

The skill gap and polarization of the software labour force: Early signs of the War of Talents between software professionals and how it threatens wellbeing

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Abstract

The demand for high-skill and deep knowledge is a key characteristic for modern-day software business. In addition, the whole impact of information and communication technology (ICT) is seen as a cross-cutting element in different industries. The software industry in Finland is suffering from a severe labour shortage and the estimations of needed labour are ranging from 7,000 to 15,000 software professional. However, despite all development and research done, the question, whether the software companies are requesting more employers or are they looking for more diverse skills, remains unanswered. Furthermore, previously there has little if any discussion, on whose responsibility is to ensure that future software experts have the right kinds of skills and competencies to secure their successful work career. This study focuses on the skill polarization between software professionals, referred to as the ‘*War of Talents*’ in this study, by using data collected by a survey (n=90) from Finnish software businesses. The results reveal some indication of ongoing skill polarization in the field and its possible impacts are discussed. Furthermore, the potential threatening impacts of the polarization process on the well-being in the information society are observed and reported. In addition, the paper proposes adding skill development applications among the offering of eWellbeing services due to the importance of work-related competencies to the self-image – and therefore also wellbeing – of individuals.

Keywords: work engagement, staff development, technology industry, knowledge management, inequalities, occupations

Introduction

In modern times, work and technologies are constantly evolving — and technological change is inherently also changing the work itself. It is widely

accepted by scholars that we are now living on the edge of a new technological era, the start of the *Fourth industrial revolution* [1]. The digitalized world is having a cross-cutting effect on our everyday life and bringing new opportunities from the

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fields of machine learning, robotics, nanotechnology as well as from artificial intelligence [1,2]. The fourth industrial revolution and digitalization are affecting how we are doing work as well as where we are doing it. The demand for new kinds of skills and competencies are arising as an impact of new innovations and technologies. [3]

Every past industrial revolution — from steam power to mass production and to the computerization and automation — have had their effects on the labour markets. There is no reason to assume that this time would be an exception. New kinds of work descriptions will be born whereas the old ones will fade away due to the impact of digitalization and automation — however, the difference this time to the previous industrial revolutions is the speed of changes. Thus, new skills are vital in both old and new occupations. [4,5] In addition, it can be seen that this revolution will most likely affect differently to the different genders and as well as people from different age groups [6]. For example, currently, only 17 % of the almost 8 million ICT specialists are women. However, attracting more women to the ICT sector could lead to economic growth, with more jobs and increased GDP. [7]

Ergo, new skills are needed to make that revolution. The ICT industry is an area of high competencies as well as skills, and the field is characterized by a constant need to upgrade ageing capabilities. However, the problem is that currently, e.g., Finland is suffering from a severe labour shortage in the ICT industry. The estimated need for software professionals during 2017–2018, when this research was carried out, varied from 7,000 to 15,000 — and the need for new talents is growing yearly estimated by 3,800 people. However, a more fundamental problem is that only around 1,100 students are graduating in Finland from the

field of computer science and technology yearly. [8-10]

The labour shortage refers to a situation where there are not enough people to step into the industry. In this study, our point of departure to the previous literature is the focus on the skill level. We are addressing whether the problem of the labour shortage is the skill gap between software professional. I.e., is there the *War of Talents* between the software professionals. In addition, we seek to understand how employers are perceiving this phenomenon. We are approaching the discussion with the research question:

Research question: How is the skill polarization seen by the top management of ICT companies and how it occurs on the topic of a labour shortage?

In this study, we use the term and concept ‘skill polarization’ to describe the situation, where those capable with modern technologies are fought for, whereas those skilled with other technologies, such as obsolete frameworks, languages, and tools, are passed over in the labour market. This study differs from the previous studies on labour polarization by focusing on the internal structure of a single industrial field and specifically on skill polarization. Furthermore, we argue that the skill polarization will have an impact on work well-being in the modern information society. In addition, we propose the required development of skills and competencies to be added and discussed as a part of eWellbeing service offerings by the employees as well as independent organisations.

To answer the research question, we use the responses of the survey for top managers of Finnish software companies regarding the labour shortage in the industry. We present a qualitative thematic analysis of the open-ended responses (n=90) given

by the managers. The results show that highly talented software professionals seem to be able to choose the company they work for, and the respondents are perceiving that the largest companies are able to provide the best benefits as well as a high wage.

