The labour market for the port of the future : a case study for the Port of Antwerp

The Job Market for the Port of the Future. A case study for the Port of Antwerp

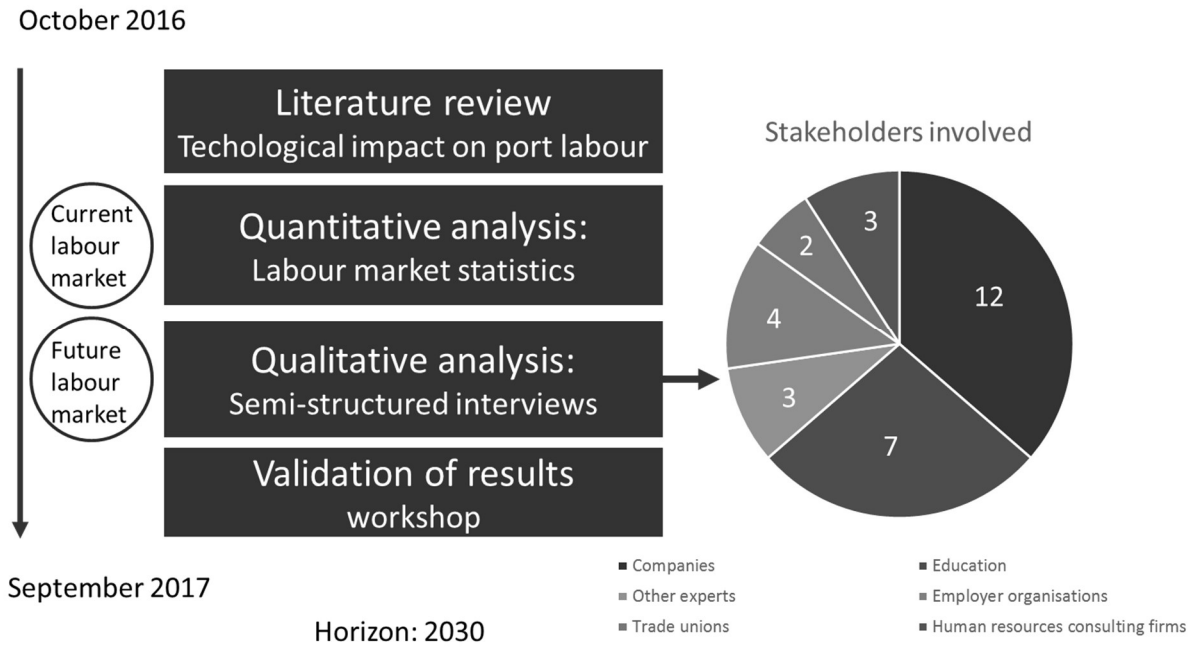
ABSTRACT

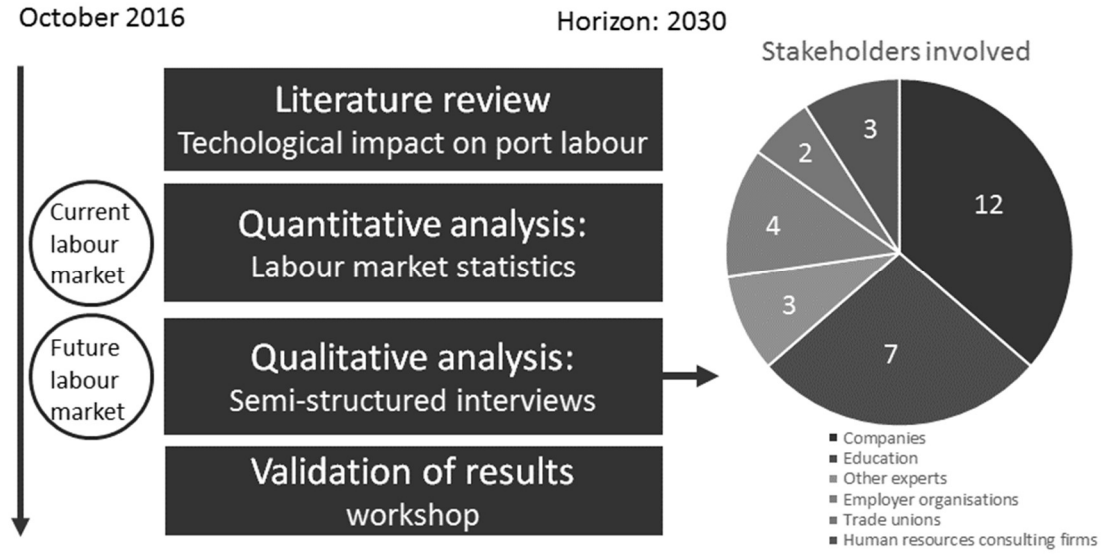
Major changes in the job market are currently observed, among others a consequence of the introduction of information and communication technology (ICT) in port areas. The question is how important the mismatch is between supply and demand for jobs, skills and competences, as a consequence among others of the above-mentioned changes. From literature, general trends in the job market are identified and their impact is translated to new trends in ports. The aim of the research is threefold: mapping the eventual mismatch in terms of employment, examining whether technological innovations (ICT and automation) have an impact on the future professions and specialisations and identifying the skills that need to be developed by education. The case is the maritime and non-maritime cluster in the port of Antwerp looking forward at a 2030 horizon. Next to conducting literature review, the study analyses quantitative data on the characteristics of employment in the port of Antwerp provided by the social security administration. Moreover a qualitative analysis through interviews was done in close cooperation with the port community, including port companies, port associations and educational institutes. The main results are threefold. First, the appearance of a polarised job market, where due to ICT introduction and automation, a lot of middle-paid paperwork jobs disappear. Second, that jobs on the floor will be more and more assisted by robotics and data applications and analysis, including use of machine learning and artificial intelligence. Third, that management jobs will become more and more complex with multi-skilling becoming a key. Therefore training programmes must include new skills like ICT, but also soft skills like teamwork and communication. Special attention is needed to motivate and host females and non-natives in the port job market.

KEYWORDS

Maritime cluster, innovation, information technology, job market, competences, gender, port of Antwerp

GRAPHICAL ABSTRACT





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1. More topic- or degree-transcending programs
2. Other skills than ICT
3. Avoid polarization through re-training
4. Learning between generations
5. Modern, women-friendly company culture
6. ICT skills in education
7. Keep attracting young people
8. Multi-job skilling and continuous learning

HIGHLIGHTS

- The impact of information technology on the job market in ports is disruptive.

- The mismatch and challenges in supply and demand of employment, skills and competences in the port of Antwerp in the next 10 year is considerable.
- The future port job market is polarized: the midfield administrative staff will mostly disappear due to ICT introduction.
- Education has to take into account that soft skills, like communication, teamwork, client orientation, flexibility and responsibility are as important as sector-specific knowledge to work in environments supported by robotics and data applications.
- The growing complexity of management processes in ports requires dedicated high level training programmes for the maritime, port and logistics sector.
- Special attention is needed to motivate and accept females in the port job market.

1. INTRODUCTION

In recent years, people following news flashes from seaport communities are submerged by the presented series of innovation initiatives. The dances of automated stacking cranes, the promises of external skeleton suits, the demonstration of autonomous vehicles and the opportunities offered by data sharing, the internet of things and blockchain are only a few examples. Innovation in ports involves production, process, marketing and organizational initiatives in firms acting in innovative infrastructural, institutional and educational environments. These technological, organizational and regulatory innovation initiatives are needed in order to obtain an increasingly efficient port handling, but also increasing safety, well-being and sustainability are high on the agenda (Vanelslander et al., 2015). Without any doubt, the impact on the job market in the future ports will be considerable. However, ports have been lagging behind for a long time and even today some seemingly obvious innovations are hardly implemented (Gubbi et al., 2014; Meersman et al., 2016; Carlan et al., 2017). Reasons for this are various: lack of capital, lack of skills, lack of trust, etc. (Acciaro et al., 2018).

In this paper, we map the challenges eventual mismatch in terms of employment, examine whether disruptive technological innovations (digital ICT and automation) have an impact on the future professions and specialisations and identify the skills that need to be developed by education, all at a horizon 2030[1]. This topic at the intersection of the scientific fields on job markets, innovation and ports, is a research gap that is definitely worthy more attention due to the economic importance of ports and the numerous jobers concerned all over the world. Considering innovation and port areas, mainly advances in information and communication technology (ICT) and robotics are important, and especially the effects of ICT introduction and automation in the maritime cluster are taken into account. The latter two concepts will also be the meaning of 'innovation' as used further in the text.

The paper continues by presenting the case of the port of Antwerp together with data and applied methodology. Next, we present, based on literature, an overview of trends in the job market due to innovation through information technology, followed by the impact on job markets of ports. The results come in four steps: the quantitative results from the analysis of social security data; the results coming from interviews with firstly stakeholders in the port area and secondly from interviews with educational institutes; lastly the results from a workshop involving the Antwerp port and job market community, dedicated to validating all the resulting outcomes. The conclusions come together with implications for both port companies and port authorities and suggestions for further research.

