The War of Talents in Software Business

Polarisation of the software labour force?

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Abstract. The modern business world is undergoing digitalisation in fast pace and, therefore, more jobs are born in the field of information and communication technology (ICT). Only in Finland, one of the leading countries in digitalisation, there is an estimated need for 7,000–15,000 software professionals while the demand for skilled labour is growing every year. The skill set required from professionals is also changing and different skills are needed in the future. ICT companies are facing problems of finding highly skilled professionals to ensure their rapid growth and new innovations. At the same time, when companies are fighting for the talents, there are ICT professionals unemployed. Offered and requested skills are not meeting in the ICT industry, which can lead to bigger problems in the eyes of workers and companies. This study focuses on the skill polarisation between software professionals at the war of talents by using data collected with a survey (n=90) to software businesses. The results reveal some signs of ongoing skill polarisation in the field and its possible impacts are discussed.

Keywords: Software business · Skill · Competence · Skill polarisation · War for talents.

1 Introduction

As pointed out already by an ancient Greek philosopher Heraclitus, over two millenia ago, *"everything changes and nothing stands still"*. This old wisdom, that the only constant is the change itself, remains true even for the modern day working life. Both the job titles and the duties of a single job are constantly evolving. However, changes in the work life are a part of a bigger picture. It is widely deemed that we are now living on a new technological era or a start of the fourth industrial revolution [1]. Currently, the digitalised world is affecting every aspect of our lives and it is expected to create new possibilities from machine learning, robotics, nanotechnology as well as from artificial intelligence [1, 2]. Even the work itself is digitalisating and demands for skills and competencies of new kinds are arising as an impact of new technologies and innovations [3].

Every industrial revolution has affected the labour market and there are no reasons to estimate that this revolution would be an exception. New work duties will be born and old ones will fade out as an impact of automatisation and digilisation. Therefore, new skills are vital in both old and new occupations. In addition, it has been discussed that this revolution will most likely affect differently to the women and men as well as people from different age groups [4]. Right now only 17 % of the almost 8 million ICT specialists are women. It is said that because of currently unequal share of caring and house works, women will have less time to invest in training and life-long learning, which is crucial in the fast changing ICT sector and jobs. Still, attracting more women to ICT sector is estimated to lead to economic growth, with more jobs and increased GDP. [5]

However, there is a problem at our hands right now: Where to find people, with those new skills, to be the changemakers? For example, in Finland, one of the leading countries in digitalisation and innovations [6], the estimated need for software professionals during 2017–2018 varies from 7,000 to 15,000 — in addition, the need is estimated to grow yearly by 3,800 person [7, 8, 9]. Authors of this study have already researched how software companies are perceiving the labour shortage and investigated that there is an ongoing *war for talents* between software companies in Finland [10, 11].

This paper turns the perspective around and studies the polarisation of labour force in the software industry. In this study, we are addressing whether there is a *war of talents* between the software professionals and how the employers are perceiving this phenomenon. That is, we study the signs of skill polarisation inside the workforce in the software industry. In this study, by 'skill polarisation' we are referring to a development process where those capable with modern technologies are fought for, whereas those skilled with other technologies, such as obsolete frameworks, are passed over. This study departs from the previous studies on the labour polarisation by focusing on the internal structure of a single industrial field and specifically on the skill polarisation.

To answer the research objective, we use the responses of the survey for the top managers of Finnish software companies regarding the labour shortage in the industry. We are interested to see if there really is an on-going war of talents between software professionals and why and how software industry see the situation. We present a qualitative thematic analysis to 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 largest companies are able to provide the best benefits as well as a high wage. Yet, also the opposite seems to be true. Often, it is mentioned that there are applicants that are skilled with obsolete technologies.

It is worthwhile to note that software business is widely considered as an industrial field of highly skilled labour. As the work is seen as an important part of modern people's identity and life, an ongoing polarisation in a high-skill field might endanger the well-being of employees in the information society. That is, the polarisation process might produce a group of highly educated and experienced ICT employees who are unable to find work, which in the end will affect the well-being of the individuals of this group. To fight against this trap of skills, actions are needed from the governmental, academic as well as from the private stakeholders.

The rest of this paper is structured as follows. First, the background is presented in Section 2 and it is followed by a description of the empirical data acquisition process in Section 3. Section 4 presents the results and the impacts of this study are discussed in Section 5. Lastly, Section 6 concludes the study.

