9]. Since 2019 e-CF is published as the European standard CEN EN 16234-1 [10]. Now it is complemented by the new standard CEN EN 17748-2:2022 Foundational Body of Knowledge for the ICT Profession (ICT BoK) [11].

Both CEN standards include transversal skills that are related to workplace or behavioral skills and include groups of learning and innovation skills and life and career skills that are regarded as important for the current and future workforce. In different frameworks and models, these types of skills are also referred to as 21st Century Skills.

A comprehensive Framework for 21st Century Learning has been developed by the P21 Partnership for 21st Century Learning [12] with input from teachers, education experts, and business leaders. The Framework defines the set of skills that need to be included in the academic curricula or extra curricula that should help the graduates to better adapt in the workplace.

European Skills, Competences, Qualifications and Occupations (ESCO) classification and framework [13] provides a common reference terminology that can be used to bridge the communication gap between the world of work and the world of education and training. ESCO has been developed as an ontology of skills, competences, qualifications, and occupations that can be used for learning outcomes and knowledge topics definition for specific occupations or professions.

An extensive list of standard developing organisations, committees, industry consortia and professional alliances is compiled annually by The Rolling Plan for ICT Standardisation Europe [14], it provides links to activities by ISO, IEEE, ACM, ITU-T and others dealing with competences, skills and education aspects.

B. *The European Qualifications Framework (EQF)*

The European Qualifications Framework (EQF) is a common European reference framework that provides the common definition for qualification levels that can applied to different disciplines [15]. The EQF defines eight reference levels related to learning outcomes that indicate "what individuals know, understand and are able to do at the end of a learning process" [16]. The EQF levels are "defined in terms of: (i) Knowledge: (theoretical and/or factual); (ii) Skills cognitive (involving the use of logical, intuitive and creative thinking) and practical (involving manual dexterity and the use of methods, materials, tools and instruments): (iii) Responsibility and Autonomy (described as the ability of the learner to apply knowledge and skills autonomously and with responsibility)"[16].

EQF provides a basis for mapping between qualification or proficiency levels in a different framework and can be used for defining qualification requirements for different professional roles, career stages and individual professional development. EQF levels 1-3 correspond to starter positions up to a master degree requiring sufficient knowledge in a field of work or study. EQF levels 4-6 correspond to advanced knowledge in one professional domain with the ability to manage complex activities and projects involving people and groups. Higher EQF levels 7 and 8 require wide cross-domain knowledge and the ability to lead and transform work context, develop new ideas and contribute to professional knowledge and research.

In the context of our research to define the professional profile for science and technology leaders able to drive the organisations and economy transformation, the EQF Responsibility and Autonomy dimension is considered the most important and can be linked to the 21st Century Skills and workplace skills.

C. *EDISON Data Science Framework (EDSF)*

The EDISON Data Science Framework (EDSF) [17, 18], that is the product of the EDISON Project and currently maintained by the EDISON Community Initiative, provides a basis for Data Science education and training, curriculum design and competences management. The main EDSF components include:

- CF-DS – Data Science Competence Framework [19]
- DS-BoK – Data Science Body of Knowledge [20]
- MC-DS – Data Science Model Curriculum
- DSPP - Data Science Professional profiles and occupations taxonomy

The EDSF can be customised for specific organisational roles or individual needs. The EDSF methodology can be used for defining competences and skills frameworks for different scientific and technology domains.

CF-DS [19] provides a basis for the whole EDSF and defines the core competence groups that are also used for the DS-BoK definition: Data Science Analytics (DSDA), Data Science Engineering (DSENG), Data Management and Governance (DSDM); Research Methods and Project Methods (DSRMP), Domain Knowledge.

The EDSF defines relations between Data Science competences, that are acquired as a result of education, and corresponding skills, that are obtained as a result of professional training or work experience. The CF-DS defines two types of skills (refer to CF-DS [19] for the full definition of the identified knowledge and skills groups):

- Skills Type A which are built based on practicing major competences acquired based on education and training; depend on years of working as a specialist,
- Skills Type B that are related to a wide range of practical computational skills, including using programming languages, development environments, and cloud based platforms.

The EDSF can be customised for specific organisational roles or individual needs. The EDSF methodology can be used for different scientific and technology domains such as it was used by the authors for the Data Stewardship Competence Framework definition (as part of the FAIRsFAIR project) [21] and Digital and Data Skills for Maritime industry as part of the MATES project) [5].