2. CASE STUDY AND METHODOLOGY

This section first presents the case study that is used for analysis in this paper. Furthermore, the methodology used to conduct the research is presented.

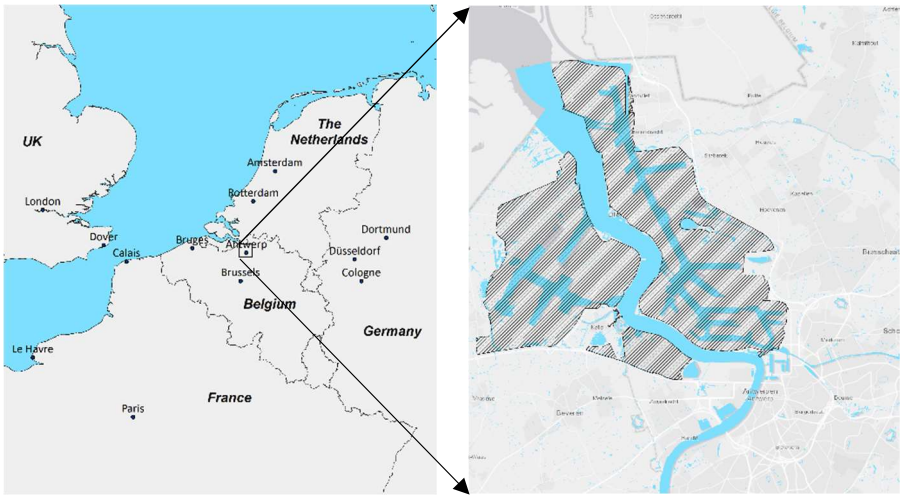
2.1 CASE STUDY PORT OF ANTWERP

As a case study, the scope of the research is the port area of Antwerp. The port of Antwerp, strategically located at the river Scheldt, is the most extensive port area in the world. The total area amounts to 13,057 hectares, of which 1,992 hectares of water surface. The Flemish government determined the contours of the Antwerp port area in the regional spatial

[1] A longer horizon does not make sense, as additional years bring more uncertainty, especially in this very quickly evolving theme of ICT innovation.

implementation plan 'Demarcation of the seaport area of Antwerp'. Within these limits, the research is conducted (Figure 1) (Port of Antwerp, 2017). The port of Antwerp is an important job generator for the province of Antwerp, and by extension for Flanders and Belgium. Furthermore, the port of Antwerp is the second port in Europe in tonnage and includes the second largest chemical cluster in the world (Vanthillo et al., 2018 ; Essenscia, 2015; We are chemistry, 2016).

Figure 1: Port of Antwerp in Western Europe (own composition)



Dashed= dedicated port area

In 2015, 142,348 people worked in the port, of which 60,656 are direct jobs (Table 1). From 2000 to 2015, a slight drop in employment in the Antwerp port area is visible. Over the 2000-2015 period, the total number of maritime vessels entering the port decreased to 14,417, while the total volume handled by the port of Antwerp climbed to 208,419 million tons. The expanding scale of the container business explains this combined observation. (Lagneaux, 2005; Mathys, 2012, 2014, 2017)

Table 1: The port of Antwerp: some facts and figures (own composition)

	Added value	Employment		Number of maritime vessels	Cargo	
	Million EUR	Direct (maritime) (FTE)	Indirect (non-martime) (FTE)		In 1,000 ton	In TEU
2000	13,870.9	61,013	91,789	16,105	130,993	4,097,247
2005	17,277.2	63,080	84,785	15,283	160,048	6,482,061
2010	19,791.5	61,506	81,828	14,783	178,159	8,468,310
2015	20,692.6	60,656	81,692	14,417	208,419	9,653,511

FTE = Full-time Equivalent Unit

Source: Vlaamse havencommissie (2000-2016); Lagneaux (2005); Mathys (2012, 2014, 2017)

The economic activities in the port of Antwerp can be divided into maritime and non-maritime cluster. This paper focuses on the maritime cluster, but this is often interrelated with the non-maritime cluster (Lagneaux, 2006). The maritime cluster deals with all companies having a direct connection to the port, like port facilities, maintenance, shipping, transshipment, storage, locks, dredging, fisheries, and maritime services. The non-maritime cluster includes all companies

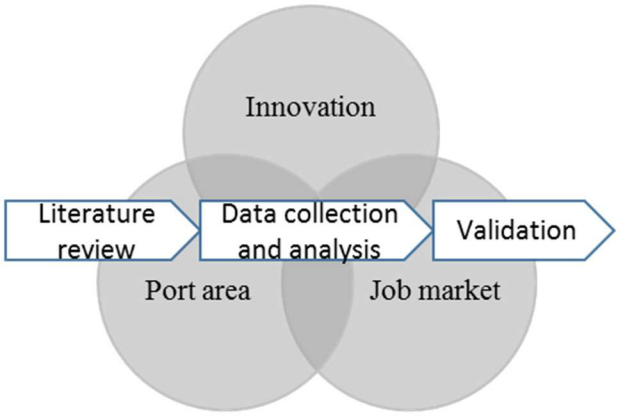
located in the port area and having an indirect link to port activities. Four non-maritime segments are differentiated among: industry (of which the chemical industry is the largest employer in the port of Antwerp), trade, transport and logistics. Road transport and the chemical industry are included in the analysis as both business segments are important in the port of Antwerp and subject to changes due to innovation (see section 4).

2.2 METHODOLOGY

The research approach in this paper consists of three steps: literature review, data and information collection and analysis, as well as and validation.

The literature review consulted publications in the field of labor markets, innovation in general and ports, as the research gap is at the intersection of these three topics (darker grey zones in Figure 2). The most important trends concerning changes in job markets were summarized. Studies done by national and regional governmental research institutions and publications of international organisations like the World Economic Forum were consulted. Relevant working papers of research institutions in the field of transportation, information technology as well as studies by sector organisations and poles of competence were included.

Figure 2: Areas of interest and approaches in the study



Source: own composition

To get a more detailed view of the current labor market in the Antwerp port area, data of the National Bank of Belgium was used in combination with detailed data derived from the social security administration[2]. The labor market statistics were requested from the Crossroads Bank for Social Security (CBSS) for the 2008, 2010 and 2014 years. 2008 was the first year that comparable data could be obtained from the CBSS. The year 2010 was chosen to verify a possible influence of the financial and economic crisis. 2014 data were the most recent ones available. Per cluster and associated sectors in the port, the following information on employed could be collected: age group, gross annual wage and gender. Where possible, a comparison was made with the Flemish Region. For this, data derived from Steunpunt Werk was used (http://www.steunpuntwerk.be/).

[2] A limitation of using the National Bank of Belgium data for the maritime and non-maritime clusters is that the impact of a port like Antwerp is underestimated: a large share of trucking and other companies serving the port are not located in the port area as used by the National Bank delimitation. However, this does not impact on the overall findings: both the quantitative and qualitative lessons drawn are valid inside and outside the port perimeter.

Next, a qualitative analysis was conducted to get insight in the future labor market. To do this, different stakeholders from the port community (see table 2) were interviewed. The semi-structured interview consisted of three parts. The first part consisted of general questions to get an idea of the developments in the field of ICT introduction and automation in the sector and their influence on the required competencies and the level of employment. In a second part, the interviewee evaluated 12 propositions using a Likert scale with 7 choices on a continuum. The third part inquired whether the education system prepares for the job market of the future. To gain insight in the job skill changes, 33 interviews were conducted in autumn 2017.

Furthermore, training coordinators of nine Antwerp logistics training programs reacted on the following topics that were quoted by the professional field: teaching professional competences and languages, integration of ICT in the courses, practical experience in training, dialogue between education and the professional field, and cooperation between different programs or faculties. The semi-structured approach allowed for other aspects than the above ones also to be addressed. The results are summarized in a SWOT analysis. Due to the sample size, it is not possible to split up the findings according to stakeholder sub-groups, as that would only lead to statistically insignificant statements.

Table 2: Stakeholders involved

Stakeholders	Number of interviews
Employer organisations	2
Employee organisations	4
Human resources consulting firms	3
Companies	12
Other stakeholders	3
Education	9
Total	33

The third step was validation of the results. To this end a workshop was organized. The aim of this workshop was to have the main results validated and discussed by various stakeholders from the Antwerp port community and to obtain additional information and nuances for the research. In total, 50 stakeholder representatives from the port community participated, as well as representatives of educational institutions from both mainstream and non-regular education, sector organizations, employers' federations and human resource managers from various sectors, temporary employment agencies, trade unions, the Flemish Employment and Vocational Training Service (VDAB) and the logistics job and training point for the port of Antwerp (Talent Stream). In total, 31 participants joined the workshop. In advance of this workshop, the participants had the opportunity to react on eight propositions (section 4) via an anonymous online survey using the Qualtrics program. The propostions came as a summary of the overall findings of the research work conducted to date. The participants had to indicate whether they agreed or disagreed with the propositions. There was also an opportunity to leave qualitative information with each of these propositions. At the end of the survey, participants were asked to place the propositions in order of urgency. The survey had a response rate of 70 percent. The input of the survey was used in the actual workshop. In the order of urgency indicated, each thesis was discussed. At the end of the workshop, another vote was taken: participants could anonymously indicate whether they agreed or disagreed with the discussed propositions.