Background

The demand for high-skilled workers, people who usually possess a degree from a college, technical school, or university, has grown every decade hand in hand with industrial revolutions [11]. In addition, it has been shown that nowadays employees possess greater variety in skills and competencies compared, for example, with workers in the 1970s [12]. The cross-cutting effect of ICT is causing the situation, that the ICT industry is not the only industry and field which requires people with programming and technical skills. Furthermore, today's software professional is not only a technical expert but he or she also possesses new kinds of 'soft skills', such as self-direction, information-processing, problem-solving and communication [13].

The estimation is that in the next decades the need for more highly-skilled workers compared with the low-skill ICT labour will grow. [14]. For example, European Commission has stated that there are an estimated 756,000 unfilled vacancies for ICT professionals in the whole economy by the year 2020. [15] In developed countries, the ageing of the population has also its effect on the situation. More talented workers are retiring than there are new talents entering the job markets. [16] Therefore, it is not a surprise, that software professionals are nowadays said to be among the most hunted workers [17].

Because for the need of a skilled workforce, some researchers have been already talking about the global '*War for Talents*', which refers to employers' competition for employees [18,19]. World Economic Forum [6] has estimated that there are already now difficulties in recruiting talents for some positions, such as data analyst, network professionals and database and electro-technology engineers. In a broader view, World Economic Forum is estimating that the open vacancies for ICT specialists on a large scale are going to be harder to fill in the near future [6].

The labour and skill-shortage can have a negative effect on countries future success. For example, Nordic countries are in the danger to stall out from the lead of digitalization [20]. In addition, the ICT industry is the second-largest industrial field in Finland, after the paper and pulp industry, and it covers 11.4 % of Finnish national export yearly. Therefore, for future Finnish economic growth, securing skilled labour is going to be crucial. [21]

The labour shortage is one perspective for the situation whereas the lack of the right skills among ICT experts is another viewpoint. The concept of 'job polarization' refers to a development of job markets towards two endpoints: well-paid high-skill jobs and low paid least-skill jobs [22]. At the same time, jobs belonging to the middle of this spectrum are disappearing. This kind of development has been reported already in the 1980s in the U.S. [23] and from early on, technological change has been accounted as one of the reasons [24]. The development has since steadily continued in the U.S. [25,26] and a similar phenomenon has also been observed in Europe [27]. However, as discussed by Goos and Manning [22], this development is not only a result of skill-biased technological change; also, the amount of routine

manual and routine cognitive jobs have been decreasing [28].

While most of the previous studies have focused on nation-wide analyses, there are also analyses focusing on, e.g., the sub-national level [29,30]. However, in this paper, we are focusing on development inside a single industrial field instead of the general population.

Material and methods

The empirical material for this inquiry was collected via an electronic survey [31]. The questionnaire was sent by the association at the request of a local newspaper at the beginning of fall 2017. The association represents software entrepreneurs in Finland, and it has over 600 members, including software companies, their managers as well as the field's central influencers. The association was used as it has involved most of the software-intensive development companies in Finland; thus, the association represents well the whole industry.

The questionnaire contains two sections. The first part is about a company's vision for the forthcoming growth and the requirement of more labour was asked. The second part contains open-ended questions regarding the labour shortage's impact on the company. The questionnaire is available from the authors upon a request. The total number of answers was 160, which indicates that approximately one-fourth of the members responded to the questionnaire. In this study, we focus on the subset of 90 responses, which contained also written answers to the open-ended questions.

When the data was reviewed through the themes in open-ended answers, the division between the high- and less-skilled labour became a remarkable cutting-edge theme. This notion motivates this

study and gives the opportunity to focus on the *War of Talents* instead of the *War for Talents*.

To study this divide between high- and less-skilled labour, we use qualitative analysis of the open-ended answers. We focused on the subset of answers discussing or emphasizing this skill divide. The overall analysis follows the basic steps of the thematic analysis [32]. Two researchers, who were familiar with the dataset, identified the answers belonging to our subset. In the meetings of the authors, the subset was gone through and overall themes related to the phenomenon at hand was identified. As the results of the meeting, the themes were selected and agreed upon between all authors.