D. 21st Century Skills in the EDSF Workplace skills

The CF-DS defined two groups of skills that are demanded by employers and required for Data Scientists to efficiently work in modern data driven agile companies:

- Data Science Professional and Attitude skills (Thinking and acting like Data Scientist) that define a special mindset that be developed by a practicing Data Scientist along their career progression
- 21st Century skills that comprise a set of workplace skills that include critical thinking, communication, collaboration, organizational awareness, ethics, and others.

Universities should pay attention to developing such skills and include them in curricula or extra-curricula activities. Refer to CF-DS [19] for a detailed skills definition.

The EDSF 21st Century skills are defined in [19] based on the analysis of the existing frameworks and community blogs and include the following individual skills:

"SK21C General group definition: Critical thinking, communication, collaboration, organizational awareness, attitude, etc.

SK21C01: Critical Thinking: Demonstrating the ability to apply critical thinking skills to solve problems and make effective decisions

SK21C02: Communication: Understanding and communicating ideas

SK21C03: Collaboration: Working with others, appreciation of multicultural difference

SK21C04: Creativity and Attitude: Deliver high quality work and focus on the final result, initiative, intellectual risk

SK21C05: Planning & Organizing: Planning and prioritizing work to manage time effectively and accomplish assigned tasks

SK21C06: Business Fundamentals: Having fundamental knowledge of the organization and the industry

SK21C07: Customer Focus: Actively look for ways to identify market demands and meet customer or client needs

SK21C08: Working with Tools & Technology: Selecting, using, and maintaining tools and technology to facilitate work activity

SK21C09: Dynamic (self-) re-skilling: Continuously monitor individual knowledge and skills as shared responsibility between employer and employee, ability to adapt to changes

SK21C10: Professional network: Involvement and contribution to professional network activities

SK21C11: Ethics: Adhere to high ethical and professional norms, responsible use of power data driven technologies, avoid and disregard un-ethical use of technologies and biased data collection and presentation."

III. Digital Transformation and Data Driven Companies

In this section, we provide an overview of the organisational models and what new culture and skills must be adopted to successfully operate and compete in modern digital and platform based economy.

A. Agile Data Driven Companies

The agile data driven organisational model is a demand of time to address fast technological change and digitalisation of industry and business. The organisational data driven is a topic of professional community discussion. The following are characteristics of this type of companies [22, 23, 24]:

1. Data-driven leadership. Leaders define the culture of their organization. A data-driven leader supports a culture of data by demonstrating data-driven decision making and involving the team members. A data-driven leader sees data as a strategic asset and makes "think and act data" a key strategic priority. Being data-driven requires a bit of a researcher's mindset and understanding of how data can be used for the business.
2. Data-driven decision-making processes. Establish a structured process of forward-looking decision making and backward-looking reviews of decisions. Build experience in aligning data analytics, insight and data-driven decision-making processes.
3. Data management maturity and automation of data management workloads, including data quality assurance. A core criterion for a data-driven organization is how much data analytics tools are automated and integrated into the organisational decision making process.
4. Data literacy. An organization's ability to succeed in the digital era is heavily dependent on its employees' data literacy: the ability to read, work, analyze, and argue with data. Data literacy is an important bridge from the abstract Data Science domain to the domain decision makers.
5. A data-driven culture adoption. Becoming data-driven involves more than technology and tools. It also requires a shift in the enterprise mindset and culture. Data driven culture becomes a reality when for example, the company's business analysts start understanding the benefits of blending their traditional business data with other data sources such as social media and environment data.

B. DevOps as a Culture for Agile Organisations

DevOps as project management practice and as a culture is recognized by modern agile and data driven companies and businesses [25, 26].

DevOps primarily was proposed and practicised as an effective software and applications development model that utilises the continuous integration (CI), continuous delivery (CD) and continuous improvement of the services and applications, with focusing on user requirements and user stories.

Agile and DevOps approaches and methods are recognized and adopted by different industries and business sectors also bringing the practice of iterative development and continuous improvement. This is specifically beneficial for data driven domains and sectors where we see DevOps adoption in the financial sector, change management, business analytics, and others. DataOps and MLOps [27, 28] are other domains where the general DevOps model finds its application and development owing to the fact that Data Science and Data Analytics process involves iterative model development and continuous improvement after the application is moved to production.

This makes Agile and DevOps important elements of the workplace and practical skills for modern organisations.