3. LITERATURE REVIEW: JOB MARKET TRENDS AND IMPACTS ON PORTS

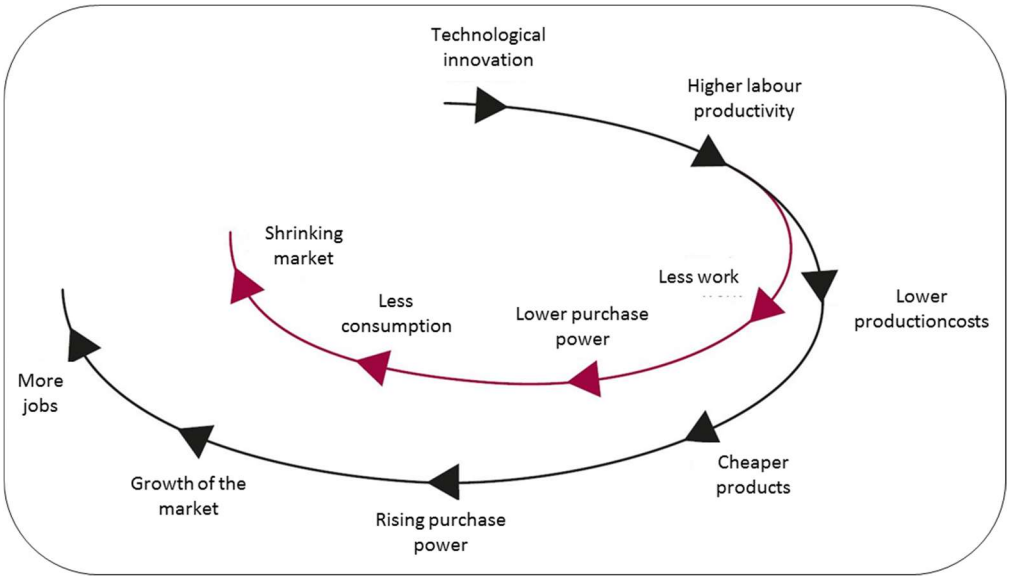
First, the reasons for innovation are discussed, followed by especially the impact of IT on jobs through ICT introduction and automation since the 1980's. Then, the focus shifts towards port environments and how these innovations are influencing employment in ports, in maritime as well as in non-maritime clusters.

3.1 HOW SENSITIVE ARE JOBS TO ICT INNOVATION AND AUTOMATION?

It is common knowledge how innovation like steam power, electricity and mechanization led to the industrial revolution from the end of the 18th century on, and how these have changed societies economically, politically and socially. From the 1980's onwards, IT ascended and brought a major rise of productivity. ICT leds firstly to digitalisation of production with the rise of automation and robotics, secondly to digitalisation of communication processes and thirdly to the Internet of Things (IoT) that links objects through Internet with sensors in networks generating big data (van Est & Kool, 2015). The goal of the preceding initiatives is to lower costs and raise efficiency (Went et al., 2015; Violante, 2008). Next to improved productivity, ICT also allows improving flexibility, lowering environmental impact and increasing safety (Graetz and Michaels, 2015). Moreover, ICT has an impact on the organisational structure of firms, which can even result in a total business scope redefinition (Venkatraman, 1994).

Job markets are changing rapidly due to IT. There are two opposite views in literature when discussing the relationship between innovation and the evolution of the size of job markets, resulting in two scenarios (Figure 3). In a first scenario, innovation will lead to economic growth and more jobs because innovations causes higher job productivity and cheaper products. Due to the resulting higher consumption, the market grows and thus more jobs will be created. In a second scenario, technological change leads to higher productivity as well, but this will cause job losses, leading to lower purchasing power, less consumption and a shrinking market (van Est and Kool, 2015).

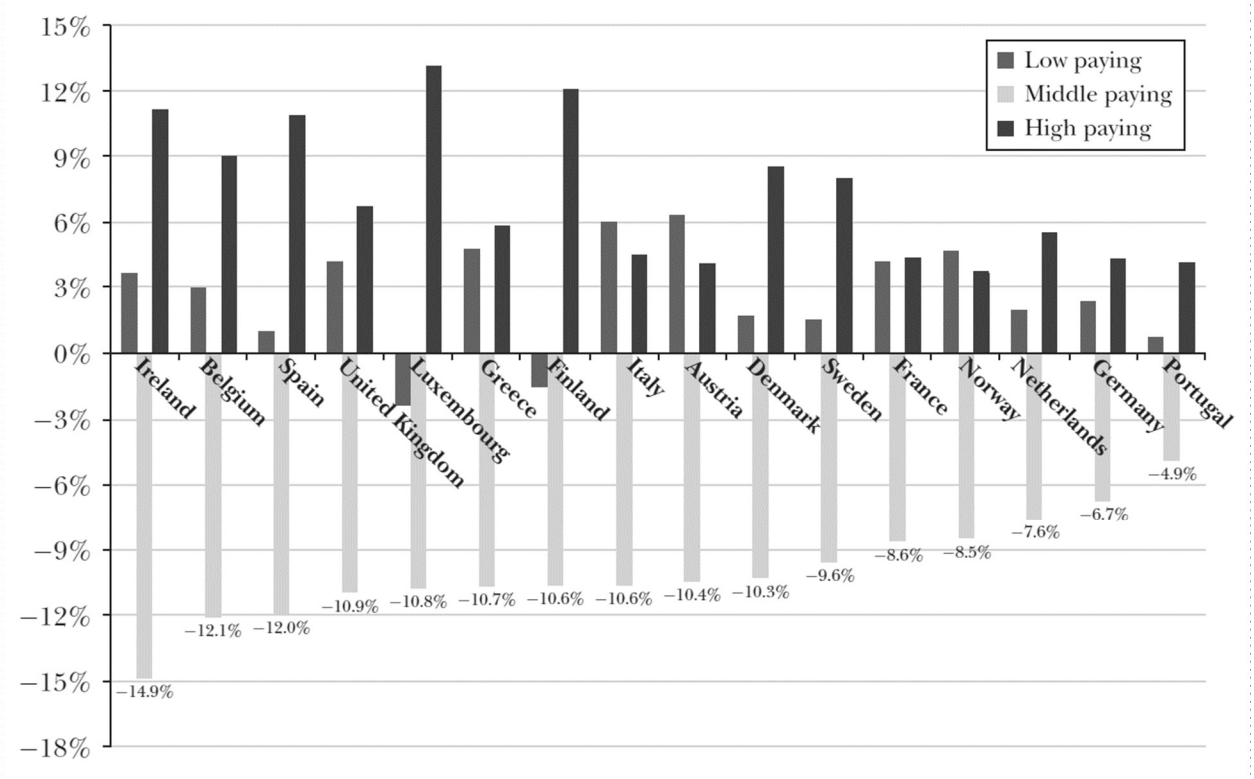
Figure 3: Innovation and the size of the job market: two scenarios (adapted from van Est and Kool, 2015, p.30)



Next to the discussion on the size of the future job market, it is more important to look at the impact of IT on different kinds of jobs. Some jobs are more prone to automation than others. Computers follow a set of rules programmed beforehand. When computing a certain task, a person first has to fully understand the set of steps needed to perform that task. Thereafter, a script can be written to make sure that the computer reads and performs the successive steps, hereby simulating what was done before by humans. Because jobs consist of different tasks, one has to look at tasks instead of jobs regarding automation. Tasks can be divided in two main categories: non-routine and routine tasks. Both can be cognitive or manual. The set of steps needed to perform routine tasks can nowadays easily be programmed in computer language. These tasks are therefore prone to automation. Numerous *manual routine tasks* (repetitive job of a physical nature) are already mechanised since the beginning of the Industrial Revolution. This substitution is taken further by computerization. C*ognitive routine tasks* are increasingly at risk since the ICT revolution in the 1980's. These tasks consist of repetitive job involving processing information. Due to this, especially clerical jobs become more and more automated. Computer technology and computing power is becoming less expensive, which makes it interesting for companies to replace this kind of job by machines. *Cognitive non-routine tasks*, like producing and manipulating or processing information, are more difficult to automate. Also, *manual non-routine tasks*, like cleaning, are less prone to automation because hand-eye coordination is needed, something in which machines, computers or robots fail up till now. (Fernández-Macías, 2012; Autor, 2015).

Middle-paid jobs consist typically of cognitive routine tasks. The demand for these jobs has lowered since the 1980's due to ICT introduction (van der Zee, 2015). This results in a polarized job market in the developed world. Since high- and low-skilled jobs are less routinized and as a consequence less prone to automation, the demand does not decrease, contrary to middle-skilled jobs. Job polarization also manifests itself in wages, although this does not reach the same level in each country (Figure 4). Moreover, Autor (2015) states that job polarization is not likely to continue in the future, as also for middle-skilled jobs, less routine skills like problem solving and the ability to adapt are still needed. The fact that jobs cannot be totally substituted for by machines or computers is an important observation. In the future, the focus will be more on complementarity of man and machine, where machines and computers complement humans in their tasks.