2   Background

Every industrial revolution has affected our society vastly. New kind of business opportunities, jobs and demands for new skills had arisen first from the mechanisation of industry, then from the mass production, after that from the automation and robotics in industry and now from the digitisation and smart solutions. Every industrial revolution has affected the jobs, erased old occupations and gave birth to new ones. However, the differentiating issue this time is the speed of changes, and that is causing more problems than excepted from the learnings of the past revolutions. [12, 13]

A high-skilled worker usually has a degree from a college, technical school or university. Previous research has shown that demands for high-skilled labour has grown every decade hand in hand with every industrial revolution [14]. It has been studied that nowadays an employee possess greater variety in the skills and competencies compared, for example, with a worker at the 1970s [15]. The software business is not the only industrial field which needs ICT professionals who can code, make applications or analyse data. This revolution, at the latest, will make it clear that ICT is, nowadays, everywhere — and the need for skilled ICT workers is everywhere. Today's software professional is not only a technical expert, he also posses new kinds of 'soft skills', such as self-direction, information-processing, problem-solving and communication [16].

The need for the skilled workforce has already lead some of the researchers to talk about a global 'war for talents' which refers to employers' competition for employees [17, 18]. For example, World Economic Forum has stated that there are already now difficulties in order to recruit talents for some job families, such as data analyst, database and network professionals, and electrotechnology engineers. [4] World Economic Forum is also forecasting that open vacancies for ICT specialists in a large scale are going to be harder to fill in the near future [4].

European Commission's study has estimated that by 2020 there will be 756,000 unfilled vacancies for ICT professionals in the whole economy. [19] It is also estimated that in the next decades there is going to be growing demand especially for more advanced digital skills compared with the low-skill ICT labour. [20] In developed countries, the ageing of the population has also its effect on the situation. More talented workers are retiring than there are new ones entering to the job markets. [21] Therefore, it is not a surprise, that software professionals are nowadays said to be one of the most hunted occupations [22].

In addition, those high-skilled experts, including software professionals, are in the sight of every growth-seeking country who wants to ensure a high level of know-how in their country. A large number of countries, among the leading immigration countries (e.g. USA, Canada and Australia), are polishing their talent attraction management strategies and political moves for talent migration. For instance, Sweden and the Netherlands have tax discounts for highly educated workers, Germany and France have launched

'scientific visa' and 'green cards' to attract high-skilled workers from the countries not belonging European Economic Area (EEA) [23, 24]. All of these actions have been done to prevent major problems in each country's economics and abilities to produce innovations, which have been seen to be in problems if the right kind of work force would be missing.

Thus, the lack of right skills and competencies is a global problem and its effect are already visible in some countries. Finland, for instance, is evidently facing a severe labour shortage in the ICT industry. The need for software professionals is already now varying from 7,000 to 15,000 and the estimated need for new workers in the industry is growing 3,800 per year. However, a fundamental problem is that only around 1,100 students graduate from the field of computer science and technology yearly. [7, 8, 9] Therefore, Finnish software companies are forced to work overtime and limit their growth expectations. [7, 11]

There are signs that Finland might be losing its potential for being one of the leading countries in digitalisation. Also, this can be the case with other top countries, most of them from the Nordics. [25] In global rankings, Finland has also lost its place in top 5 innovative countries[1]. It cannot be stated that that is because of the labour shortage in the software industry; however, it may have been among the one of the reasons as the ICT industry is fuelling innovations in other industrial fields with its solutions. In addition, Finland does not have a change to lose in this competition because already now the ICT industry is the second largest industrial field in the country, after the paper and pulp industry, and it covers 11.4 % of Finnish national export yearly. [26]

Next, we move our discussion to the polarisation of job markets. This is a useful research area to explain and understand the development in the software industry. The concept of *'job polarisation'* refers to a recent development of job markets towards two end-points: well-paid high-skill jobs, and low paid least-skill jobs [27]. At the same time, jobs belonging to a middle of this spectrum are disappearing. This kind of development has been reported already in the 1980s in the U.S. [28] and from early on, the technological change has been accounted as one of the reasons [29]. The development has since steadily continued in the U.S. [30, 31] and the similar phenomenon has also been observed in Europe [32]. However, as discussed by Goos and Manning [27], this development is not only a result of skill-biased technological change; also, the level of routine manual and routine cognitive jobs have been decreasing [33].

