

Industry 4.0 and the impact of technology on the future of work. A qualitative approach to the IT jobs

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Abstract

Scientific research leads the scientific progress based on which information technology (I.T.) professionals drive technology changes, impacting our daily life, business, and work models. The same inventions are impacting the work of the software developers, the ones responsible for building this technology. While I.T. professionals are building new tools for automation used in the industry, the work of I.T. professionals is significantly impacted by the tools they build. Paying heed to these considerations, the paper intends to bring forward qualitative research based on semi-structured interviews with 18 I.T. professionals. The research purpose is to scrutinize to what extent the workers in the software development industry are aware of the transformations happening in their profession, how they see the future of their jobs and how they prepare for that future. The I.T. engineers taking part in the interviews see the impact of technology in changing their work models, making them more productive rather than a threat to their jobs. They also understand the importance of continuous learning, keeping up with technological changes and soft skills.

Keywords: industry 4.0, technology, automation, future of work, IT jobs

Introduction

The topic of Industry 4.0 and the future of work, its impact on business management models, and its social implications started to gain momentum in the academic literature (Roblek *et al.*, 2016). The impact of technology on the work models is discussed across different industries like transportation, medicine, or manufacturing.

From a bird's eye view, the impact of technology changes on the software industry itself is discussed only broadly. The I.T. industry building technologies like robotic process automation and machine learning, which are responsible for work automation in many industries, is being itself changed by those technologies. In the same way, robots have changed the nature of traditional industry software while automation is augmenting and even replacing the need for manual jobs in

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work like application deployment (Talwar *et al.*, 2005) or automatic code generation. While the number of technology jobs is growing (Schrage *et al.*, 2020), the introduction of cloud computing and significant data machine learning are creating employment and augmenting a substantial number of software development tasks. Even if automation of I.T. processes has not yet replaced numerous software development jobs, it is increasingly changing the nature of those professions and reducing the prevalence of several traditional I.T. professions.

Kurzweil (2005) and Tegmark (2017) describe the exponential rate of change based on the diminishing time between technology breakthroughs such as the internet and IoT and predicting the artificial intelligence impact on human jobs, potentially replacing even the technical professions. Most of the research analyses the jobs being replaced by automation, jobs becoming more demanding, and new professions being established (Manyika *et al.*, 2017; Tytler *et al.* 2019; Schwab *et al.*, 2020). There are also proposals on what the appropriate responses to changes in the job market are. I.T. skills continue to be in extremely high demand and are predicted to grow (U.S. Bureau of Labor Statistics, n.d.). Like the famous “boiling frog” that is in tepid water and boiling slowly, it does not see the danger. The question to be answered by I.T. employees through empirical studies would be about the extent to which the workers in the software development industry are aware of the transformations happening in their profession and how they see the evolution of their work, and how they prepare for that future. Answering such questions would add to the existing literature in the field and would complement the empirical initiatives unfolded in international studies and technical reports.

Starting from these considerations, the paper is intended to bring forward qualitative research based on semi-structured interviews with 18 I.T. professionals. The research purpose is to scrutinize to what extent the workers in the software development industry are aware of the transformations happening in their profession, how they see the future of their job and how they prepare for that future. Furthermore, the study seeks to explore the perception about the future of the work of I.T. employees and compare it with formal global research on this topic.

This paper expands on an earlier study on the sustainable management of I.T. enterprises, measuring the perception of IT managers about how managerial strategies are prepared to cope with the accelerated rate of technology change and its impact on the workforce (Pînzaru *et al.*, 2021). To this end, the paper is organized into several main sections: future of work literature review, qualitative interviews with IT professionals, findings and discussion of the findings and conclusions.

1. The impact of digital transformation on the future of work

"Technology is moving so quickly, and in so many directions, that it becomes challenging even to pay attention" (Manyika *et al.*, 2013, p. 5) McKinsey institute has identified twelve potential economic disruptive technologies: Mobile Internet, Automation of knowledge work, The Internet of Things, Cloud Technology, Advanced Robotics, Autonomous and near-autonomous vehicles, next-generation genomics, energy storage, 3D printing, advanced materials, advanced oil and gas exploration and recovery, Renewable energy (Manyika *et al.*, 2013). According to (Vidu *et al.*, 2022), with the adoption of Artificial Intelligence, every manager must consider the readiness of their transformation business. New technologies are responsible for the highest net job creation in I.T. and engineering (European Political Strategy Centre, 2019).