Figure 4: Change in occupational shares for 16 EU countries between 1993-2010 (Autor, 2015 p.15)


15%
12%
9%
6%
3%
0%
−3%
−6%
−9%
−12%
−15%
−18%
Low paying
Middle paying
High paying
Ireland
Belgium
Spain
United Kingdom
Luxembourg
Greece
Finland
Italy
Austria
Denmark
Sweden
France
Norway
Netherlands
Germany
Portugal
−14.9%
−12.1%
−12.0%
−10.9%
−10.8%
−10.7%
−10.6%
−10.6%
−10.4%
−10.3%
−9.6%
−8.6%
−8.5%
−7.6%
−6.7%
−4.9%

3.2. HOW SENSITIVE IS THE PORT JOB MARKET TO INNOVATION?

In the following sections, the evolution regarding the future jobs in port areas will be discussed. A distinction is made between the maritime and the non-maritime cluster.

3.2.1 THE MARITIME CLUSTER

The first information technologies: ICT replaces paperwork

With the first generation of information technologies, ports evolved to an era of less paperwork. This progress was needed in the logistics sector because of the rising need for efficient streams of information due to increasing importance of containerization and intermodal transport. Actually, in ports the flows of information are as important as the physical streams of goods (Prajogo and Olhager, 2011). New ICT systems like electronic data interchange (EDI) and terminal operating systems (TOS) were created and reduced the port's dependency on paper documents (Heilig et al., 2017). Despite this evolution, ports have been lagging behind in ICT developments for a long time and unfortunately even today a lot of paper documents are needed for administrative procedures or procedures on the terminal (Meersman et al., 2016). Many companies still use telephone and email. When installing a cloud-based system, firms can perform more efficiently. This means that some basic tasks, which can be automated and digitalized, will disappear. Implementation of ICT systems and real time data can improve the transparency of the logistics chain. Regarding this, the tasks performed by the forwarder will evolve from pure operational tasks to an architect of transport, where providing adequate and personalised information is the central task. Consequently, job content is increasingly becoming more complex in a sense that more knowledge and skills will be expected in the future. Next to this, more general competences like knowledge of languages and ICT competences will be required. In general, higher-rated diplomas will be asked for working in the logistics sector (Vanthillo et al., 2018).

Logistics service providers evolve in a role of providing consulting and management of goods flows. Logistics traditionally is a very job-intensive sector. In many countries, the sector features a shortage of qualified staff. An explanation for this is the low prestige and the low wages compared to other sectors (McKinnon et al., 2017). Over time, a trend of outsourcing was observed in the industry: shippers focused on their core business, and left all value added activities to logistics service providers. However, this trend is reversing, especially as shippers want to provide more flexibility to their customers and as they want to keep control. This will likely lead to a reduced work volume for shippers. (Kindt and van der Meulen, 2015)

On 1 May 2016, the European Union introduced its new Customs Law Book. This new version among others allows for electronic processing of customs formalities. This required new competencies both among public officials as within companies: management, professional and operational. To that purpose, the European Commission developed a competence handbook (European Commission, 2017).

Automation in warehouses

Automated solutions are increasingly finding their way into warehouses. However, these are less and less the fully automated solutions where no workers are left in a warehouse. Instead, the focus is increasingly on complementarity between humans and robots. The robot accounts for the routine tasks, while humans provide the tasks where flexibility is needed. An example is a transport robot following the order picker automatically, reducing the number of actions the human has to perform. Other applied technologies are augmented reality and providing order pickers with real-

time info. Another development is the use of drones for stocktaking in warehouses (Machill and Freund, 2017). This evolution results in a change of competences needed in the warehouse towards ICT-related skills and higher-valued competences (McKinnon et al, 2017). The rising complexity of tasks also implies that higher diplomas will be asked for these jobs in the sector (Vanthillo et al., 2018). Still, automation will result in a decrease of the number of jobs in the warehouses: the most advanced robots can perform more complex tasks and become more and more cheaper then staff. Savings on loans are estimated between 40 and 75% (Geujen and Buck, 2017).

Automation of container terminals

Most environments are too unpredictable to install highly automated systems. However, when there is a controlled environment, extensive automation is possible (Autor, 2015). This is the case for container terminals where the separation of the different modes contributes to a predictable and simple environment. Several ICT systems made automation possible, together with the advent of laser technology in the 1990's. This technology was important for terminal handling operations while it was needed for distance detection, collision prevention, damage detection and functions such as profiling and locating of objects (Heilig et al., 2017). But still, automated systems do not reach the same efficiency as some manually-operated systems (Oliveira and Varela, 2016). Due to the work in this kind of technological environment, the urge for specific skills for dockworkers has risen. This is especially the case on container terminals, more than on terminals for general cargo. Ports increasingly offer training programmes to their dockworkers. There is a trend to multi-skilling, this is when one worker does different tasks in one shift, to raise efficiency and flexibility of the workforce. In some cases this is leading to the disappearance of jobs for specific tasks (Van Hooydonk, 2013).

Evolution towards smart ports

More and more companies are using real time data in their business models. With accurate and real time data, changing customer needs can be discovered in a fast way, errors can be detected sooner and the decision process can be supported. However, the analysis of data still remains a challenge. The rise of Internet of Things and the generation of big data will play an important role in simulating traffic, exploring optimal locations for a terminal or in detecting customer preferences. To achieve this, all actions and operations in the port will have to be actively measured and monitored, while having continuous interaction with all actors in the port community (Heilig et al., 2017). An example of smart port initiatives is a project in the port of Hamburg to actively measure and monitor the traffic and goods in the port. The main challenge in this evolution will be data sharing, as most companies are still unwilling to do this (Meersman et al., 2016). ICT skills, modelling skills, data-analysis, statistics and software development will be important assets for future employees. Possibly, the ICT tasks will be done by external ICT- or consultancy companies, but the need for profiles who have knowledge about ICT and the port itself will be crucial to lead the evolution to smart ports and the digital transformation into the right direction. Next to new ICT competences, knowledge and skilfulness, port companies are looking for people fitting in the companies' culture and with the right attitudes such as flexibility, independence, stress-resistance and responsibility. (D'hoop and Van Tittelboom, 2016)

3.2.2 THE NON MARITIME CLUSTER

Chemistry of the future

Chemical companies are often organized in clusters. This means companies are located in the vicinity of each other, thereby acquiring external economic advantages. Chemical clusters are frequently located in port areas and have mostly evolved around a source of raw materials or as a supplier for an industry downstream (Notteboom, 2010). Since the rise of the clusters in the 1950's and 60's, a lot has changed in the chemical industry. Due to globalization, the interconnectivity between clusters has risen. As a consequence, economic shocks in one part of the world have a large impact on other chemical clusters around the world. Also, consumers focus more and more on sustainability, making chemical companies to shift their focus more to sustainable products and processes. The high-tech character of the sector requires continuous investments in knowledge and further specialization. The Internet of Things, big data and implementation of real time data are important changes for the future. Regarding this, the sector is facing two challenges. First, data sharing will be needed. Like in other sectors, this remains an issue (EPCA, 2011). A second challenge is the aging of the workforce in some cases, e.g. the port of Antwerp where the sector does not find sufficient new profiles (Essenscia, 2016).

Like in other sectors, the chemical sector is also facing a round of ICT introduction and automation. Manual and repetitive tasks are prone to disappearing over time. Moreover, the supportive jobs will continue to decrease in number, meaning that employees will have to perform more and more tasks by themselves supported by ICT. In the end, especially the job content will change (De Vos & Gielens, 2016). In a research about the future of jobs in chemistry, De Vos and Gielens (2016) expect a growth of competences needed in the future. On the one side, the tasks employees have to deal with are increasingly becoming complex and specialized. This requires specific knowledge and skills. On the other side, employees must understand and manage the broader process and have to talk along with other specialists. This implies that also broad knowledge and expertise is needed. The broadening and specialization of knowledge, together with the increase of the skills required, makes that the organization of work will change. Teamwork becomes more and more important, requiring a set of personal and interpersonal skills needed among employees. Communication and co-operation are basic skills required. Workers have to cope with a rapid evolution of technological developments and need to learn fast. Next to this, flexibility, being able to work autonomously, self-operability and responsibility becomes more important on all levels. An overall higher diploma needed will be a consequence (De Vos and Gielens, 2016).

Trucking

An emerging phenomenon in trucking is platooning, whereby trucks travel in a fixed convoy, with only in the first truck eventually a driver, and with the other trucks following in the leader's slipstream. If technology allows, follower trucks do not need to be manned anymore. However, under current legislation, a driver is still needed in each truck. Drivers in the follower trucks could then pick up other tasks, for instance planning or administration. That will require a different level of competences than present among the average truck driver (Janssen et al., 2015). It might provide a solution though to the current shortage of truck drivers, which is said to be linked to the low job profile and remuneration. The observation is not typical for Europe, but is found also in other continents, as shown by Jiang et al. (2017) for Shanghai.