The responding companies represent well Finnish software industry; most of them are employing between 10-249 persons and having yearly total turnover under 50 million euros. Two respondents represent larger companies (over 250 employees) and a few represented microenterprises (less than 10 employees). A typical respondent was in a top management position (e.g., CEO, CIO, CTO). All answers were given in Finnish and the authors translated the presented quotations. Answers are treated confidentially and we have removed such details that could help to identify a company.

Results

In the following, the four found cross-cutting themes, arisen in the thematic analysis, are presented. The frequently appearing themes are the surplus of less-skilled developers, the lack of the right skills, competition for the high-skilled labour and unclear responsibility for developing the new competencies.

The surplus of less-skilled software professionals

There was a clear division in attitudes towards ‘high-skilled’ software professionals and ‘less-skilled’ software professionals. For example, those respondents, who said that they were not experiencing the labour shortage, commonly gave an explanation that there is already an abundance of offering in the less-skilled software professionals.

Overall, the main message was that the question is not about the shortage of labour, it is more about the skill gap and difficulties to find the highly skilled professionals. For example, some of the respondents reported that:

“There are enough basic-level programmers, but not necessarily enough those programmers who are skilled and able to understand modern platforms.”;

“There seems still to be some experts at the job markets. Especially in the resource rental market, there seems to be over-supply and low prices. [...] highly skilled labour is hard to recruit, even though there is workforce available.”;

and

“There are some basic-level experts [available in the job market] but experienced professionals are under the rock.”

The lack of the right kinds of skills

When the respondents were discussing the high-skilled experts, the previously acquired experience was mentioned often as well as the know-how on modern technologies, tools, and frameworks. The ability to learn new technologies was seen as a crucial aspect and if an expert was skilled already in some new technologies (e.g., AI, robotics, au-

tomation), it was seen as a significant benefit. Talking about the attractiveness of the professionals, respondents mentioned several times that they have been forced to recruit people under the set pre-requirements to be able even to fill the position. For example, a respondent notes that:

“Hard to find normal-level programmers, but so far I have found only when I have been ready to make compromises on the knowledge and experience”.

What data did not reveal was the level of expertise required by employees. Because the ICT industry is described as a field of high competence and fast development, the expected skill level is ought to timely and deep-level expertise demanding. Overall, it was seen from data that more advanced skills were looked for. However, what are the right or normal skills seem ambiguous and not well-defined.

War for talents

The labour shortage of software professionals and especially the lack of high-skilled professionals was also attributed to the fact that wage competition is also getting tougher. Especially respondents from small or medium-sized companies were saying that they cannot anymore compete of experts with salaries. On the positive side, when the competition with salaries is not seen as productive, the companies have turned their focus on work well-being issues. As pointed out by a respondent:

“Recruiting, especially finding more experienced developers, is difficult. On the other hand, competition from the experts forces us to pay attention to management and to the fact that the workplace also has enough to provide for the employees. When these

things are fine, it will ultimately affect the whole company's result. This also makes software firms leaders in the Finnish employers' scene".

In addition, it was also pointed out in single answers that the employers are often seeking 'unicorns', extremely skilled and yet cheap employees. Finally, several respondents pointed out the fear that the experts are active to change jobs and compete employers against each other's and that was also mentioned as one of the reasons why these respondents were not eager to invest in retraining. As discussed by a respondent

"The salary demand of available workers is beginning to rise unrealistically high. Too often a motivation for people who exchange jobs often is just raising wages, which is a strong signal that a person should not be hired — he will also easily switch to the next company".

Similar kinds of observations were reported also by another respondent, who stated that:

"It is important to pay attention to the employee's well-being at work because otherwise, the experts will go away. Wage growth is also significantly higher than the national average, almost 10 % per year".

However, as pointed out also in this answer, the positive consequence is that the companies are forced to focus on the well-being in the work in order to keep the high-skilled experts.

Unclear responsibility for the new skill development

Recruiting the new skills is one possibility to get new competence to the company but updating the

skills of already existing employees is going to be crucial for software companies' resilience already now and even more in the future. What was alarming, that respondents' companies were divided into two groups: whether they were interested to invest in retraining and competence building of less-skilled employees or not. As characterized by one respondent that:

"There is a specific problem on the software side that the competence is largely outdated in five years. Employers generally cannot afford or are not willing to retrain people to today's tools and requirements because it is considered a society's task".

Furthermore, it was pointed out in a few responses that it is possible that an employee changes the company after an expensive training. However, there were also those respondents emphasizing that competence building is something that employers should support and pay. For instance, a respondent reported that:

"The [Inter]net offers quite a lot of self-study material in the form of different courses. Our firm invest and pay these for employees".