The future of work concept is attracting the interest of academic researchers and international organisations. The consensus from systematic literature reviews (Piccarozzi *et al.*, 2018), research (Webb, 2019), consultancy firms such as McKinsey (Manyika *et al.*, 2017), Deloitte (Schwartz, Monahan, *et al.*, 2019), (Schwab *et al.*, 2020) and organizations like World Economic, and OECD (Arntz *et al.*, 2016) is that low-skilled repetitive work like clerk's operation managers and call centre operations are most likely to be an the other hand, jobs involving soft skills like social services, healthcare, education, and highly skilled professions are expected to be in higher demand (Schwab, 2018).

McKinsey (Manyika *et al.*, 2013) has researched the drivers of changes. Further, the World Economic Forum (Schwab, 2018) proposed a list of future jobs as "Data Analysts and Scientists," "A.I. and Machine Learning Specialists," "Big Data Specialists," "Process Automation Specialists," "Information Security Analysts," "People and Culture Specialists" and skills like "Analytical thinking and innovation," "Active learning and learning strategies," "Creativity, originality and initiative" and "Technology design and programming." All these components may be considered as a prerequisite to what the future holds for this field of interest.

In order to support the emergent technologies, the nature of I.T. jobs is also changing with the increased demand for Data Analyses and Science, A.I. and Machine Learning, Big Data Specialists, Digital Transformation Specialists, New Technologies Specialists, Process Automation Specialists, Human-Machine Interaction Designers, Service or Solution Designers. Roles like data entry clerks and administrative jobs are likely to disappear, and be replaced by automation. Analytical thinking, active learning, creativity, design and programming, critical thinking, complex problem solving, and emotional intelligence systems analysis skills are expected to demand higher demand (Schwab, 2018). From this example, we see that accelerated technology changes, built by software engineers, are generating more demand for certain I.T. professions and requiring new a new set of skills.

An important factor in job transformation is digital transformation. That is defined as "Digital transformation is concerned with the changes digital technologies can bring about in a company's business model, which result in changed products or organizational structures or the automation of processes" (Hess *et al.*, 2016, p. 124), having the following dimensions: Explore and exploit new digital technologies; Changes in organizational structures, processes, and skillsets necessary to cope with and exploit new technologies; Ability to finance a digital transformation endeavour; Changes in value creation reflect the influence of digital transformation on a firm's value creation. More permeable and agile organizational, continuously adaptable structures are needed. to support swift technological transformations (Hanelt *et al.*, 2021).

Subsequently, the jobs of the engineers producing the recent technologies are impacted by the technology they are developing. Not only that, we have new technologies impacting the workforce, but the speed of change has been growing exponentially Kurzweil (2005). We see Moore's law predicted doubling of the number of transistors on integrated circuits every year and a half, validated from 1970 until today (Moore, 2009). The growth of data is projected at 40% to 60% per year (Cassard *et al.*, 2018).

In line with Roblek (2016), the literature review on Industry 4.0 identifies EBSCOhost, ProQuest, ScienceDirect, Web of Science, and Google Scholar as good sources for information on this topic. The topic of industry 4.0 gives a general context of the industry technology trends, as are the smart infrastructure, IoT, Health care sensors, security, and privacy. Industry 4.0 literature review covers the impact on the organizational model with concepts such as Self-Organization adaptation to human needs and digital sustainability (Piccarozzi *et al.*, 2018; Roblek *et al.*, 2016). The impact on the professions is covered more by the future of work literature is explored in scientific papers, as shown in systematic literature reviews (Piccarozzi, *et al.*, 2018) and research (Webb, 2019).

On the topic of future of work, a significant body of research is done by big five consultancy companies McKinsey (Manyika, 2017), Deloitte (Schwartz, Hagel *et al.*, 2019) and international organizations, including the World Economic Forum (Schwab, 2018), and OECD (Arntz *et al.*, 2016). The general conclusions are that business ecosystems are becoming more agile and networked (Soto-Acosta *et al.*, 2016; van der Aalst *et al.*, 2018; Stratone *et al.*, 2022).