3.3. MAIN LESSONS FROM LITERATURE

A general finding from the literature review is that especially routine jobs have a high risk of disappearing. Middle-paid jobs risk being the first victim, leaving a polarization between low- and highly-paid jobs. Translated to the port sector, this has implications in both the maritime and non-maritime cluster. In the maritime cluster, ICT introduction already shows its impact, through less standard work performed, and more initiative, leadership and flexibility required, resulting in a search for higher diplomas. Automation leads to reduced workforce active in warehouses. At terminals, especially for containers, automation goes slower, but especially ICT introduction leads to the need for more ICT competences. In the non-maritime cluster, digitalization and data sharing will become key issues. Automated trucking might provide an answer to the general driver shortage. The next section matches the literature findings with the empirical results.

4. EMPIRICAL OBSERVATIONS: THE JOB MARKET OF THE PORT OF THE FUTURE IN ANTWERP

This section provides the findings of the empirical research. First, statistics and numbers of the job market at the port of Antwerp are shown. Second, the results of the interviews with port stakeholders are presented. Third, focus is on the question round with educational institutes. Fourth and finally, the results of the overall validation with the wider port community are shown, including stakeholder representatives and educational experts.

4.1 THE PAST AND CURRENT PORT JOB MARKET IN NUMBERS

This section gives the results of the analysis of statistics and figures about the job market at the port of Antwerp. Focus is on its evolution, striking features and points of attention for the future.

4.1.1. Number of jobs and sub-sector shares

Over the past three decades, the port of Antwerp has witnessed a decline by about 10,000 jobs, to a total of about 60,000 in 2015 (Figure 5). Especially the industry within the port perimeter got hit, whereby the latter lost its top employer status to the maritime cluster. Top employer sub-sectors are the ‘chemical industry’, ‘shipping agents and forwarders’ and ‘stevedores’. The former is composed of just a handful of companies, each of them typically employing a large amount of people. The latter took care of the largest job increase over all sectors, which is also concentrated among just a handful of operators. The largest job loss is found in the sub-sector ‘automobile manufacturing’ due to the closing down of the Opel plant in 2010. Interesting observation with respect to a likely impact of ICT introduction in the port is the fact that the sub-sector ‘other logistics services’ is a strong grower: ICT design and programming is an important part of that sub-sector. Also the sub-sector ‘port construction and dredging’ features good growth. Complementing the job figures with those for value added, it can be seen that overall value added shows an increasing trend (Figure **6**), with the exception of the year 2009 linked to the global financial-economic crisis. That implies that apparently more value added is needed to keep the number of port jobs more or less stable. Concerning the industry, the added value increased despite of the decreasing number of jobs. This is an indication of the fact that in industry, innovations are already implemented and successful.

Figure 5: Evolution of total employment in the port of Antwerp (adapted from NBB, 2014)

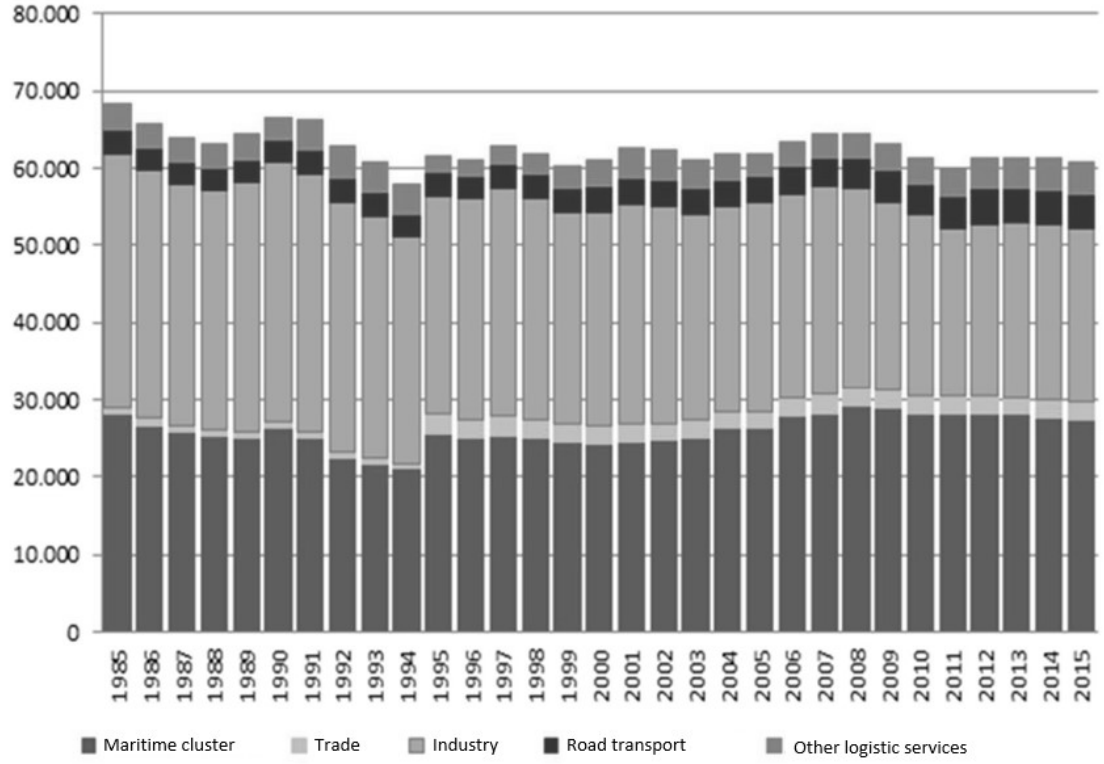
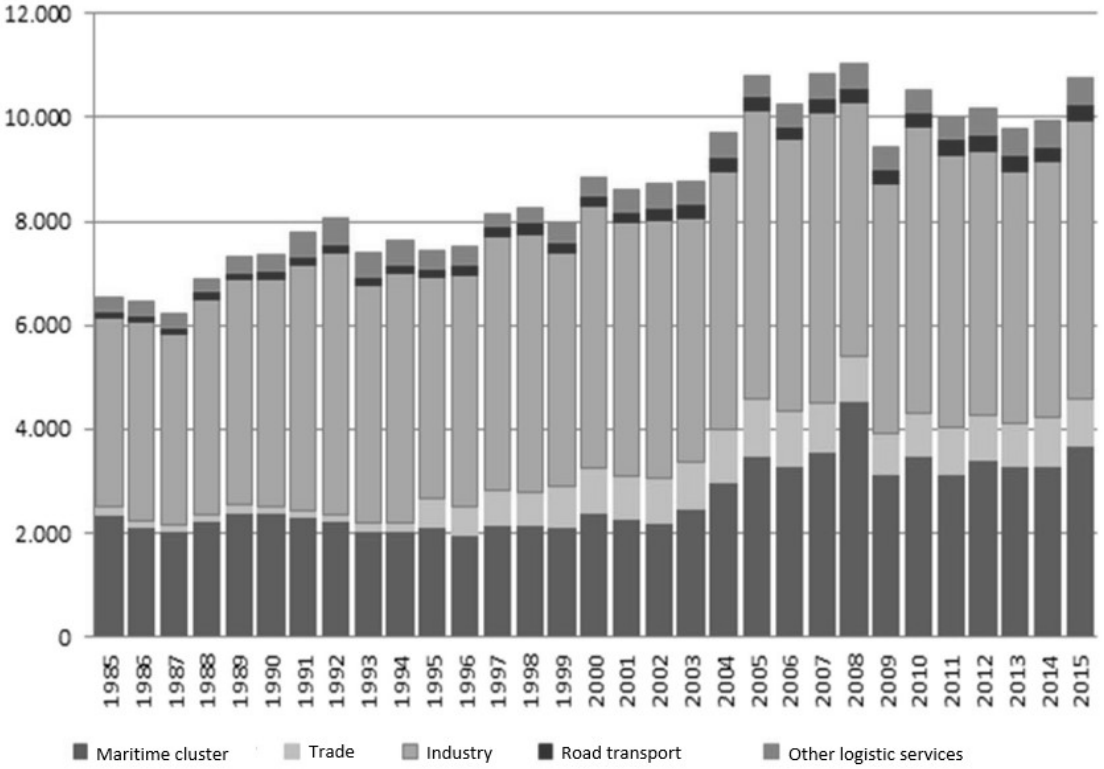


