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Ready for the future: an exploratory study on competency requirements for bachelor graduates in logistics

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ABSTRACT

Purpose – In this paper, we examine the competency requirements of bachelor graduates in logistics based on current and expected trends and developments in logistics. The obtained insights can be used to develop logistics educational programs and curricula accordingly.

Design/methodology/approach – First, current and expected trends and developments in the field of logistics are identified. A literature review is conducted to list proposed competencies for logisticians. In addition, 18 in-depth interviews are conducted with senior logistics professionals and academics to examine the competency requirements of logistics graduates in the near future, given the developments in the area of logistics.

Findings – We describe how technological-, social- and business trends and developments are affecting the context and content of jobs in logistics. We discuss how, as a result, the competencies required of logistics graduates change. Competencies are distinguished in knowledge, skills and attitude. In addition to having general business knowledge and fundamental knowledge about logistics (e.g., warehouse or inventory management), having knowledge about data science will become more relevant. Software and IT skills but also collaboration, problem solving and innovation skills will become more important the coming years. Also, attitude characteristics such as proactivity, flexibility and curiosity will become more relevant.

Originality/value – Existing literature has focused on identifying possible relevant competencies in the field of logistics and supplychain management. This study focuses particularly on competency requirements in the near future, given the trends and developments in logistics. The findings of this study can be used to inform development of logistics educational programs and curricula.

Notes and Acknowledgements

The European Forum of Logistics Education is a network consisting of 31 higher education institutes across Europe. Their goal is to share knowledge and information on logistics education and stimulate internationalisation of education in Europe. The interested reader is referred to <https://efle.eu> for more information.

In several annual meetings of the European Forum of Logistics Education (EFLE) from 2013 - 2019 (Jena, Emmen, Madrid, Hasselt, Vesoul, Rotterdam and Copenhagen) the future content of logistics education at bachelor level in Europe, especially what competencies (Knowledge, Skills and Attitude) will be needed in the nearby future (5 – 10 years), has been discussed. This has led to a research project which the current study is part of.

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Introduction

The competition in the field of Logistics and Supply Chain Management (SCM) is fierce (Thai, 2012). Companies experience continuous and increasingly rapid developments in their business environments. To prosper in such environments, companies require employees who have up-to-date knowledge and skills (Thai, 2012). In fact, success increasingly depends on firms' ability to bring in, develop and keep employees with the appropriate competencies to stand out in the future (Carter & Carter, 2007). In order to adequately prepare logistics bachelor students for the rapidly changing and evolving working environments, curricula of educational programs in Logistics and SCM should be updated on a regular basis.

In this study, we examine developments in the field of Logistics and SCM and analyse the competency requirements of bachelor graduates in logistics now and in the near future. For the purpose of this study, competency refers to *one's ability to combine knowledge, skills and attitude to show expected behaviour when performing a professional task*. This definition is used by the educational programs in Logistics and SCM of the Dutch Universities of Applied Sciences and is in line with the definition proposed by the Council of the European Union (see Council of the European Union (2018)).

Traditionally, individual competencies are a topic of interest in the field of Human Resource Management (HRM). With the increasing strategic relevance of having the right employees with the right competencies, in recent years competencies have received increasing attention in Logistics and SCM research (Hohenstein et al., 2014). Prior studies examined competency requirements for various roles in Logistics and SCM for management level as well as operational level, such as the skills that are required of senior managers in logistics (Murphy & Poist, 2007), supplychain managers (Derwik et al., 2016; Ellinger & Ellinger, 2014; Flöthmann, Hoberg, & Gammelgaard, 2018; Prajogo & Sohal, 2013), procurement professionals (Giunipero & Percy, 2000; Karttunen, 2018; Mulder et al., 2005), supplychain planners and analysts (Flöthmann, Hoberg, & Wieland, 2018), fashion supplychain manager (van der Veen et al., n.d.), and humanitarian logisticians (Bölsche et al., 2013; Kovács et al., 2012). Some studies have focussed particularly on requirements of entry-level logisticians. For instance, Gibson and Cook (2003) conducted surveys among US undergraduate students and employers to examine their preferences regarding logistics positions. Murphy and Poist (2006) conducted a survey among US search firms that recruit Logistics managers to compare the skills required at senior- and entry-level. Other studies have