The most common suggestion for employees to cope with the accelerating rate of change is education for technical literacy and, in general, continuous education to adapt to market changes. Deloitte's (Schwartz, Hagel, *et al.*, 2019) research recommends that employees engage in lifelong learning, shape their career paths, and pursue their career paths. According to the same study, the organization must redesign technology and learn and implement new organizational structures,

leadership and culture. Governments are expected to support lifelong learning and reassess policies and regulations.

As seen with Mitchell (2022) literature review on the future of work, the focus has shifted from impact of automation to workplace changes, employee wellbeing and telecommuting. The reviews enforce the conclusion that employees working on routine jobs are likely to be soon replaced by digital technologies but it also introducing the technology as the enabler for remote communication and remote work. Skills, in particular soft skills, are present as key for success in an ever-changing world. Research by Kolade and Owoseni (2022) shows that while the between 2018-2020 the key themes were post work prospects and the adoption of digital technologies into creative domains, post 2021 the key themes are the emergence of industry 5.0, remote work and human-computer collaboration.

Based on this theoretical background, the following research questions are worthy of being formulated, that is, R1: In the context of Industry 4.0, what is the technology's impact on work automation and efficiency? R2: What are the effects of digital transformation on I.T. jobs? R3: To what extent are the I.T. jobs likely to change, and what would be the drivers of future work shifts?

Pursuant to the aforementioned research questions, the goal of the qualitative research is to examine the respondents' perceptions of the digital transformation, past changes in their jobs and profession, technologies generating these changes, expectations of future changes and the way they prepare to cope with the accelerated rate of technology evolution and job market evolution.

2. Research methodology

The research is conducted following the method described by Gill (2008) for semistructured interviews, as the most common method for data collection in qualitative research. Fugard and Potts (2015) suggest a wide range of participants needed in qualitative interviews between 12 and 101, but concludes that 6-10 respondents are recommended for interviews and saturation occurs within 12 interviews. The respondents have been selected using a judgment sample strategy (Marshall, 1996) from different small medium and large organizations in Romania. The respondents had been informed about the ethical principles and anonymity. The interviews have been recorded and transcribed.

Eighteen information technology professionals from various start-ups and small and large organizations were included in the interview. The questionnaire was sent in advance and was discussed in face-to-face meetings or via Microsoft Teams. The results were processed with NVivo 12 qualitative data analysis solution. It includes a balanced mix of line managers (54%) and individual contributors (44%). While all the people responding to the interview are working in

delivering software solutions, 15 are engineers, while 2 are economists, and 1 has psychology studies. Nine respondents have under ten years of experience, and seven have from 10 to 19 years and only 2 with over 20 years of experience. That is correlated with a typical seniority distribution in a young I.T. industry (U.S. Bureau of Labour Statistics, 2020). The managers' category includes project and delivery managers. Individual contributors come from a mix of delivery professions: developers, manual and automatic testers and dev-ops. Respondents are working in various organizations and have different past professional experiences. This mix of profiles, jobs, and experience helps the research with a different perspective, making similar responses more valuable.

The interview guide has five chapters and a total of 18 questions. The first set of questions captures the biographical data relevant to the research as possession, position, and years of experience. The second part has one open question about the definition of work. The following two sessions look at past changes in their work, their view on the future of their profession, and how they prepare for such a future.

The first question is defined as a baseline for what the respondents understand from digital transformation. Responses include keywords like technology change, automation, lower cost, improved performance, new behaviours, change in society, easy life, and lower risk. One particularly interesting response was "changing people's habits, perceptions, way of living and working, adopting latest information technology and software products," referring to technology's impact on people's way of living and culture. The responses are generally capturing professional life but also the technology's impact on work automation and efficiency.

The next set of questions captures the changes responders had in their past careers, moving to new roles or transformations that they have seen in the same profession. That distinction was not evident in all responses, but the data covers all aspects, with people giving a personal perspective on their resumes. The data analyses have separated and made a distinction between the two types of changes.

The third part of the interview takes the perceptions of the interviewers of how I.T.'s job is likely to change, what will drive the change and what is expected to be the role of automation. Finally, the last part is about how they see their careers evolving, what skills they need to develop, and how they prepare for that.