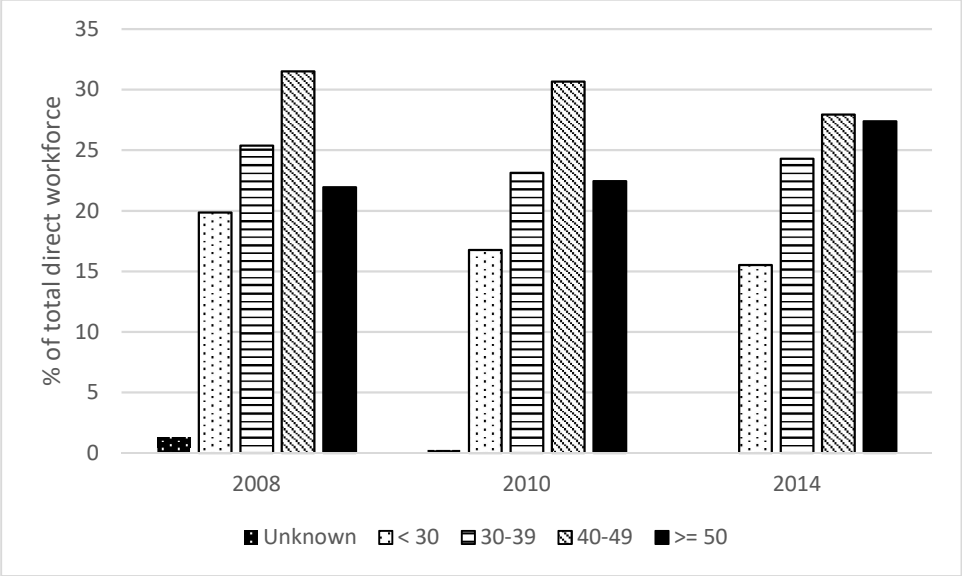
Figure 6: Evolution of total value added in the port of Antwerp (adapted from NBB, 2014)



4.1.2. Age

It turns out that age is a point of attention in the port. Since 2008, the age category '40-49 years old' has been the largest one (Figure 7). Since 2014, this age group has been slightly declining, flowing over in the increasing 'over 50' group. At the same time, the inflow on the young side is declining. This implies that the port population gets older, and the inflow of fresh blood is lacking. In the maritime cluster, 'Port construction and dredging' is a good performer in attracting young people, whereas 'Shipping agency and forwarding' features the opposite. The latter is worrying for the future, as section 4.1.1 showed that this sub-sector currently is an important employer in the port of Antwerp. In the non-maritime cluster, the sub-sectors 'other logistics services' and 'electronics' feature the largest inflow of young people, whereby the former is promising given its strong relation to digitalization. The trucking sub-sector is probably the sector with the biggest problem: a very old job population, and very little inflow of young people, resulting in a shortage of staff that can already be felt in 2018.

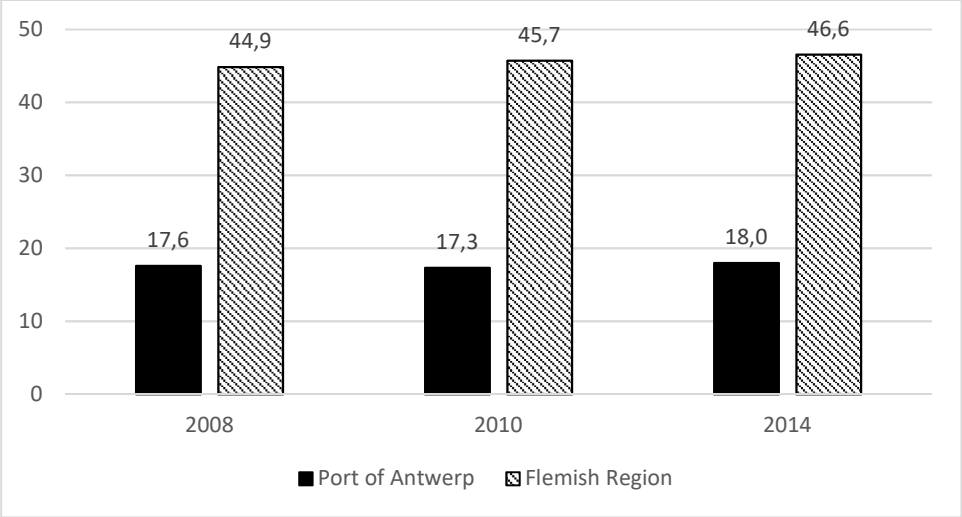
Figure 7: Evolution of age division in the port of Antwerp (own composition, based on CBSS)



4.1.3. Gender

Only one in six employees in the port is female (Figure 8), which is much lower than in most other economic sectors. That trend has remained more or less stable during the past decade. Linking gender and age, it can be observed that the majority of staff in older age categories is male. This means that if the younger women in the sector manage to stay aboard, the sector will get more female gradually.

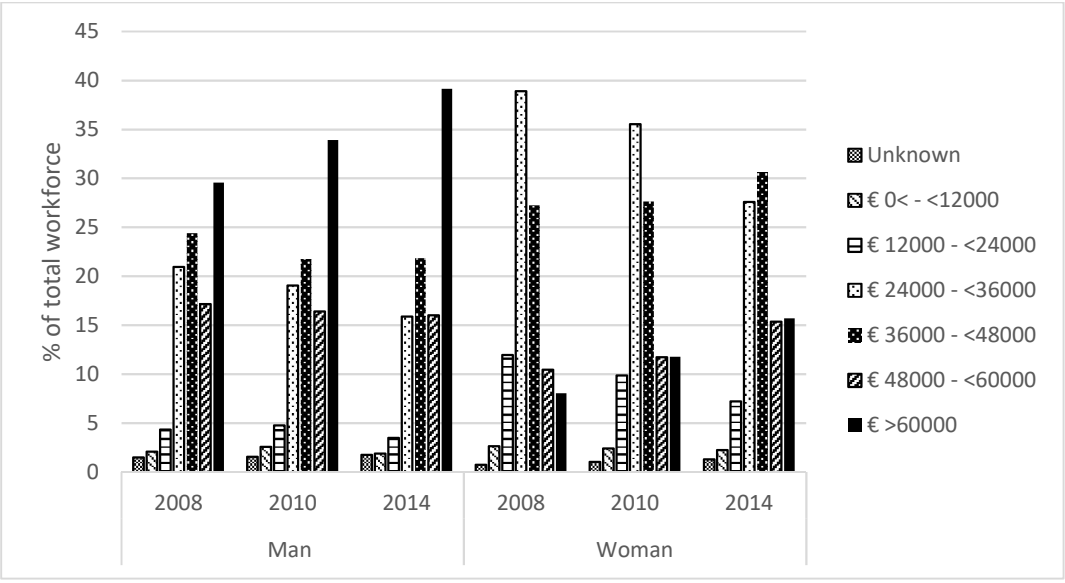
Figure 8: Share of female in total employment (own composition, based on CBSS and Steunpunt Werk)



4.1.4. Wages

A good remuneration usually is the basic condition to attract sufficient and good staff. It turns out that overall in the port of Antwerp the largest (gross) income category hosts most employees (Figure 9). Moreover, it is the fastest growing wage category. As such, this is a positive element in the war for talent. However, there are large divergences among sub-sectors. The predominance of the largest wage category is mainly due to the chemical sub-sector, where the large majority of the staff finds itself in the highest wage category. Opposed to that, one finds the trucking sub-sector, where the two highest wage categories are hardly present. That most likely also explains the observation from section 4.1.2 that trucking is hardly able to attract young drivers. An important qualification also has to be made with respect to gender. The highest wage category mainly hosts men. In 2014, 39% of all male port employees found themselves in that category, against only 16% of all female employees. This is partly explained by the strong presence of men in the chemical sub-sector, where wages typically are higher. Obviously, this gender discrepancy does not favour women to develop a career in the port.

Figure 9: Gross wage category division in the port of Antwerp (own composition, based on CBSS)



4.1.5. Full-time or part-time jobs

The large majority of the jobs in the port of Antwerp are full-time, which is significantly different from the nature of jobs outside the port, where many more jobs are part-time (Table 3). This latter is true in particular also for women, although the female share in full-time jobs remains much lower than the male share. Linking that to age and wage (sections 2.1.2 and 2.1.3), the fact that more women are working part-time probably explains why they cannot expand their career into higher-wage jobs in the port at a later stage, as will be further supportedin section 4.2.

Table 3: Overview full-time/part-time jobs (based on CBSS, * Source: Statbel, 2016)

	Port of Antwerp				**Belgium***			
	Full-time		Part-time		Full-time		Part-time	
	Man	Woman	Man	Woman	Man	Woman	Man	Woman
2008	96.0	78.0	4.0	22.0	91.8	57.1	8.2	42.9
2010	95.4	75.5	4.6	24.5	90.8	55.8	9.2	44.2
2014	94.6	72.9	5.4	27.1	90.6	56.7	9.4	43.3

4.2 WHAT THE PORT STAKEHOLDERS TOLD US ABOUT THE JOB MARKET

This section gives the results of the interviews and workshop held with sector representatives and associations. The purpose of this section is to empirically verify findings from section 3 (literature) as well as section 4.1 (figures) on four main issues: the expected future evolution of the number of jobs, the observed changes in required competences in port jobs, the extent to which job supply matches demand in a digitalizing world, and whether current training and education sufficiently prepare future generations to work in the port.