C. *Technology Development and Innovation*

In our increasingly interconnected world with multiple dependencies on digital infrastructure and external or third party services, new technologies development and innovation require a group of specialists working together as one project team with multi-domain knowledge and practical experience. The range of competences and skills should address the following dimensions/pillars and goals:

- Technology development: agile/fast development, short time to market, continuous improvement and change management, efficiency in services and resources usage, automation in services delivery and decision making; cost of development, and ROI.
- Societal aspects: improve life/wellbeing, health, social equality and cohesion, services availability, social security, etc.
- Ethics: ethical code of conduct, ethical use of technology, personal data protection.
- Sustainability (separate from societal aspects): architectural/technological sustainability, green technologies, energy and waste efficiency, ecological and climate impact. The sustainability dimension should be linked with the UN Sustainable Development Goals (SDG) [29] and related initiatives in education [30].

All these aspects need to be reflected in the research and development activities by professional organisations and practitioners. They should also be brought to the attention of the students at all stages of education, in particular in activities such as project development, and essays writing where the students need to make their choice or decision according to established criteria that should include not only technical aspects but also societal and sustainability aspects.

IV. Skills for Data Driven Digital Economy

A. *Skills for Industry 4.0*

The emerging Industry 4.0 will change not only technologies and manufacturing but also impose new requirements on the workforce. We refer to the World Economic Forum (WEF) report "The Future of Jobs" (2016) [31] that presented a view on the employment, skills and workforce strategy for the future economy. The importance of defining skills required for future industrial transformation is reflected in other reports, publications and blogs. [32, 33]. The following (soft) skills are defined as important, besides the direct professional competences and skills:

1. Complex problem solving
2. Design and System thinking
3. Critical thinking
4. Creativity
5. People management
6. Coordinating with others
7. Emotional Intelligence
8. Judgment and decision making
9. Services orientation
10. Cognitive flexibility

To respond to industry demand and Industry 4.0 challenges, European Commission funded the Executive Agency for Small and Medium-sized Enterprises (EASME) Initiative (2018 – 2019) to develop the Curriculum Guidelines 4.0 addressing Industry 4.0 challenges that offer the education and training providers a systemised overview of the new ways of organising learning experiences of individuals and groups for Industry 4.0 [34]. This is a comprehensive report of 214 pages providing extensive analysis of the technology trends, state of the play in education and training, and summarising recommendations for curriculum development.

B. *Digital Competences and Data Literacy*

The EC conducted the study and published the report on "Digital Competences for Citizen" (DigComp), the new version 2.2 published in 2022 [35]. The report extended definition of the digital skills that are grouped into the following competence groups: (1) Information and data literacy, (2) Communication and cooperation, (3) Digital content creation, (4) Safety (user and applications security), (5) Problem solving. All individual competences are defined as having eight levels of proficiency aligned with EQF. Data literacy includes such important competences as understanding and evaluating data, managing data, and extracting valuable information from data. The Problem solving group defines many competences that can be aligned with the 21st Century skills.

Essential knowledge to build a foundation for data literacy and data driven decision making is statistical methods. Understanding statistical models and criteria behind data analytics and machine learning processes is important for trustworthiness, quality, and risk assessment in data based decision making and control. All employees must learn how to interpret the results they receive from the analytics team and what are assumptions and constraints in such results.

To enable actionable data related skills, it is important to combine basic theoretical knowledge of data management and governance with understanding the industry best practices such as Data Management Body of Knowledge) DMBOK [36] and FAIR (Findable, Accessible, Interoperable, Reusable) data maturity model [37].

Design thinking, system thinking and research methods are important skills that have the power to convert company's data into the actionable decision making process, or convert technological data into an automated/autonomous manufacturing process.

C. *Design Thinking and System Thinking*

Table 1 below provides an overview pf the design thinking cycle and stages together with the system thinking cycle that allows complex/system approach to problem solving and aligning problem space, solution space and user/consumer needs.

The main difference of the two thinking models is the focus on the system in system thinking and focus on users and needs of people in design thinking.

Table 1. Design and System thinking cycle stages

Design Thinking	System Thinking
• Understand • Observe • Define point of view • Ideate • Prototype • Test • Reflect	• Problem definition • Mapping of reality • Situation analysis • Goal formulation (decision making criteria) • Search for a solution • Evaluation • Decision

Design thinking is best realized in inter-disciplinary team work and is closely related to Agile technologies which are focused on fast product development and continuous improvement based on user feedback. In its own turn, design thinking empowers agile teams for consistent problem solving. Design thinking should continuously switch and iterate between problem space and solution space.