While the majority of the previous studies have focused on nation-wide analyses, there are also analyses focusing on, e.g., the sub-national level [34, 35]. However, in this paper, we focus on development inside a single industrial field instead of general population. Yet, the extant literature of job polarisation might help to explain and understand the potential consequences of polarisation inside an industrial field. In our case, we focus on the 'skill polarisation' which refers to the development of two end-point categories for employees: those who are highly skilled in relevant modern technologies, and those who are skilled yet in, e.g., obsolete technologies.

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[1] World Economic Forum. "South Korea and Sweden are the most innovative countries in the world ". https://www.weforum.org/agenda/2018/02/south-korea-and-sweden-are-the-most-innovative-countries-in-the-world/. Accessed April 10, 2018.

3   Research Process

The empirical material for this inquiry is collected via an electronic survey [36] sent to the members of the Finnish Software Industry & Entrepreneurs Association (*Ohjelmis-toyrittäjät ry*). 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 questionnaire was sent by the association by the request of Helsingin Sanomat[2] at the beginning of the fall 2017.

The questionnaire consisted of two parts. In the first part, a company's vision for the forthcoming growth and requirement of more labour was asked. In the second part, open-ended questions regarding the labour shortage's impact on the company was presented. Overall, 160 answers were gathered, thus, indicating that approximately one-fourth of the members responded to the questionnaire.

This study continues the work done previously by us in [10, 11]. In [10], we studied how the Finnish software businesses perceive the labour shortage in the field of ICT with a quantitative analysis. We showed that there are signs of the labour shortage influencing on the growth and innovations in the field. In [11], we used a qualitative analysis to identify the reasons and consequences of the labour shortage.

During the analyses of the data, it was noted that frequently appearing theme in the open-ended answers is the division between the high- and less-skilled labour. This division motivates this study and this paper departs from the previous ones by focusing on the *'war of talents'* instead of the *'war for talents'*.

To study this divide between high- and less-skilled labour, we use a qualitative analysis of the open-ended answers. We focused on the subset of answers discussing or emphasising this skill divide. The overall analysis follows the basic steps of the thematic analysis [37]. Two researchers, who are familiar with the dataset, identified the answers belonging to our subset. In the meetings of the authors, the subset was went through and overall themes related to phenomenon at hand was identified. As the results of the meeting, the themes were selected and agreed between all authors.

All respondents were numbered, from #1 to #90, and in the direct quotations, we are identifying different respondents with the unique identifier. All answers were given in Finnish and the presented quotations were translated by the authors. Finally, as all answers are treated confidentially, we have removed such details that could help to identify a company.

4   Results

In the responses of the top level managers, a clear division between 'high-skilled' software professionals and 'less-skilled' software professionals. Among those respondents, who have not perceived the labour shortage, a commonly given explanation was that there is abundance of offering in the less-skilled software professionals whereas it is hard to find the highly skilled professionals. For example, respondents reported that:

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[2] Kempas, K. "Koodareita haetaan yhä useammin ulkomailta, koska Suomessa ei riitä osaajia – jotkut yritykset haluavat olla 'sataprosenttisesti suomalaisia'". Helsingin Sanomat, October 5th, 2017.

- *"There are enough basic-level programmers, but not necessarily enough skilled and able to understand modern platforms."* (ID #50);
- *"There seems still to be some experts on the market. Especially in the resource rental market, there seems to be over-supply and low prices. [. . .] highly skilled labour is hard to recruit, even tough there is workforce available."* (ID #83); and
- *"There are some basic-level experts* [available in the job market] *but experienced professionals are under the rock."* (ID #48).

Highly skilled professionals were characterised by, on one hand, the know-how on modern technologies, tools and frameworks. On the other hand, experience was often mentioned. Several times the respondents mentioned 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 points out that it is *"[h]ard 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"* (ID #30).

However, it is a worth noting that experience alone is not all as there is a mismatch of skills offered and requested. For a simple example, please consider the following. Due to the boom of Nokia's phones in the early 2000s, there are lots of those skilled with, e.g., Symbian operating system whereas the companies are nowadays looking for Android and iOS professionals. Also new technological paradigm changes, such as cloud computing and robotic process automation, have emerged in the last few years and the experience of the previous generation's tools, processes and frameworks is no more as valuable as it used to be.

As a consequence of the labour shortage and especially on the lack of high-skilled professionals, several respondents report that salaries of the high-skilled professionals have been started to grow over the limits. Therefore, several respondents pointed out that small or medium-sized companies 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, *"[r]ecruiting, 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"* (ID #25).