focussed on assessing educational programs in Logistics and SCM. For instance, researchers have examined the evolution of educational programs in Logistics and SCM (Gravier & Theodore Farris, 2008; Onar et al., 2013) or studied how such programs compare to the needs of companies in the industry in, for instance, the US (Lutz & Birou, 2013) or the UK (Bourlakis et al., 2013). Gravier and Theodore Farris (2008) discuss macro-environmental factors that influence logistics education (i.e., an increase in the number of programs, a limited number of logistics-trained faculty, changes in content requirements and teaching environment). Recently, Manders et al. (2020) conducted a literature review complemented with focus groups and interviews with companies and organisations to examine developments in the Logistics sector and discuss how these developments impact companies and the required knowledge and skills of their logistics professionals.

However, to the best of our knowledge, there are no recent and solid studies that provide insight on competencies that graduates starting as entry-level logisticians should possess. Therefore, in this study, we focus particularly on competency requirements of bachelor graduates in logistics (level 6 of the European Qualification Framework). Based on a literature review, we evaluate trends and developments in Logistics and SCM practice and develop a framework that describes relevant knowledge, skills and attitude aspects (KSA's) for logisticians. This framework is complemented with the empirical findings from 18 in-depth interviews with senior logistics professionals and senior logistics academics to examine the relevance of these competencies in the near future, given the trends and developments in the logistics sector.

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In doing so, this study updates the current literature on competency requirements in Logistics and SCM. Additionally, whereas prior studies have focussed mostly on skill requirements, we take a broader perspective by examining knowledge, skills and attitude requirements. Educational and training institutes, amongst which members of the European Forum of Logistics Education (EFLE), can use these findings as a benchmark for their programs and curricula and to improve education in the field of logistics and SCM. Furthermore, this exploratory study focuses particularly on developments, and (future) competency requirements, in Logistics in The Netherlands. As demands in other Logistics areas may be different, a direction for further research is to include other countries/regions in the study. This study serves as a starting point. A suggestion is to use this study's findings to develop a survey to obtain more representative insight in the importance of KSA's, to assess their relative importance and compare findings across countries or regions. To this end, the next phase of the broader research project that this study is part of, is to conduct a pan-European survey amongst a.o. the EFLE members to formulate advice on the development of logistics bachelor curricula.

The remainder of this article is organized as follows. In section 2 we present a literature review in which we assess current developments in the field of logistics and examine competency requirements to develop a framework that describes relevant knowledge, skills and attitude aspects (KSA's) for logisticians. In section 3 we describe our research methodology. In section 4 we present the findings of the study. In section 5 we discuss our findings and we end with conclusions in section 6.

Literature review

In this study, we examine current and future competency requirements for bachelor graduates in logistics. In this section, we conduct a literature review to identify trends and developments in the field of Logistics (section 2.1) and to develop a framework that describes relevant knowledge, skills and attitude aspects (KSA's) for logisticians (section 2.2).

Trends and developments in logistics

Fuelled by, amongst others, societal challenges, requirements and expectations on the demand side, technological advancements and developments in the labour market, the logistics sector faces technological developments as well as social and business developments. These developments have implications for the knowledge and skills that companies require from logistics professionals now and in the near future. Therefore, in this section, we discuss technological and social and business trends and developments that are expected to change the logistics business environment in the short- to mid-term.

Climate change is a global societal challenge which makes the transition to a sustainable economy inevitable (Wagner et al., 2019). Sustainable development, meaning that 'current and future generations have the resources needed, such as food, water, health care, and energy, without stressing processes within the Earth system' (Schoenmaker & Schramade, 2018, p. 33), is highly important. Sustainability concerns significantly impact the logistics sector (Kersten et al., 2017). Emissions of greenhouse gasses have to be reduced significantly. In broad terms, this means that supplychains have to be redesigned (Topteam Logistiek, 2019). Logistics companies are faced with the assignment to develop and implement new technologies and logistics concepts to become more sustainable. Reducing adverse effects of key activities such as transportation and warehousing asks for innovations such as the usage of cleaner fuels, green energy logistics, electrification and the optimisation of logistics flows, innovations in smart facility management and the usage of renewable energy sources (Chung et al., 2018; Topteam Logistiek, 2019).