The Design Thinking mindset includes the following aspects:

- Driven by the problem solving curiosity
- Focused on people as a target for products or services
- Accept complexity
- Develop process awareness and the whole lifecycle
- Visualise and show relations
- Prototype, experiment and iterate
- Co-create, grow, and scale with varying perspectives and frameworks
- Collaborate in networks
- Reflect on actions

System approach and system thinking are considered as important set of skills for the future economy, reflecting a complex and interconnected environment and a problem space in which future workers will work. The system approach has been developed and widely used in the technical domain, however its benefits recognized in other domains. The mindset of the system thinker, should:

- Always look at the big picture
- Think positively about system improvement, and don't complain if the system doesn't work
- Check the results and improve results with each iteration
- Reflect on the way of thinking because it affects what will happen
- Take time to penetrate even complex interconnections
- Search for the key to the system
- Consider facts from different perspectives
- Accept the change takes place gradually and interconnections also trigger changes
- Identify an effect that was triggered by an action

Design and system thinking can be implemented by adopting Agile and DevOps methodology that actually defines a culture of project/goal/mission based collaboration and team management.

D. Research Methods in Technology Education

As organizations are adopting data driven technologies and Data Science practices for solving complex problems, they turn to apply the research method to the process of extracting value from data. The Data Science process is based on the research process and using research methods.

The research methods generally include creating a hypothesis, collecting data (in observation or active experiment), running tests to validate the hypothesis, and finally, providing report and data for making a business decision.

Research Methods and Project Management are included as a separate competence group and Body of Knowledge group [19, 20]. Traditionally, research methods are included in the social sciences and humanities, but it is not typical for Computer Science programs. It is highly beneficial to have an introduction to Research Methods in Computer Science and Data Science programs as a general professional orientation.

V. Education for New Generation Professionals

A. Managers vs Experts vs Generalists

Knowledge workers and managers are commonly understood organisational roles that constitute standard departments or units focused on organisational or project goals that however can have complex hierarchy and relations. Experts or expert groups are typically cross- or inter-organisational; they act as think tanks or policy defining boards. Experts possess a critical body of knowledge, typically multi-domain or multi-discipline, with a proven record of contribution to the expert domain and the ability to cross-pollinate between domains. Experts are rather embedded into the advanced organization or unit (playing leading role there) than acting as individuals in distributed expert groups. Experts can be positioned at EQF levels 7 or 8.

The complexity of modern technologies and the extensive span of knowledge that modern organisations must possess brings to surface such a category or role as a generalist. When introducing the generalist concept (apparently as contrasting to or complementing a manager or an expert concept), it is important to understand the following their properties: (1) category of possessed knowledge: single-/multi-/cross- domain; vertical or horizontal span; (2) role in organization: managerial, advisory or research/development; (3) qualification level: how deep knowledge and skills are required.

The generalist may be an important category or profile, but it can presumably perform effectively at a specific level of professional development. To have a strong background in one or more domains, generalist must posses/acquire sufficient practical experience in those domains, multidisciplinary knowledge and experience would provide a benefit.

Having outlined the main aspects of defining generalists, we leave further discussion to the specialists and experts in management and administration.

B. From competences and Skills to Curriculum development

When introducing specific elements into the curriculum to achieve the required qualification level, we need to understand the relations between competences, skills and knowledge related to a specific professional profile. Figure 1 illustrates such relations as used in e-CF [10] and EDSF [7, 19].

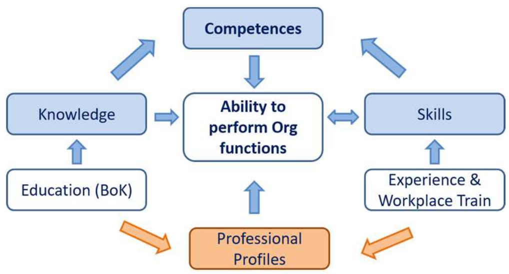

Figure 1. Relation between competences, knowledge and skills.