4.2.1. The future number of jobs at the port and its sub-sectors

A general trend seems to be that at best a stagnation of the total number of jobs in the port is expected. The main reasons are twofold, and are both trends that are currently ongoing already: containerization, implying a shift towards a less job-intensive commodity type, and ICT introduction/automation.

In *terminals*, over time, a reduction of the total staff is expected, witness the increased use of automated stacking cranes as well as container bridges steered from a distance. However, at the same time, investments in straddle carriers are still done today, which implies that it will take at least another ten years before those operations will become less job-intensive. Markers will most likely disappear much quicker as a job: the manual registration will be replaced by electronic scanning. Although also non-container terminals may feature automation (for instance with the use of loading stabilizers), the latter will be less of an issue than at container terminals.

Forwarding and shipping agencies seem to witness a similar trend: less jobs in the future, unless very specialized ones, but shortages to fill existing vacancies already today.

Warehouses seem to be a big candidate for automation, thanks to the principle of environmental control. Lots of technological support equipment has been developed for warehouse applications. However, interviewees state that port warehouses will be slower adopters of such technologies. On

the one hand, this is said to be due to the resistance by unions against change. On the other hand, activities like stuffing and stripping or value-added services are harder to automate.

Customs will continue to perform routine operations for another 7 to 10 years. However, centralized clearance will enable many declarations to be done from abroad. Belgium may lose a lot of these activities due to its high job cost. Further on, digitalization will lead to customs operations that require less people involvement anyway.

Experts from the *chemical sector* estimate the total number of jobs in the sub-sector not to decrease too much: between 1980 and 1990, a lot of automation has already happened. The sector is already highly specialized. Nevertheless, also in this sub-sector, a search for increased productivity is ongoing.

For *trucking* finally, low wages and high training costs are blamed for the shortage of staff, which would persist at least until 2023. It is expected however that demand for drivers will continue to increase, as truck productivity cannot be improved endlessly. An emerging testing practice seems to be truck platooning. It remains to be seen what exactly will be the uptake in the trucking sector in general, and in port drayage in particular. A large number of uncertainties, both technically and legally, still need to be taken away. Platooning will have an impact though on the total number of jobs if uptake becomes substantial.

4.2.2. Changes in required competences

The phenomenon of job polarization, with a focus on higher-skilled logistics jobs on the one hand, and lower-skilled manual job on the other, as referred to already in section 2, gets emphasized also during the interviews. Already at the time of writing, purely administrative logistics jobs are gradually disappearing. This happens through outsourcing, often to foreign back offices on the one hand, and through automation and ICT introduction on the other. That implies that multiple tasks will be put in the hands of one person, supported by ICT, requiring higher skilling and multi-skilling. Knowledge will need to be broader and deeper at the same time. In what follows, a split is made between the maritime and the non-maritime sub-clusters in the port, detailing changes in relevant sub-sectors.

As to *terminals*, automation is confirmed to be an important issue. However, it is also stated that the port of Antwerp does not meet the speed of developments prevailing in other ports: only one Antwerp terminal operator has engaged into partly using automated stacking cranes. The other terminals still feature a lot of manual operations, including straddle carriers. The main reason for that is that today manual operations still allow for more flexibility and hence higher overall performance than automated ones. Nevertheless, the trend towards increased automation is commonly agreed upon. That also reflects in a shortage of staff: current staff can often not be upgraded to the required level in the more technological environment, and new staff seems not available to a sufficient extent on the job market. A partial explanation for that may be the wages, which are on average lower than what is found elsewhere in Belgium for similar jobs. At breakbulk terminals, ICT introduction rather than automation is the key issue. Again, this implies different skill needs than in the past.

In the *forwarding* business, service providers will need to shift from the historical ‘document shifting’ towards providing more value added and integrated supply chain management. The latter includes cost benchmarking on behalf of the customer, vertical supply chain mapping, as well as promoting horizontal collaboration. The sector is therefore increasingly in search of staff with higher-level analytical skills. Programming skills are not required, but knowing when to apply which ICT tools is. Furthermore, communication skills will become more important, as well as team working abilities. Finally, also being able to apply a project-based approach will be crucial in the future, whereas this is not the case in the present.

In *warehousing*, a lot of technology has been featuring for a while: palettizing, packing, etc. More recently, the use of smart glasses and tablets took automation a step further. In general, it does not look like fully-automated warehouses will become the norm: technologies are mainly meant to support people, not to replace them.

As to *shipping agencies*, it is observed that they more and more become integrated in shipping companies: the former independent companies have gradually disappeared. Integrated shipping agencies these days are organized in virtual teams, with members spread across the globe, and with a very flat organization. Independent shipping agencies can nearly only survive in niche markets. Examples are the dry bulk segment. For that type of commodities, standardization and hence also automation and ICT introduction are less feasible.

Customs are generally said to be lagging behind in ICT introduction, although most interviewees immediately add that a catchup is happening. Especially with respect to risk analysis, digital technologies get tested and implemented at a rapid pace. Ways are sought to increase the chances of catching fraudulent and illegal traffic, with a minimum intrusion in actual logistics operations.

The *chemical industry* is marked by very strong specialization. Many entities specializing in specific products split off from their mother companies. Minimum certification is required: operators need to have a minimum knowledge of chemical processes and installations. They also need to widen their scope of activities: the classical distinction between process operator and technician fades out. Autonomy, self-steering and responsibility become core terms. The ability to decide is a key required skill. More and more of these decisions are also derived from data. ICT has long been introduced in the chemical sector, but there are still a lot of opportunities for further automation.

In the *trucking* sub-sector, just 15 years ago, the ability to drive was about the only key requirement. In 2018, computer skills are required, as drivers need to electronically announce themselves at gates and terminals. Also customer friendliness and language knowledge are newly required skills. In case platooning, as mentioned higher, succeeds in the market, drivers could take up other roles, like for instance performing administrative tasks.

4.2.3. Challenges in filling future port vacancies

The influx of new, young staff seems to create a certain tension within many companies. Most of them still feature a hierarchical structure, whereby new staff is supposed to learn from existing staff. With the growing importance of ICT, that hierarchical relationship must be transformed into a flatter one, whereby the older generation can build on its sector experience, whereas the younger generation can pass on its ICT skills to the existing staff. An open question is how fluent that transformation will happen.

Furthermore, younger staff generally seems to search for a good balance between life and work, more than their predecessors did. Company cultures and structures will therefore need to adapt to more flexible working regimes, whereby part-time jobs will occur more often. Section 4.1.5 shows that the port of Antwerp is already at a disadvantage in that respect compared to other sectors of economic activity, so this phenomenon may lead to additional tensions.

A final challenge is the possibility to keep new staff for a longer period of time, even if the right conditions are created within the company. Young staff is said to come to work on a project, not for life. Especially higher-skilled staff, which will need to be employed more than in the past in the sector, is prone to doing this. Therefore, the search for new staff will occur at a much higher frequency.

4.2.4. Is education preparing new staff in the right way?

The interviewees stress the importance of ICT skills in logistics training. It is observed that education still thinks too much in 'pillars': ICT programs do not pay enough attention to logistics, and vice versa. Furthermore, more attention is said to be needed to soft skills: teamwork, communication, project work, flexibility and resistance in case of stress. Interviewees are aware that many of these skills are at least partly endogenous and can hardly be trained.

A general observation seems to be that education often is too theoretical and not enough applied, and the quality of those obtaining a degree could be higher. That is partly caused by teachers and trainers that are not enough aligned with developments in the field. It also makes that staff itself is not trained nor capable enough to absorb the rapid changes in the port sector.

4.3 WHAT THE EDUCATIONAL INSTITUTES TOLD US ABOUT SKILLS AND COMPETENCES

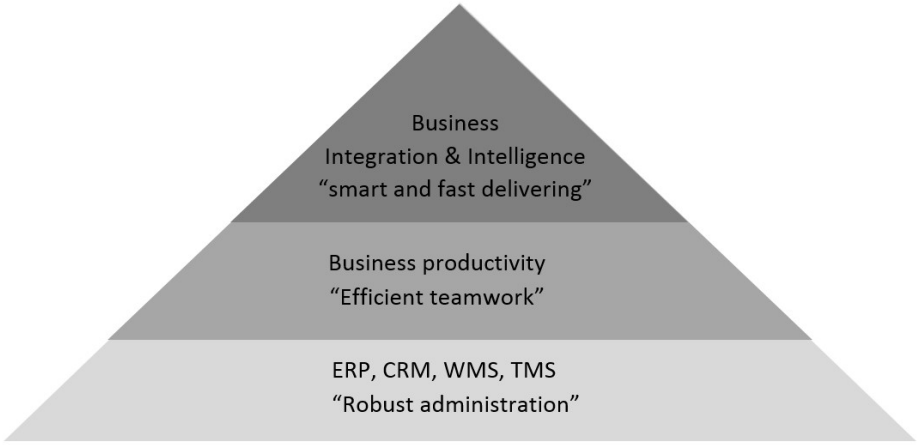
This section presents the results of a consultation of educational institutes, complemented with a workshop with sector representatives. It consecutively deals with communication between education and the sector, practice experience in education, skills and languages, integration of ICT, widening training programs, keeping training programs up to date, and updating educational programs in the near future.