Furthermore, the logistics sector is confronted with a shortage of skilled logisticians (Kersten et al., 2017; Van Amerongen et al., 2019; Wagner et al., 2019). The working population in the logistics sector is ageing. In the coming years, this will result in an increase in the

outflow of logistics professionals. At the same time, it is observed that the inflow of logistics professionals is declining, strengthening personnel shortages (Van Amerongen et al., 2019). In addition, services are given an increasingly important role in the business models of companies. As a result, strategies shift from a transaction-based focus to a relation-based focus with personalisation and customisation of offerings (Derwik & Hellström, 2017). This shift towards servitisation has an impact on the role and requirements of logistics professionals.

Rapid technological advancements have also a major impact on the logistics business environment. Digitalisation with significant progress in, amongst others, computing power and storage capacity of computers, sensor developments leading to reduced costs, and more digital connectivity speeds up the adoption of new technologies in logistics (Chung et al., 2018). Such advancements make it easier to collect and store data. This generates opportunities for Data Science, extracting knowledge from (typically large) data sets, and data driven decision-making. Furthermore, the Internet of Things, computing devices that are interconnected via the internet and exchange data, offers opportunities for, for example, smart warehousing or real-time visibility of vehicles and products which enables predicted delivery (Chung et al., 2018). Additionally, a recent development is blockchain technology. A blockchain is a distributed ledger technology that can record transactions between parties in a secure and permanent way. Such technology can make it easier to (safely) share data, facilitating transparency between parties in the supplychain. It will assist the automation of administrative and commercial processes in logistics and speed up cycle times (Chung et al., 2018). It is expected that in logistics the application of private blockchains will grow. Examples are SAP-HANA and IBM Tradelens. Additionally, the development of IT platforms that share information in the chain through ERP packages that are used in the various links in the chain is expected to grow.

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The use of digital technologies can make supplychains smarter, faster and more agile (Chung et al., 2018; Wagner et al., 2019). It can reduce transaction costs, making personalisation easier and the need for economies of scale less important. Shorter response times, a broader assortment and lower order sizes lead to more volatile supplychains but also brings about the challenge to remain efficient (Topteam Logistiek, 2019). At the same time, it puts more emphasis on the coherence between the physical and digital infrastructure (Topteam Logistiek, 2019).

Technological advancements also generate opportunities for automation and robotisation of highly repetitive, labour- and sometimes physically intensive physical and administrative processes, particularly in the field of logistics (Chung et al., 2018; Van Amerongen et al., 2019). These developments are already adopted in warehouses and port terminals. Robots are increasingly used for handling activities for storage and transshipment in terminals,

warehouses and cross docks. Think, for instance about Automated Guided Vehicles and picking robots. Developments in robotisation accelerate as they become more affordable. In order picking, the current payback time of a robot is estimated to be about 3 years (Topteam Logistiek, 2019). Warehouses can be fully automated within a few years. A related development is Artificial Intelligence, i.e., the development of computer systems such that they are able to perform tasks requiring human intelligence. It can especially be used for taking over repetitive work. An example is back-office automation of checking invoices (Tradecloud). Developments in automation and robotisation are stimulated by the increasing labour shortages in logistics and an ageing working population in combination with the growth in e-commerce which increases demand for rapid order processing and delivery (Chung et al., 2018).

Competency requirements

Defining competency

In recent years, in line with the increasing strategic relevance of having the right employees with the right competencies, individual competency has received increasing attention in Logistics and SCM research (Hohenstein et al., 2014). In this literature, a clear definition of competency is lacking and the term has been used inconsistently (Kotzab et al., 2018). Researchers refer to skills, knowledge and competencies to be used in a specific context somewhat interchangeably and use different categorisations to group these different aspects. In this regard, the field of educational research may prove informative. There, competency is typically defined as "consisting of integrated pieces of knowledge, skills and attitudes", and it is assumed to be essential for appropriate functioning on the job (Bartman & De Bruijn, 2011, p. 126). For the purpose of this study, similar to educational programs in Logistics and SCM of the Dutch Applied Universities we define competency as *one's ability to combine knowledge, skills and attitude [KSA's] to show expected behaviour when performing a professional task* (Council of the European Union, 2018). In other words, "competence is not limited to cognitive elements (involving the use of theory, concepts or tacit knowledge); it also encompasses functional aspects (including technical skills) as well as interpersonal attributes (e.g. social or organisational skills) and ethical values" (Cedefop, 2014, p. 21). This view is in line with Male et al. (2011), who refer to competences as the manifestation of knowledge, skills, and attitudes. Knowledge, skills and attitudes are defined as follows:

- "knowledge is composed of the facts and figures, concepts, ideas and theories which are already established and support the understanding of a certain area or subject;
- skills are defined as the ability and capacity to carry out processes and use the existing knowledge to achieve results;
- attitudes describe the disposition and mind-sets to act or react to ideas, persons or situations" (Council of the European Union, 2018, p. 7).