On the negative side, companies were divided whether to invest into retraining and competence building of less-skilled employees or not. As characterised by one respondent that *"[t]here is a specific problem on the software side that the competence is largely outdated in five years. Employers generally can not afford or are not willing to retrain people to today's tools and requirements because it is considered a society's task"* (ID #61). 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 emphasising 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"* (ID #70).

In addition, it was also pointed out in single answers that the employers are often seeking for 'unicorns', extremely skilled and yet cheap employees. Finally, several respondents pointed out that the experts are active to change jobs and compete employers against each others. 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"* (ID #14). Similar kinds of observations were reported also by other 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"* (ID #64). 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.

5 Discussion

We recapitulate our study's key findings in the following three observations:

– While there is an overall labour shortage in the software industry, there seems to be a constant supply for less-skilled software professionals whereas high-skilled professional are highly sought for.
– High-skilled professionals are characterised, not only by experience but also by competencies on — or ability to learn — modern technologies.
– High-skilled professionals compete employers against each others for raising wages. Also, they easily change employers which is a reason why some of the firms are not interested to invest into the training and competence building.

Altogether, these hints on the possible polarisation of the labour inside the software industry. However, due to the overall labour shortage, also less-skilled are, at least now, able to get jobs. Nevertheless, the miss-match of skills and jobs is creating a market for skilled. During the war for talents, skilled workers can bid between employees and at the same time less-skilled professionals have to take what is offered — even if it is a job where overtime work is done because of the lack of resources and labour shortage. Those less-skilled workers will find themselves at the skill trap — to success in the field of ICT they should master new technologies and skills but they do not get enough support and retraining from their present employees because of time and resource limits. Thus, the war of talents can lead to situation where the skill and competence development of some of the ICT professionals slows down. This could lead to seizing of development level of the ICT professionals' skills and competencies in general, which is not ideal.

Meanwhile, companies are looking for affordable yet highly skilled people with competence in specific technologies. In the survey, it became clear that these people are rare and hard to find. It could be stated, that in the war of talents these people are like *unicorns* — mythical creatures that simply do not exist. Highly skilled people seem to know that they are the ones that everybody needs and wants, which raises their expectations about the compensation as well as other benefits. However, it has also become apparent that monetary compensation is not enough — also the quality of the

workplace is an important factor affecting the desirability of the workplace. Companies working in the ICT field have become known for breaking the model of traditional workplace by focusing on comfort and bringing pleasure to offices.

Creating playgrounds for adults is not all that these companies are doing. Perhaps a more sustainable approach is taken by companies that offer training and competence building as part of the employment. However, as multiple respondents stated, training requires a lot of resources, which companies are already short of because of the labour shortage. It was hinted that training could also be a waste if workers choose to leave the company, which often is the case with high-skilled workers. On one hand, training the employees could help to prevent polarisation by narrowing the gap between less- and high-skilled workers.

On the other hand, this phenomenon could also put the companies in unequal positions, since bigger companies are more likely to be able to invest in the salaries and training of their employees as well as to well-being and activities in the workplace. Smaller companies often lack the extensive resources of time and money. Furthermore, the responses from smaller firms emphasise chronic hurry, which might imply less time is left for competence building of employees. However, smaller companies do have the advantage of lower hierarchies, which could mean that they are able to react to the desires of their employees faster than bigger companies. Since changes require resources, there is a limit to which they can be acted upon especially in the small companies. Thus, competition for high-skilled personnel could lead to increasing inequality between companies.

The field of ICT is drastically fast-phased in its development. Development of old and new technologies requires a lot of skills, competencies as well as company resources. Vacuum of skilled employees has created a suitable ground for the war of talents, which could lead to a decrease of the overall skill and competence level. War of talents does not particularly encourage skilled people to update their skill sets and competencies — especially when training is seen as something that binds the limited resources of a company. This could lead to a situation where today's skillful and competent people are tomorrow's outdated relics.

If the polarisation becomes reality, it could result in a situation where the field has only a little true knowledge and a lot of people with none to mediocre skills and competencies. This could lead to increasing the turn-over of employees, decreasing job satisfaction and raising levels of unemployment. The war of talents might become a war of shooting stars, a war between people at the peak of their skills and competencies, but who are not able to up-date their skills.