3. Findings

Focusing on the definition of digital transformation, the responses cover a wide range of topics, from technology and social change with automation generating new behaviours leading to

increase efficiency, lower cost, lower risk, improved performance and making an easier life. The rate of change is seen in some cases as disruptive: "Digital transformation incurs a disruptive change in how a wide variety of professions, activity domains and companies large or small perform their daily activities" (A.I, I.T. manager) by persons with more work experience and more responsibilities, but if we look at the day to day work that is perceived as "slow migration of people's day by day needs and activities into the digital world" (P.M., QA Test Automation Engineer). Digitalization is changing the way we work "the digital transformation is a new behavioural approach which is bringing a new way how the market's actors (producers and consumers) or business partners are exchanging information" (S.V.G., Consultant). From the first question, technology is seen to impact the future of work dramatically, "everything becomes digital sooner or later" (V.C. I.T. manager). A similar perspective on the disruptive impact of technology comes from A.M.L. (Development Manager) - "Science Revolution," when easy jobs, without any challenge, consisting of repetitive tasks will be replaced by robots or computers." Others, like S.C. (Development Manager), do not see the high impact of technology change. "I.T., we still follow a traditional way of working."

Changes in past roles are reported to happen from every six months in some cases to even up to 10 years for some engineering professions. The most significant impact was in the case of V.C. (Business Analyst), who had lost their previous job because of automation: "My first job was in insurance, as a data entry operator... Now those contacts are scanned and automatically...". Not only are non-IT jobs replaced by automation but also, in certain I.T. professions, "there are no Project Managers, or Enterprise Architects" (S.C., Development Manager). Another job rapidly losing ground is manual testing - "Initially I was working as a manual Q.A. engineer, but now I am an automation Q.A. Engineer" (C.L. QA Engineer). "My role changed from testing manually an entire release to testing automatically more than 50% of a release, which means building automated tests from previously written test cases in order to speed the delivery" (C.M, Integration Engineer). But new jobs have appeared and employed more and more people like DevOps - "The deployment model changed, and the storage of the source code needed adjustments to follow DevOps guidelines" (E.C., Developer).

For developers, is it more about keeping up to date with rapid technology change - "In my case, being a developer needs first of all to be up-to-date with technologies I am working on" (A.M.L, Development Manager) but also more automation on development work - "New technologies enabled more automation in the area of software development and especially software deployment... Effort in keeping the technical stack of your application up to date is taking up much more capacity than it used to 15 years ago" (S.C., Development Manager).

Even when we do the same work, the way we do that is now different "possibility of having a Work from Home... collaboration between teams that are geographically placed in different locations" (M.C., Integration Engineer) and "work model changed from coordinating teams collocated to distributed teams in different locations and countries" (R.M., Release Manager). One of the respondents is considering the organizational model and how projects are managed - "release manager following mostly waterfall methodology to a more agile project manager" (R.M., Release Manager).

In summary, all respondents agreed that they need to adapt to keep up with technological changes by changing jobs, roles, or ways of working. As pointed out by S.G.V. (I.T. Consultant) - "I had to adapt the specificities of my roles to the new expectations (speed, quality, visibility, communication, etc.) to remain as relevant."

The technologies responsible for job changes are identified in the major new developments we have seen in Cloud Computing, Machine Learning but also specific software technologies and frameworks like software as a service, virtualization, microservices, as well as communication and collaboration tools as professional social tools. As in the previous question, developers are looking at the rapid introduction of new frameworks or new versions of existing tools "frameworks (especially Spring), NET, Android, React / Angular" (A.M.L., Developer), "Distributed applications, web services, Containers" (E.C., Developer). The listed technologies depend on the person's role, with some considering more the software deployment tools, "DevOps systems like Kubernetes, dockers, etc." (M.P., Development Manager).

Planning and collaboration tools are also mentioned: "The introduction of new planning tools (excel and Microsoft project plan lose market share in favour of Jira, Jama, etc.)" (A.I., I.T. manager), "Tools like Jira, that eliminate the need for a PM" (S.C., Development Manager). C.D. (Testing Lead) mentioned the Internet as a critical driver to change, being the only answer that took into consideration a longer time frame of about 20 years while he only has 11 years of professional experience but looks at a radical change factor not only for the I.T. profession but the entire humanity.