Additionally, we make a distinction between hard skills (functional) and soft skills (relational). It has been acknowledged that soft skills are becoming increasingly important in the logistics sector (Bak et al., 2019; Ellinger & Ellinger, 2014). In fact, it has been indicated that key hiring decisions focus on more soft (interpersonal and relational) skills whereas hard skills have become a standard requirement (Bak et al., 2019).

The professional- and (educational) training profile Logistics of the Dutch National Logistics Platform for Universities of Applied Sciences (Landelijk Platform Logistiek (LPL) HBO) is the basis for the logistics bachelor programs in logistics of the Dutch Universities of Applied Sciences (de Vries et al., 2019). It describes the professional profile of logisticians based on the professional practice (the working environment) of logisticians and it formulates the logistics key competency as *the professional development, management and execution of processes*.

Towards a framework of logistics competency

By means of a reviewing studies (i.e., articles published since 2006) on current and future competency requirements of logisticians we aim to develop a preliminary framework of relevant KSA's for logisticians. The literature on competency requirements in Logistics and SCM is fragmented and diversified (Derwik & Hellström, 2017), but can be distinguished in works that (mainly) take the perspective of logistics practice, and works that (mainly) take the perspective of educational programs. Note that the articles used in the literature review may conceptualize competency differently and/or use different categorisations.

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Some studies examine general logistics and SCM competency requirements. For one, Kotzab et al. (2018) conducted a meta-analysis to examine knowledge, skills and attitudes that are important in the field of Logistics and SCM. They find that the majority of skills identified in the academic literature represent social skills. However, an analysis of job postings indicate that they include more cognitive- and meta-level knowledge and skills than social skills. As another example, Derwik and Hellström (2017) conduct a systematic literature study to provide an integrated view of research on the topic of SCM competency. The authors distinguish functional, relational, managerial and behavioral components of competency that exist at the individual-, intra-organisational-, and inter-organisational level. Furthermore, Thai (2012) examines the current and future skills and knowledge of logistics professionals in Australia. He distinguishes business-, logistics- and management skills and finds that logistics educational programs should focus more on logistics related skills and knowledge. Jordan and Bak (2016) complement a literature review with in-depth interviews with academics and a survey among graduates and employers to identify supplychain skills and attitudes required of higher-educated graduates by companies in Logistics and SCM. They observe the importance of the ability to comply with regulations, decision-making skills such as problem solving and planning, and behavioral skills such as communication and time management. Flöthmann, Hoberg, and Gammelgaard, (2018)

distinguish (what they refer to as) SCM competencies in individual and organisational components to examine how they affect SCM performance. The individual components are distinguished in SCM core skills and knowledge, managerial skills, and IT skills. Using structural equation modeling they find that individual components positively affects companies' SCM performance.

Other studies have focussed on competency requirements for specific positions in Logistics and SCM. For instance, Manders et al. (2020) examined skills that are required of logistics professionals in general. Murphy and Poist (2007) conducted a longitudinal study to identify skill requirements of senior logistics managers. Derwik et al. (2016), Ellinger and Ellinger (2014), Flöthmann, Hoberg, and Gammelgaard (2018), and Prajogo and Sohal (2013) studied competency requirements of supplychain managers. Van der Veen et al. (n.d.) study the skill requirements of successful supplychain managers in the fashion industry. Giunipero et al. (2012), Karttunen (2018) and Mulder et al. (2005) examined skills required by purchasing professionals. Flöthmann, Hoberg, and Wieland (2018) focussed on competencies of supplychain planners and analysts and Bölsche et al. (2013) and Kovács et al. (2012) on knowledge and skills of humanitarian logisticians.