Consequences of this phenomenon can be really harmful to the whole industry of IT. However, to understand the war of talents and its impacts on the IT, we should research it further. It would be beneficial to conduct empirical investigations amongst the employees in the field of IT. How do they see and feel the war of talents? Do they have the resources to develop their skills and competencies? Do they they feel that they can be the winners in this war? In other words, how is the war of talents affecting the well-being of the professionals in the field of ICT?

Finally, this study is naturally limited by its method and focus on a single Nordic country. As it is known, often people, who are the most interested in the phenomenon

under study, answer to the questionnaire and this can, therefore, 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 makes direct generalisation to other economies hard. Nevertheless, this study opens interesting avenues for future inquiries.

6 Conclusions

This paper studied the polarisation employees inside the software industry. Based on an analysis of a survey, we found that there are signs of divergence to those highly skilled and fought for the experts of modern technologies and to 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 a high-skill industry. This kind of development can lead to significant inequalities in the well-being in the work in future information societies.

Acknowledgements

References

[1] Schwab, K.: The fourth industrial revolution. Foreign Affairs (January 2018), https://www.foreignaffairs.com/articles/2015-12-12/fourth-industrial-revolution, accessed January 23, 2018

[2] Hermann, M., Pentek, T., Otto, B.: Design principles for industrie 4.0 scenarios. In: 2016 49th Hawaii International Conference on System Sciences (HICSS). pp. 3928–3937 (2016). https://doi.org/10.1109/HICSS.2016.488

[3] OECD: New Markets and New Jobs. No. 255 in OECD Digital Economy Papers, OECD Publishing (2016). https://doi.org/10.1787/5jlwt496h37l-en

[4] World Economic Forum: The Future of Jobs: Employment, Skills and Workforce Strategy for Fourth Industrial Revolution. Global Challenge Insight Report, World Economic Forum, Geneva, Switzerland (2016)

[5] European Institute for Gender Equality (EIGE): Women and men in ict: a chance for better work-life balance (2018), http://eurogender.eige.europa.eu/system/files/events-files/women_and_men_in_ict_presentation.pdf, accessed April 8, 2018

[6] Digibarometri 2016. Helsinki, Finland (2016), http://teknologiateollisuus.fi/sites/default/files/file_attachments/digibarometri-2016.pdf

[7] Luoma, E., Rönkkö, M., Tahvanainen, S.: Ohjelmistoyrityskartoitus 2017. (Finnish software industry survey 2017) (2017), http://www.softwareindustrysurvey.fi/wp-content/uploads/2017/10/Oskari2017-vfinal.pdf, accessed January 23, 2018.

[8] Tieto- ja viestinttekniikan ammattilaiset TIVIA ry: Ohjelmisto-osaaminen Suomen talouskasvun ja uudistumisen jarruna – vuonna 2020 Suomesta puuttuu 15 000 ohjelmistoammattilaista (2017), http://www.tivia.fi/lehdistotiedote/ohjelmisto-osaaminen-suomen-talouskasvun-ja-uudistumisen-jarruna, press release

[9] Naumanen, M., Leinonen, A., Lehtoranta, O., Loikkanen, T., Nieminen, M., Pelkonen, A., Pellinen, P., Parkko, J.: Tekbaro 2017. Tekniikan akateemiset TEK, Helsinki, Finland (2017)

[10] Hyrynsalmi, S.M., Rantanen, M.M., Hyrynsalmi, S.: The war for talents in software business: How Finnish software companies are perceiving and coping with the labour shortage? (2018), manuscript in review.

[11] Hyrynsalmi, S.M., Rantanen, M.M., Hyrynsalmi, S.: Do we have what is needed to change everything? A survey of Finnish software businesses on labour shortage and its potential impacts. In: Proceedings of 13th IFIP TC9 Human Choice and Computers Conference: "This Changes Everything". pp. 1–12 (2018)

[12] Katz, L.F., Margo, R.A.: Technical change and the relative demand for skilled labor: The united states in historical perspective. Working Paper 18752, National Bureau of Economic Research (February 2013). https://doi.org/10.3386/w18752

[13] Frey, C.B., Osborne, M.A.: The future of employment: How susceptible are jobs to computerisation? Technological Forecasting and Social Change **114**, 254–280 (2017). https://doi.org/10.1016/j.techfore.2016.08.019

[14] Falk, M., Biagi, F.: Relative demand for highly skilled workers and use of different ict technologies. Applied Economics **49**(9), 903–914 (2017). https://doi.org/10.1080/00036846.2016.1208357