The perspective on the *future of I.T. jobs* is similar to the perception of past changes. A combination of new programming languages, software adoption as a service platform coupled with a transition from waterfall project management to agile methodologies, increased automation testing and distributed teams collaborating using technology.

Three of the responses show that software development becomes more manageable, and it is expected for Automation to keep enhancing automatic code generation - "Frameworks that generate code. A.I. will be capable of writing basic functions. Features" (S.C., Development Manager). The fact that the manual testing profession is likely to disappear has been pointed out in many cease -

"Manual QA. I see that as a dying profession. I am surprised the demise of manual Q.A. is not happening sooner" (S.C. Development Manager) "Q.A. engineers will not exist anymore their role will be taken by programmers" (C.L., QA engineer).

In all cases, the perception of all people being interviewed is that change happens "at least once per year you get to work with something new and challenging" (P.M., QA engineer), "developer will have to reinvent her/himself every i.e., four years or even faster" (A.I., I.T. Manager). With many repetitive jobs being replaced, humans are expected to be needed more on expert jobs - "Automation will replace simple tasks, the ones with higher repetition rate, the ones who will deal with a huge amount of data. Humans will be experts supervising the results and the well-functioning of the systems" (C.M., Integration Engineer). A project manager's view is that automation will eventually replace all types of jobs except the ones involving creativity - "Both – most manual work will be replaced, but innovation will still rely on human creativity" (R.R., Program Manager). One developer does not see technology as a threat to the jobs but as a way to make work easier and increase efficiency - "The automation will not replace the human agent in I.T. but is making it be more productive and implement faster other automations" (E.C., Development Manager). There is even the perception that with information technology driving the industry 4.0 revolution, "the total number of jobs can increase" (G.M., Architect). Regardless of how many and how fast the jobs will be replaced it is essential to remain agile - "flexibility will be key, so I count on my capability to adapt" (A.I., I.T. manager).

Concerning *technology*, artificial intelligence is mentioned in almost all responses, "A.I. – not yet extremely visible, but on its way to come and become indispensable" (M.P. Development Manager). Artificial intelligence is perceived to be the technology to replace the work of software engineers - "A.I. developers, but once he gets to technological maturity, they will become obsolete as well" (V.C., Delivery Manager). Even quantum computing, which is, for the moment, more of a research project (Hey, 1999) with almost no impact yet in the industry, is seen as a potentially disruptive factor - "quantum computing which will force the rethinking infrastructure and applications" (N.S., Project Management).

A.I. (I.T. manager) has anticipated the last set of questions concerning the way professionals need to prepare for future changes in the job market. "On average, 15 years would be required for an education plan to affect the labour market. Therefore, there will always be a hunger for top talents because of this speedometer gap between what society can offer to a fast-paced industry".

The last set of questions in the interview is about *their future*, what they see themselves doing, what skills they need, and how they plan to build those skills. Most people indicate they will stay in similar jobs or will likely to more senior positions as they form development in architecture. There is

one response taking a significantly broader perspective in the fact that the jobs of the future will likely be in the gig economy rather than full-time employed - "Self-employed, consultant" (P.M., QA engineer), "I see myself working towards my own company" (S.C., Development Manager) or doing volunteering work "shift to volunteering in education, if not, then I would see myself leading A.I. projects" (M.P., Development Manager).

Regarding *skills*, developers tend to think about continuous changes in their toolsets. "DevOps (programming in Java / Android / React / Angular, etc.; scripting, database performance, use of automation tools – Jenkins / TeamCity, etc.)" (A.M.L., Development Manager). Non-IT skills are recognized to become more important than technical "1. Creativity, 2. Communication skills, 3. Adapting to change" (C.D., QA engineer). The answers, in general, cover a mix of developing soft skills with keeping up to date with the technology - "ability to adapt to constant change, agility, understanding of the business processes and ability to optimize them using new technologies," "soft skills and comfortable with the technologies the role requires" (M.A, I.T. Manager).

From the development perspective, the interviewed I.T. professionals prefer self-learning, including online platforms "I try to do several online technical trainings using Udemy and/or PluralSight every year" (A.I., I.T. Manager), professional experience "Learning by doing" (C.L., QA engineer) or massive online open courses (MOOC) "Not very formally for the moment, more following different online MOOC courses (i.e., Coursera, TedX) or following online webinars (i.e., Gartner)" (M.A., I.T. Manager). While I.T. companies do offer training programs (ANIS, 2019), there was only one answer talking about formal training programs as well as "reading books and attending courses" (S.D., Java Developer).