There are some studies that have focussed particularly on requirements of entry-level logisticians. For instance, Gibson and Cook (2003) conducted surveys among US undergraduate students and employers to examine their preferences regarding logistics positions. They identified key skills and experiences entry-level managers should possess. Communication skills, leadership- and general work experience were considered most important by employers. Murphy and Poist (2006) conducted a survey among US search firms that recruit managers in Logistics, Transportation and SCM to compare the skills required of senior- and entry-level logistics managers. They find that management skills are most important at both levels but strong differences exist regarding the specific skills required in the area of business, logistics and management. At entry-level personal characteristics, such as integrity, self-motivation and confidence, are considered most important whereas at senior-level leader-related skills such as the ability to motivate others, to make decisions, and to persuade are considered more important.

Other researchers have focussed on assessing logistics competency requirements from the perspective of educational programs in logistics. These studies are mostly US focussed. For instance, Lutz and Birou (2013) conducted a survey of (primarily US) logistics undergraduate and graduate courses in higher education to examine how topics taught in these courses compare to needs of companies in the industry. They find that the industry prefers students with a well-balanced skill set and recommend that logistics educational programs focus more on problem analysis and on people (social) skills. Furthermore, Onar et al. (2013) compare European master programs in Logistics that are published by the European

Logistics Association in 2004 and 2011, to examine trends in graduate SCM programs, to identify knowledge and skills relevant for SCM education and to propose a framework for designing such programs. Also, Bournakis et al. (2013) examine how SCM topics emphasised by UK universities compare to the topics that UK-based companies emphasize in their hiring processes. They find that while research output of UK universities generally matches industry's needs, the topics addressed in their logistics postgraduate programs are quite different from industry-hiring needs.

Based on the literature, we develop a framework of competency requirements for logisticians. Following our definition of competency, we categorise the competency aspects identified in the reviewed studies under knowledge, skills and attitudes. Table 1 provides an overview of the KSA's identified in prior research.

Table 1 Preliminary framework of competency requirements (knowledge, skills, attitudes) for logistics graduates. Note that there is no interrelation between the rows in the table.

Knowledge about	Skills		Attitude
	Hard skills	Soft skills	
Basic logistics (Derwik & Hellström, 2017; Jordan & Bak, 2016; Karttunen, 2018; Kotzab et al., 2018; Murphy & Poist, 2006; Thai, 2012)	Computer/software skills (Derwik & Hellström, 2017; Flöthmann, Hoberg, & Wieland, 2018; Jordan & Bak, 2016; Karttunen, 2018; Kotzab et al., 2018; Murphy & Poist, 2006; Thai, 2012)	Decision making skills (Bak et al., 2019; Derwik & Hellström, 2017; Jordan & Bak, 2016; Karttunen, 2018; Murphy & Poist, 2006; Thai, 2012)	Motivation (Bak et al., 2019; Jordan & Bak, 2016; Murphy & Poist, 2006)
Mathematics (Jordan & Bak, 2016; Karttunen, 2018; Kotzab et al., 2018; Murphy & Poist, 2006; Thai, 2012)	Financial management (Jordan & Bak, 2016; Karttunen, 2018; Kotzab et al., 2018; Murphy & Poist, 2006; Thai, 2012)	Business communication (Bak et al., 2019; Jordan & Bak, 2016; Karttunen, 2018; Kotzab et al., 2018; Murphy & Poist, 2006)	Flexibility (Bak et al., 2019; Jordan & Bak, 2016; Karttunen, 2018)
Professional experience (Derwik & Hellström, 2017; Jordan & Bak, 2016; Karttunen, 2018; Kotzab et al., 2018; Thai, 2012)	Foreign language (Karttunen, 2018; Kotzab et al., 2018; Murphy & Poist, 2006; Thai, 2012)	Teamwork (Bak et al., 2019; Flöthmann, Hoberg, & Gammelgaard, 2018; Jordan & Bak, 2016; Karttunen, 2018; Kotzab et al., 2018)	Adapt to change (Jordan & Bak, 2016; Karttunen, 2018; Murphy & Poist, 2006)
Logistics related regulations (Derwik & Hellström, 2017; Karttunen, 2018; Murphy & Poist, 2006; Thai, 2012)	Analytical (Flöthmann, Hoberg, & Wieland, 2018; Jordan & Bak, 2016; Karttunen, 2018)	Ability to plan (Bak et al., 2019; Jordan & Bak, 2016; Karttunen, 2018; Thai, 2012)	Learning to learn (Kotzab et al., 2018)
Basic technology (Derwik & Hellström, 2017; Karttunen, 2018; Murphy & Poist, 2006; Thai, 2012)	Cost control (Karttunen, 2018; Thai, 2012)	Interpersonal relations (Bak et al., 2019; Flöthmann, Hoberg, & Wieland, 2018; Karttunen, 2018; Murphy & Poist, 2006)	Enthusiasm (Bak et al., 2019)