[15] Becker, S.O., Muendler, M.A.: Trade and tasks: an exploration over three decades in germany. Economic Policy **30**(84), 589–641 (2015). https://doi.org/10.1093/epolic/eiv014

[16] Spiezia, V.: Jobs and skills in the digital economy. OECD Observer (2016)

[17] Chambers, E.G., Foulon, M., Handfield-Jones, H., Hankin, S.M., Michaels, E.G.I.: The war for talent. The McKinsey Quarterly **1**(3), 44–57 (1998)

[18] Beechler, S., Woodward, I.C.: The global 'war for talent'. Journal of International Management **15**(3), 273–285 (2009). https://doi.org/10.1016/j.intman.2009.01.002, the Emerging CEO Agenda in Multinational Companies

[19] European Comission: The Digital Single Market – State of Play. European Union (2017). https://doi.org/10.2759/746724

[20] Berger, T., Frey, C.B.: Digitalization, jobs and convergence in europe: Strategies for closing the skills gap. Tech. rep., University of Oxford (2016)

[21] Mahroum, S.: Europe and the immigration of highly skilled labour. International Migration **39**(5), 27–43 (2001). https://doi.org/10.1111/1468-2435.00170

[22] Lehner, F., Sundby, M.W.: ICT skills and competencies for SMEs: Results from a structured literature analysis on the individual level. In: Harteis, C. (ed.) The Impact of Digitalization in the Workplace: An Educational View, pp. 55–69. Springer International Publishing, Cham (2018). https://doi.org/10.1007/978-3-319-63257-5_5

[23] Chaloff, J., Lematre, G.: Managing highly-skilled labour migration - a comparative analysis of migration policies and challenges in oecd countries. OECD Social, Employment and Migration Working Papers, No. 79 (2009). https://doi.org/10.1787/225505346577

[24] Bauer, T.K., Kunze, A.: The demand for high-skilled workers and immigration policy. IZA Discussion Paper No. 999; RWI: Discussion Papers No. 11. (2004)

[25] Chakravorti, B., Bhalla, A., Chaturvedi, R.S.: 60 countries' digital competitiveness, indexed. Harvard Business Review (2017)

[26] Haaparanta, P., Tamminen, S., Heikkinen, S., Aunesluoma, J., Nilsson Hakkala, K., Kiviluoto, J., Lavikainen, K., Rissanen, A.: 100 vuotta pientä avotaloutta – Suomen ulkomaankaupan kehitys, merkitys ja näkymät. Tech. rep., Valtioneuvoston selvitys-tutkimustoiminta (2017)

[27] Goos, M., Manning, A.: Lousy and lovely jobs: The rising polarization of work in Britain. The Review of Economics and Statistics **89**(1), 118–133 (2007). https://doi.org/10.1162/rest.89.1.118

[28] Bluestone, B., Harrison, B.: The growth of low-wage employment: 1963-86. American Economic Review **78**(2), 124–28 (1988)

[29] Bluestone, B.: The Polarization of American Society: Victims, Suspects, and Mysteries to Unravel. Twentieth Century Fund Press, New York (1995)

[30] Autor, D.H., Katz, L.F., Kearney, M.S.: The polarization of the US.S. labor market. The American Economic Review **96**(2), 189–194 (2006)

[31] Autor, D.: The Polarization of Job Opportunities in the U.S. Labor Market: Implications for employment and earnings. The Brookings Institution, Washington DC (2010)

[32] Goos, M., Manning, A., Salomons, A.: Explaining job polarization: Routine-biased technological change and offshoring. The American Economic Review **104**(8), 2509–2526 (2014)

12

[33] Autor, D.H., Levy, F., Murnane, R.J.: The skill content of recent technological change: An empirical exploration. The Quarterly Journal of Economics **118**(4), 1279–1333 (2003)

[34] Abel, J.R., Deitz, R.: Job polarization and rising inequality in the nation and the new york-northern new jersey region. Current Issues In Economics and Finance **18**(7), 1–7 (2012)

[35] Terzidis, N., van Maarseveen, R., Ortega-Argilés, R.: Employment polarization in local labour markets: The dutch case. Tech. Rep. 358, CPB Netherlands Bureau for Economic Policy Analysis (2017)

[36] Dillman, D.A.: Mail and Internet Surveys: the Tailored Design Method. Wiley, New York (2007)

[37] Braun, V., Clarke, V.: Using thematic analysis in psychology. Qualitative Research in Psychology **3**, 77–101 (2006), http://eprints.uwe.ac.uk/11735