Both e-CF and EDSF define a set of competences together with the connected to them proficiency/qualification levels, knowledge topics, skills and attitude. Competence is defined as a demonstrated ability to apply knowledge, skills and attitude to achieve desirable results as part of organisational function. Skills are proven abilities to perform certain functions and are supported by practical experience. Knowledge are acquired as a result of education, training or (self-)study and often must be supported by qualification tests. It is important that education or training is attended at the certified program or curriculum. Initial skills are obtained as a part of education or training and further developed through work experience and workplace training. Learning Outcomes in the curricula are defined based on the competence definition and required qualification level that must be achieved after finishing education or training program or course.

VI. Experience of Including Transversal Skills into the University Curriculum

A. Multiple ways of developing Transversal and 21st Century Skills in Academic Curricula

University curricula are typically busy and regulated based on approved academic programs. Most of the universities and the University of Amsterdam Faculty of Science, in particular, include the mandatory course in the Bachelor program on basic academic skills (PAV - Practicum Academische Vaardigheden) [38]. The Pav course spans all years of the Bachelor study and includes such topics as: Communication: Writing and Presenting; Collaboration and team work; Reflection; Planning and organizing; Working with scientific information. PAV is a general skills course but some courses additionally articulate PAV elements, especially those that are project based.

However, the need to introduce students, especially master students, to a wider spectrum of transversal and 21st Century skills aligned to their study domain.

The presented in this paper analysis and suggestions are based on the authors' experience in developing and teaching a number of bachelor and master courses. Below we provide short information on how it is done in a few courses.

B. Webtechnologies (Bachelor Artificial Intelligence) [39]

This is the first year bachelor and a first project based course developed in groups. That is why it is so important to introduce the students to the main C21 competence.

The students have high level of freedom to select the project topics and type of application or website that must be delivered working in 4 weeks. However, the students are motivated to select a topic related to one of the Sustainable Development Goals. Short reference to SDG and related initiatives is given in the first introductory lecture. The introduction to the course and the syllabus provides information on important C21 skills and intended learning outcomes.

The project development requirements include elements that facilitate multiple skills related to design and system thinking, user design, global thinking, and collaboration and team work.

C. Master Courses in Software Engineering and Data Science

Two courses DevOps and Cloud based Software Engineering (DevOps, Software Engineering at the University of Amsterdam) [40, 41] and Big Data Infrastructure Technologies for Data Analytics (BDIT4DA, Data Science at the National Technical University of Ukraine) [42] initially developed independently but in recent years found mutual enrichment. This is due to increased acceptance of the DevOps methods in Data Science and Data Analytics domains, on the one hand, and increased use of Data Science and Analytics methods in many projects that SE and DevOps teams deal.

Such alignment of two courses is introducing two lectures on DataOps/MLOps and Data Science Project Management.

Both courses are project based, while focusing on different learning objectives: the DevOps course stresses on the using CI/CD and cloud based tools; the BDIT4DA projects are focused on developing Data Analytics workflow and implementing it on one of the cloud based Big Data platforms to address the scale, volume, and variety of data source in real life business cases.

The final project, including a literature study, is the key component to achieving practical experience in implementing concepts and technologies related to the course subject, such as the DevOps and Software Engineering and Big Data Infrastructure Technologies. The students have the freedom to select the project topic as soon as they satisfy the established criteria of complexity and set of used technologies. Applying project based education model will also facilitate some of the 21st Century and workplace skills such as team work, design thinking, and agile project development skills, what is a part of the DevOps course learning outcomes.

VII. Conclusion and Future Developments

This paper presents the ongoing research by authors on identifying critical transversal professional skills for the emerging data driven digital economy and Industry 4.0 that are not limited by widely accepted the 21st Century skills.

The paper also presents the authors' experience in implementing such skills in bachelor and master courses. The experience shows that a clear definition of intended skills and understanding of relations between knowledge and skills acquisition elements and stages allows developing the course components that in the best way achieve learning objectives while giving much freedom to the students in matching course requirements and final reporting. The used project based learning model is proven effective in forming important professional skills and also facilitating the students self-learning, self-organisation, and team work. This also provides an opportunity for some students to test their ability for leadership in the project teams.

The paper presents an extended overview and analysis of the existing initiatives and developments in defining critical competences and skills for the future data driven digital economy. The important outcome of the presented research and development is the proposed vision of what specific learning outcomes should be added in modern curricula to facilitate the development of professional and 21st Century skills for modern and future data driven digital economy.

The authors hope that the presented paper will provide a contribution to further discussion on the topic of preparing future engineer-business generalists who can lead technological, economic and social change.

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