When processing the responses of the participants in the study, attention was also paid to the overall set of responses to see what the words described and what is in the mind of I.T. professionals regarding their professional future. The findings revealed that automation and learning have the highest frequency. The overall word cloud includes project, development and software specific to their work, and A.I. is mentioned as the most important disruptive technology, whereas Q.A./testing is most often pointed out as a job being automated (Please see Table 1 and Figure 1).

Table 1 Word count derived from the interviews

RANK	WORD	FREQUENCY
1	AUTOMATION	28
2	SOFTWARE	27
3	DEVELOPMENT	23
4	PROJECT	21
5	MANUAL	20
6	DEVELOPER	19

The ability to finance the transformation was not touched on in any of the responses. That may be explained by how the title of the research has framed the context of technology impact in the work of software engineers and not the company as the actual purpose of the study. The I.T. professionals do see the digital transformation impact on their lives as well. Personal aspects are not part of this definition or research and are not related to the evolution of jobs, but people do feel how technology is impacting their lives.

Most people being interviewed have seen significant changes in their work model from as frequently as six months up to 5 to 10 years. However, there are four situations where there was no change or at least no significant one. There is no direct correlation between people who responded that their job had not changed with any specific profession or number of years of experience. For those who reported changes, the reason was always technology. The job impact is coming from having to stay up to date with technical changes, using cloud computing and machine learning for developers, moving from manual to automatic testing for quality assurance professions, moving from developer to closer to the business architecture jobs, implementing RPA (Robot Process Automation) ending with a situation where a banking operation manager job was automated, and he had to find a new technology job.

Jobs reported being replaced: project managers with Agile Coach, manual testing with automatic testing, and developers with Dev-Ops, in this order. The World Economic Forum is forecasting a spike in the number of software engineers and recruiters, and human resource specialists while reducing the number of positions for support specialists, system administrators, and most crucial project managers (Schwab, 2018). The same report puts mobile internet, cloud computing, the internet of things, and artificial intelligence as the most disruptive technologies for the job market. Cloud computing and the internet are also a result of our interviews. On top of that, the I.T. professionals interviewed for this study consider social media, mobile communication, and robotic-process Automation as technologies changing the work in I.T. The changes are in the tools they work with, as well as the work model enhanced by technology with collaboration platforms, enhanced processes, and leaner organizational structures. Hierarchies are replaced by flat teams (Malone, 2004), enhancing collaboration.

While some of the people responding to the survey had to change their jobs, they have seen changes in their existing roles. Developers must continuously keep up to date with the change in technologies. Collaboration technics and remote work are changing everybody's way of working. Geographically distributed teams, network teams (Schwab *et al.*, 2020) remote staff, and virtual workplaces (Hagel, *et al.*, 2019; Schwab *et al.*, 2020; Hanelt *et al.*, 2021) prove similar to this

research results. The Deloitte report also includes "comprehensive technical skills" as the main factor in changing the nature of I.T. jobs.

Looking forward, WEF predicts that jobs most impacted by Automation are operations managers, accounting, and administrative positions (Schwab, 2018). This list is not specific to I.T. One response concerning the jobs expected no longer to be relevant starts with "non-I.T. jobs" that are any other jobs outside the industry. For the I.T. professions, the jobs likely to continue to disappear are manual testing, service desk, release managers, and repeated tasks. Project managers' jobs are also predicted by the persons being interviewed and not be relevant in the future.

New jobs expected to become in more demand, according to the World Economic Forum, are data analysts, Artificial Intelligence and Machine Learning, and big data specialists, all related (Weil, 2019) to the development of artificial intelligence. Other professions are Software Application Specialists, Process Automation Specialists, Information Security Analysts and

User Experience and Human Machine Specialists. The research similarly points out big data and machine learning, security analysts, and design as the primary change driver. DevOps is also seen as a profession getting increased traction. The analyses included in the review and the research results show that new professions expected to be in increased demand are both in the technology space as well as design and innovation (Weil, 2019).