Education and the sector in Antwerp have good contacts among each other. *Communication* happens both formally and informally. Every one to three years, most programs meet up in an advisory board. More informally, there is contact through internships and workshops. As to *practice experience in education*, university programs get criticized because of being too theoretical. Especially in one-year programs, having students choose and perform an internship is not easy. Bachelor degrees have more practice-oriented approaches, with internships, both for observation and practice.

Education heavily emphasizes *skills and languages*. In all considered programs, degree students need to have good communication and social skills, and need to be able to work in teams. Attitudes and skills like project work, customer orientation, management skills and problem-solving are the topic of separate courses. Languages often represent up to 40% of all credits.

Digitalization has made *integration of ICT* all the more important. Figure 10summarizes the three different layers present in most companies, going from very basic to very advanced. Bachelor degree programs devote a substantial amount of their program time to the bottom layer of applications. However, it is admitted that in general, higher education focuses too much on data input, and not on processing and analyzing and interpreting them (middle and top layer). A limitation is the fixed number of program hours, whereby choices need to be made: introducing more ICT courses in the program implies omitting other topics. Schools also lack money to introduce new supporting tools (softwares, e-learning tools, etc.).

Figure 10: Three possible layers of ICT integration in companies (Gijs, 2016, p.15)



Cross-program co-operation, which should allow *widening the programs*, is considered by educational institutes. However, it is also stressed that programs should keep enough depth. The first port of Antwerp Hackaton[3] was a nice opportunity for a number of institutes to bring students from different institutes together in cross-disciplinary teams.

Keeping programs up-to-date with the quickly changing business reality is also a challenge. Most schools have fixed learning programs, which limit flexibility. The way to integrate business updates is often having guest lecturers from the business. The above findings are summarized in the below SWOT table (Table 4).

Table 4: SWOT analysis for port-related educational programs

Strenghts	**Weaknessess**
* Focus on business practice in non-university programs * Co-ordination between education and business practice * University colleges: emphasis on languages and skills * Non-university degrees: directly employable staff	* University degrees have limited practice * Programs often run behind business practice by lack of interest from companies in long-term co-operation * Slow adaptation pace of programs * Course or program-transcending initiatives are hard to achieve
Opportunities	**Threats**
* More frequent resonance councils * Support by companies for developing ICT learning environments * Opening up programs for wider inflow of diplomas * Company-specific software implemented	* Limited financial means * No or limited data analysis in ICT courses * Full training programs logistics management * Focus too much on executive administrative tasks

4.4 RESULTS AND RECOMMENDATIONS VALIDATED BY A WORKSHOP

During a workshop with the wider port community, job institutions and educational experts, the above findings were summarized into statements, which were then translated into recommendations. The latter were then also scored into a priority ranking. This section shows those eight recommendations

[3] This Hackaton was organised by Port of Antwerp on 9-11 December 2016.

in order of priority, from high to low, so as to make clear to the concerned actors which actions need primary attention, rather than just giving them in the order of the preceding sections.

1. With broadening job profiles, training programs will need to be more topic- or degree-transcending. For now, small initiatives, like course exchanges and hackatons, are taken, but more is needed. A solution could be to let students obtain two master degrees, in different disciplines. More structurally, a program reform could allow for cross-disciplinary degrees. A note is made on the practical feasibility of inserting a very broad range of skills in one program. As a follow-up of this research, Antwerp training institutes already started reorganizing programs, according to short- and longer-run action plans.
2. Next to ICT competences, also other skills will become more important. It is recognized that professional skills and attitudes are hard to acquire and are person-bound. Specific training and workshops already remedy this. It will be important in the future that companies open up towards internships and visits, as the best way to acquire the skills on the floor. The Antwerp employer associations offered their support to co-ordinate and stimulate this.
3. The number of administrative tasks in the port of Antwerp will decrease significantly by 2030, especially in agency and forwarding. New jobs will become more complex and demanding, and will be request a higher level of thinking and abstraction. Suitable measures are needed for people that do not fit that picture, so as to avoid polarization.
4. Digitalization makes the relationships on the floor change. Learning between the generations will become very important. Young generations can bring on new ICT skills, whereas older generations bring on their experience in the sector. As this does not come by itself, company's management will have to take it up. Hierarchical barriers are to be avoided. Public companies could take up an exemplary role here. Antwerp maritime sector associations highlighted the topic in subsequent sector events.
5. The port of Antwerp needs to ensure a modern company culture with more diversity and a flexible working time. Only then, women will be inclined to search for a job in the port. Also, people with a foreign background are relatively under-represented.
6. Learning ICT skills should get a more central role in education. Not only softwares should be promoted, but also analytical thinking and data interpretation. Port companies often do not need ICT staff strictly, but rather people with an open mind towards ICT. As education cannot do that alone, companies and education will need to work together more closely, with concrete applications as a learning environment. The University of Antwerp evolved into more interdisciplinary training initiatives, which can function as pilots for further generalization.
7. The port of Antwerp overall features a relatively young job population compared with Flanders' numbers. To keep on attracting young people, it is crucial that the rapid technological changes are also absorbed in the educational programs. Learning in the working environment and dual learning can be relevant initiatives. That also avoids that companies alienate from young employees' desires, and that they become places where those young employees do not want to work or leave early.
8. It looks like port companies by 2030 will have pulled back to their core activities, having outsourced all others. In combination with staff savings, it is important that new employees are trained not just for one job, but get to know different working environments. Continuous learning will become key, involving advanced sector-specific education with lecturers from the business. In that perspective, C-MAT's advanced and modular programs can function as an example which keeps training accessible to people with a full-time job.

5. CONCLUSION: JOB MARKET, SKILLS AND COMPETENCES IN THE PORT OF THE FUTURE

Ports are more and more facing an increase of ICT introduction and automation in both the maritime cluster and the non-maritime cluster. This holds the risk of creating a mismatch between supply and demand of employment, skills and competences. The research reveals that the number of jobs lost due to ICT introduction and automation is difficult to predict. It is uncertain which of the two broad scenarios from section 2 (increase or decrease of purchasing power) will actually materialize. More certain is the required change of skills for the future. Compared to other sectors, the maritime cluster and logistics sector are lagging behind in ICT introduction. The number of administrative workers in these environments can still be quite high. Overall, the port of Antwerp features a relatively young population, which is ageing quickly though. This especially comes up in the trucking sub-sector, which has severe difficulties in attracting new people. Part of the explanation could be lower wages. This is opposed to the chemical sector, which has significantly higher wages. Problematic is the low number of women active in the port. Main cause is the image of the port: lower wages, unflexible working regimes, and hard, physical work. A similar observation can be made with respect to employees with a foreign background.

ICT introduction and automation will require new and more specific skills. ICT will penetrate in all levels and over all sectors. Communication and co-operation skills will be more and more important, just as data analysis and interpretation. Like in other sectors, also here administrative functions will more and more disappear over the coming years and upskilling of employees will be the case requiring overall higher diplomas.

Also, jobs requiring lower education will change. On the maritime side of the port, especially container terminals are facing extended automation, due to environmental control. Working in a highly technological environment, skills of dockworkers had to change and this will continue in the future. A reaction of ports is to offer dedicated training programmes to dockworkers. Also in warehouses, automated systems find their way increasingly requiring a change of skills of workers.

A limitation of the study is the fact that for the empirical analysis, only interviews and workshops and especially the quantified, accounting part of companies' annual accounts could be used. Social accounts of the same companies were unfortunately not useful, as they suffer from bad completion rates and quality, even though they would allow providing more qualitative insights especially for the job topic of this paper. Suggestions for further research are to investigate the future job market of different ports and compare them. Therefore, not only an extended literature review is needed. The analysis of detailed and comparable data on employment in the ports is needed to discover past trends. These trends can be extended to different scenarios for the future. To validate the data, interviews with stakeholders that can influence policy-making in all considered ports can be held, as was done in this paper for Antwerp. Last but not least, educational programs in different countries could be compared, so as to draw lessons on which program best prepares for the future port needs.

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Annex A**:** Part 3 Questions for interviews

General questions:

1. What is your position within this company? What does this mean? What is your experience with the labor market?

2. The following figures from the National Bank of Belgium indicate that the added value created in the port of Antwerp has been on the rise since 1985. At the same time, employment remains approximately stable. How do you think employment in the port of Antwerp will evolve towards the future? (Rise / fall / stagnation). Why? What is the influence of technological innovations in this?

3. How will the content of jobs change in the future? How do you think jobs in the port will look like in 10 years?

Education:

1. What is generally the required level of education for jobs in the sector?
    a. for white collar jobs
    b. for blue collar jobs
2. Are there currently enough qualified people for these jobs?
3. Do school leavers need extra training?

4. Should things change in the educational programs to continue to have good employees in the port of the future?
    a. for regular courses (secundary to higher education)
    b. Non-regular courses (VDAB, Portilog, Talentenstroom;…)