Discussion and analysis

In the following, we present the key findings. It is followed by implications and a summary of the study.

Key findings

We will summarize the results of our research as follows:

- While there is still an overall labour shortage in the software industry, there seems

to be a constant supply for less-skilled software professionals whereas high-skilled professionals are highly sought for.

- High-skilled professionals are characterized by not only experience but also by competencies on— or ability to learn— modern technologies.
- High-skilled professionals compete employers against each other's for raising wages. In addition, they easily change employers, which is a reason why some of the firms are not interested to invest in training and competence building.

These three points from above are what we call the War of Talents in this paper. What was also seen as conclusions of this paper:

- The software companies, which want to attract highly skilled talents, are forced to put more effort into employer brand, work comfort and recruitment's processes. This applies to existing staff members also.
- Overall, it should be questioned whether the industry is suffering from the labour shortage in the ICT industry or from the skill shortage.

These notions describe the situation of the War for Talents, the war between software companies among skilled software professionals.

Implications

This research focused on the top-level managers' attitudes towards the skill gap and labour shortage of software professionals. In the data, we saw that the most cross-cutting theme was the polarization of software professionals and their skills. The

alarming finding was the attitudes towards retraining the already existing staff members. Some of the respondents were afraid, that those employees, who got the new skills and pieces of training, would also leave the company after they have been retrained. The retraining of the workforce is a challenging problem – it has been commonplace that employees are expected to train themselves in their free time or on special days offered by the company.

Still, what is representational for the fourth industrial revolution is the speed of change. To ensure the competence of ICT companies but also the working life abilities of already existing software professionals, new ways to retrain people for the new technologies is going to be crucial. If there are not equal opportunities for professionals to train themselves, the skill gap between professionals is going to grow bigger. More awareness for this is needed by professionals, employers, and governmental actors.

This discussion drives us to the case at hand. Already in 1998, Gini [33] noted that one cannot any longer easily separate work from an individual's self-image. He even noted, by following Descartes' famous statement, that "*Laboro ergo sum*" → I work, therefore I am. Furthermore, he notes "*We need work, and as adults we find identity and are identified by the work we do*" [33, p. 714]. That is, as Gini pointed out, work and work-related skills have an important role for individuals' self-image and, therefore, also in their comprehensive well-being.

Therefore, this study aims to raise awareness regarding the potential polarization of skills and its implications to the overall wellbeing of individuals in the information society. The *War of Talents* is expected to create inequalities and unhappiness in the well-being in the information society as illus-

trated in Figure 1. That is, it is likely that there will be a growing number of workers who are dissatisfied with their self-image and their job; whereas, at the same time the number of professionals – who are highly-valued, highly-distinguished and highly-salaried – would also grow. Thus, the skill and job polarization would potentially lead to a kind of a caste system where less-skilled in modern technologies are second-class citizens whereas high-skilled are fought for. It is also possible that the less-skilled would create threats to their own well-being due to the dissatisfaction with their work duties and skills.

This kind of development would have undesirable consequences for all stakeholders involved in the Fourth industrial revolution. Firstly, the workforce would feel unequal and threatened. Secondly, this could lead to comprehensive ill-being also affecting the life outside the workplace. Thirdly, inequality would ultimately also slow down the growth of companies due to the lack of and internal competition for the high-skilled professionals. Fourthly, a shortage of high-skilled developers could also prevent other industries to renew their information systems and improve productivity. This would be seen in slowing economic growth in the other industries.