People need to prepare for the changes in I.T. professions and even more for jobs expected to disappear. Analytical thinking and innovation, active learning, creativity, originality, initiative, problem-solving, technology design, and problem-solving are presented (Schwab, 2018). as essential skills to cope with future changes. That does match with research responses of creativity and problem-solving. The responses and the research results show that even when using different concepts like emotional intelligence, soft skills, leadership, and cultural awareness. The research also points out I.T.-specific technical skills: dev-ops and cybersecurity or data experts. Most important, adapting to change and agility are seen as critical aptitudes. Books, open learning platforms, conferences and, in fewer cases, formal training are used to build these skills. MOOCs (Massive Open Online Courses) are considered the new form of online training well suited for self-directed learning (Margaryan *et al.*, 2015). Self-directed training was mentioned in all responses, while formal in-class training was only in 10% of the cases.

Correlating the number of years of experience with the perceptions of changes in the I.T. industry, we observe that young professionals do not see accelerated change as more experienced professionals do. The fact can be explained considering that younger generation Z people have access to technology from a very early age, not having much time to notice radical technology evolution, with digital technologies impacting their entire lives (Pînzaru *et al.*, 2019).

While technology had a significant impact on 95%, technology workers reported the need to adapt to changes in their development tools and collaboration tools. Managers are more interested in the efficiency increase from Automation and changes in management models making the organizations leaner and more responsive to dynamic markets. Some of the people responding to our research have lost their jobs due to Automation and had to learn a new skill moving into I.T. professions.

With only a few exceptions, the perception of change was limited to one's role and environment. Only 3 of the interviewed persons have considered the entire industry and the complex ecosystems of roles involved in building complex software solutions.

Conclusions

With increased attention and research on the topic of Industry 4.0 (Kamble *et al.*, 2018) and the future of work (Mitchell *et al.*, 2022), the impact on the jobs in the high-tech industry driving this change does not get any special attention. However, the results of this qualitative research do match the conclusions of more extensive studies and, in addition, do provide specific insight into the I.T. professions with examples as project managers not having a role in agile I.T. organizations or having more and more software development tasks automated by the new dev-ops profession.

Automation is increasingly replacing non-IT jobs. Specific jobs in software development are disappearing and being replaced with new jobs developing. Even for occupations that have not changed and are not expected to change, the nature of the work is impacted by using new tools and learning new technologies continuously. The organizations adapt their structures by reducing the number of management levels, project management roles in particular, and becoming more flexible and responsive to market changes. The skills required to build future careers are technology-related, mainly concentrated on big data and machine learning. I.T. professionals increasingly recognise that soft skills such as creativity and problem-solving are becoming as important as technical skills.

I.T. is a new industry, and I.T. employees are used to the rapid technological change rate. While we investigate the perceptions of the future of I.T. professions, the interviews show that the future is already happening in terms of rapid changes in the tools and work models pushed by technological changes. The perception of the interviewed IT professionals, they are not concerned about losing their jobs. Instead, they see technology as a means to make them more productive. Technology is seen as taking on repetitive processes while letting the experts focus on the innovative component of the work and building knowledge.

Skills building, are recognised by the people being interviewed as being essential to once keep up with the new tools used in software development and well

To sum up, this qualitative research is only a first step in understanding the perceptions of I.T. employees about the I.T. impact on their work. However, it is a necessary step in order to provide context for future research. Quantitative research on this subject would develop more specific conclusions and industry trends.

Limitations and Future Research

The group size is an important consideration. By its very nature, qualitative research only allows for a limited number of participant responses and is of no use for in-depth research. The results of this research are intended to help define the research questions for quantitative research with a statistically relevant number of respondents.

In order to develop a better understanding of the future of work in the hi-tech software profession, more research has to be done not only on the technology and nature of the jobs but also on the underlying social, economic and political factors influencing the job market as well the elements making this industry sustainable. Existing reports on the future of work and results of this research show that education and continuous learning coupled with an agile approach of the employees and organizations are the main factors enabling the workforce to adapt, justifying more detailed discussions on this topic. On one side, future research will need to consider the specific changes in the I.T. profession, the skills that employees and organizations will need to develop accordingly and how local factors in Romania and managerial strategies are influencing the transformation of I.T. jobs.

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