Business ethics (Jordan & Bak, 2016; Karttunen, 2018; Murphy & Poist, 2006)		Problem solving (Bak et al., 2019; Flöthmann, Hoberg, & Wieland, 2018; Jordan & Bak, 2016; Karttunen, 2018)	Self-confidence (Murphy & Poist, 2006)
Local and international business regulations (Derwik & Hellström, 2017; Murphy & Poist, 2006; Thai, 2012)		Time management (Bak et al., 2019; Jordan & Bak, 2016; Karttunen, 2018)	
Sustainable logistics systems (Karttunen, 2018; Thai, 2012)		Intercultural management (Karttunen, 2018; Kotzab et al., 2018; Thai, 2012)	
Reverse logistics (Karttunen, 2018; Thai, 2012)		Leadership (Bak et al., 2019; Jordan & Bak, 2016; Karttunen, 2018)	
Impact of globalisation (Thai, 2012)		Infrastructure planning and management (Bak et al., 2019; Karttunen, 2018; Thai, 2012)	
Modelling of operating systems (Thai, 2012)		Collaboration (Bak et al., 2019; Jordan & Bak, 2016)	
		Innovation and entrepreneurship (Karttunen, 2018; Kotzab et al., 2018)	
		Stress management (Bak et al., 2019; Jordan & Bak, 2016)	

Research methodology

Based on a literature review, we identified trends and developments in the field of logistics and developed framework of competency requirements for logisticians. To examine what knowledge, skills and attitude aspects are relevant for bachelor graduates in logistics to possess in the near future, given the developments in the field, we conduct semi-structured in-depth interviews. We use purposive sampling to select specific people who are knowledgeable about the research topic (Sekaran & Bougie, 2016). Particularly, judgment sampling was used because the selected respondents are in the best position to provide the information and insights required (Verhoeven, 2015). We conducted a total of 18 interviews with academic lecturers teaching bachelor level Logistics and SCM related courses and senior professionals working in the field of Logistics/SCM for more than 10 years. The academics have experience with student internship supervision, they are knowledgeable about the bachelor curricula in logistics and work in close collaboration with companies

in the industry. As such, they are knowledgeable about trends and developments in the sector, about current offerings in logistics bachelor curricula as well as industry needs. Most professionals have experience as hiring managers of graduate students, hence, they have first-hand information on recruiting requirements of junior logisticians. Additionally, given their experience in the sector, they are knowledgeable about current trends and developments. All but one respondent work in The Netherlands.

Data sources and research instruments

The purpose of the interviews is twofold. Given that competency requirements change with trends and developments in the sector, the aim is to obtain insight in competency requirements of logistics bachelor graduates as well as to gain understanding of future developments in the field of logistics and how they affect competency requirements of bachelor graduates that start as entry-level logisticians in the industry.

Interviews with academics. In total, eight in-depth semi-structured interviews were conducted with academics. As these academics all work in close collaboration with companies and have experience with student internship supervision, these interviews helped to gain insight in trends and developments in logistics and what these imply for competency requirements of bachelor graduates in logistics.

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Interviews with senior logistics professionals. In total, ten in-depth semi-structured interviews were conducted with senior logistics professionals. These interviews helped us to gain insights in the most prevalent logistics trends and developments considered by companies. Additionally, it provided information on the competency aspects of bachelor graduates that companies consider important now and in the near future, particularly given the developments in the sector.