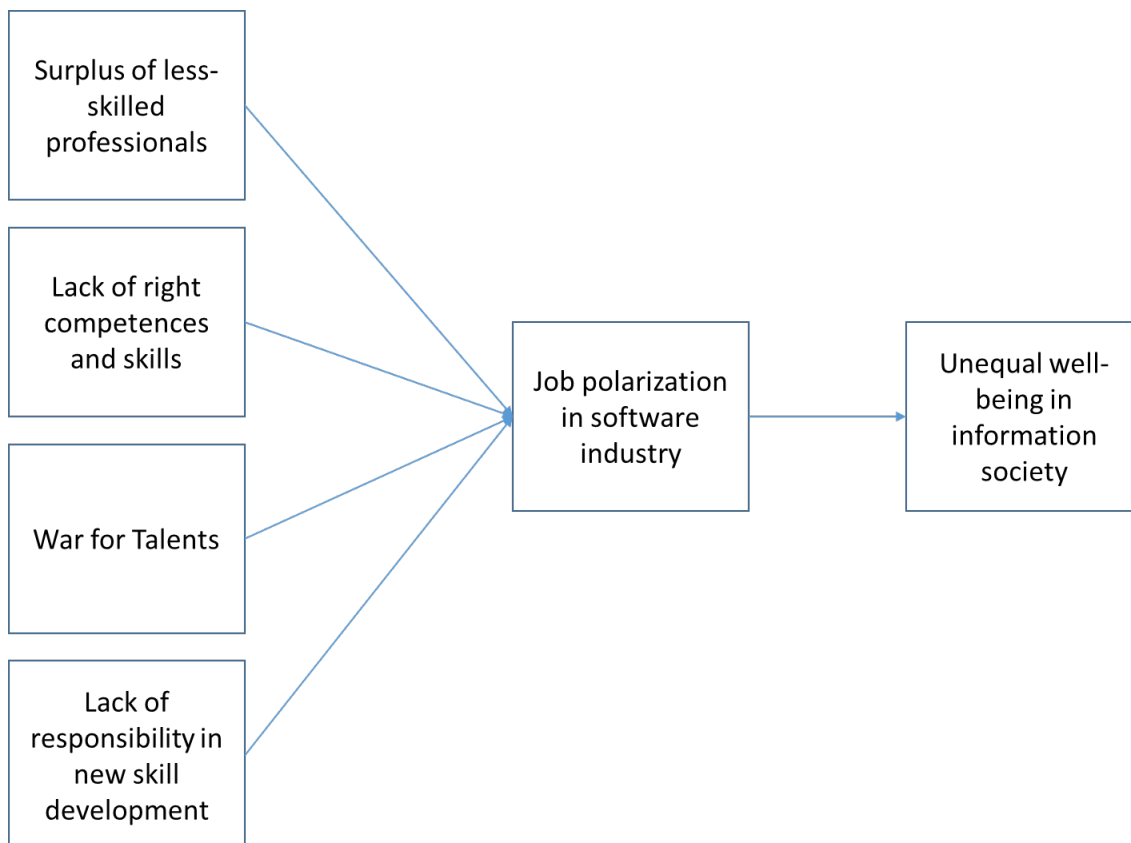


Figure 1. The four found phenomena leads to increasing job polarization in the software industry. Consequently, this promotes well-being inequalities in the information society.

As a solution for the potential threat, our proposition is to include skills and competency development as part of the eWellbeing application services. That is, as pointed out the work is an important factor for the self-image of the modern-day workers – and likely, even more important for highly-skilled workforce – and for treating one's wellbeing comprehensively, also the development of modern skills and competencies should be included.

Summary, limitations and future directions

This paper studied the skill polarization inside the software industry. Based on a survey, we found that there are signs of divergence between those highly skilled and fought for the experts of modern technologies. and those less-skilled experts (i.e., the War of Talents). This is a noteworthy observation as the software industry and the ICT field are widely considered as high-skill industry. This kind of development can lead to significant inequalities in the well-being in the work in the information societies. To prevent this growing threat, we propose including skill and competency development as part of the eWellbeing application service portfolios due to the importance of work to the self-image of modern workers.

This study is naturally limited by its method and focus on a single country. Often people, who are the most interested in the phenomenon under study, answer the questionnaire and this can create a bias to the responses. Furthermore, Finland's

software industry has its own characteristics (e.g., the implications of the post-Nokia era) which limits direct generalization to other economies.

Nevertheless, this study opens interesting views for future inquiries. For example, it would be beneficial to conduct empirical investigations amongst the employees in the field of ICT. How do they see and feel the war of talents? Do they have the resources to develop their skills and competencies? In other words, how is the War of Talents affecting the well-being of the professionals in the field of ICT? Furthermore, adding skill and competency development into eWellbeing offering requires further attention.

One of the questions is also the level of skills demanded of software employees. What is the 'normal' skill level and what are those high skills employers are waiting for? This is important for those software professionals, who try to resolve by themselves what kind of new skills they want or need to possess.

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Conflict of interest

The authors declare that there are no conflicts of interest.

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