The interviews are based on the preliminary logistics competency framework developed in section 2. First, we asked open questions about future logistics trends. Thereafter, we asked questions directly related to logistics trends identified in the literature review. Second, we asked open questions about knowledge, skills and attitude requirements that are considered critical for bachelor graduates as future logisticians. Again, we followed up with questions about specific KSA's. We started with open questions as we wanted respondents to come up with ideas and suggestions that they consider relevant, before providing them with suggestions about trends, developments and KSA's, therewith possibly biasing information provided. In this regard, the competency framework from section 2 was used as a checklist. Respondents were encouraged to elaborate on their answers to obtain in-dept insight. The interviews were recorded and transcribed afterwards.

Data analysis

To be able to analyse the amount of data generated through qualitative data collection, the transcribed interviews were coded and categorized for analysis. We rearranged the qualitative data to help recognize patterns in the data and to draw meaningful conclusions (Sekaran & Bougie, 2016). The data analysis is based on four steps (Sekaran & Bougie, 2016): The researchers coded the data by formulating codes based on the content of key phrases or sentences. For instance, remarks about customer relation management were coded as ‘CRM’ and insights about information-driven technology and big data were coded as ‘data’. As an example of what the coding scheme looks like, Figure 1 provides an overview of part of the coding scheme used. Column 2 shows the code name that was used and column 3 provides a brief explanation of the code.

Once the data was coded, the codes were categorized. The types of trends are distinguished into social trends and technological trends, based on the categorisation of the DHL Trend Radar (Chung et al., 2018). As explained in section 1, following our definition of competency, we distinguish knowledge, skills and attitudes. Therefore, codes related to these KSA's were grouped together accordingly. Skills were categorized as hard skill or soft skill (see section 2.2.1). Column 1 in Figure 1 indicates the code (sub-)category based on this categorisation.

Figure 1 Partial sheet of the data analysis process. Each trend/development and KSA is shown with one code as an example. T = Technology, S = Social, A = Academics, SP = Senior professional

Category and sub-category	Coding unit	Description	Resp. (A).1	Resp. (A).2	Resp. (A).3	Resp. (SP).1	Resp. (SP).2	Resp. (SP).3	count (A)	count (SP)	count (total)
Future trends (T)	automation	robotics, automation process operation, drone	●	●				●	5	6	11
Future trends (S)	sustainability	sustainable business development		●				●	4	5	6
Knowledge	Business	general business knowledge, financial/T/sale&marketing/ supply chain fiance, operation process, understand the value chain		●	●		●	●	5	9	14
Soft skills	communication	internal and external communication		●	●	●	●		6	6	12
Hard skills	IT & data	basic to intermediate IT skills; data analysis: interpretation and understand the data	●	●	●	●	●	●	6	9	15
Attitude	proactive/initiative	proactive, taking the initiative, don't wait until problem come to you	●	●	●	●	●	●	5	8	13
Must-have skills	data	data analysis	●	●	●	●	●	●	7	8	15
Better to have, no obligated skills	leadership	leadership and managerial skills	●	●	●	●	●	●	8	8	16

Findings

In this section, we present the findings from the in-depth interviews. First we discuss the trends and development that the respondents observe and expect to develop in the field of logistics in section 4.1. Finally, in section 4.2, we present the findings on the competency requirements of future logistics graduates.

Trends in logistics

Based on their experience in the field of logistics, respondents provided an outlook on the developments that will affect the field of logistics in the near future (i.e., the coming three to five years). In this regard, respondents addressed various technological as well as social and business trends which they observe in the industry and/or expect to develop in the area of logistics. An overview of the trends mentioned in the interviews is given in Table 2. Respondents agree that automation and robotisation will continue to develop in, and change, operations processes. They believe such technology will continue to be one of the main trends in the field of logistics in the coming years. An academic addressed the potential of drones to be used for the delivery of goods and he expects to see this application more and more in the future. Respondents also recognise that the use of Data Science is a key trend that will significantly affect the field of logistics. Relatedly, respondents observe and expect that logistics operations will digitalise further. Because of the technological trends and developments resulting, for instance, in more and more possibilities to collect, store and analyse data, logistics will become smarter. This offers opportunities for companies to further reduce their logistics costs.

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Furthermore, various social and business trends were highlighted by the experts in our study. For one, sustainability is expected to continue to grow in importance. Particularly, stakeholders' expectations about sustainable business operations force companies to implement sustainability strategies. Also, respondents expect that the demand for human capital, particularly high-skilled logisticians, remains an important issue. The working population in the logistics sector is ageing. In the coming years, this will result in an increase in the outflow of logistics professionals. At the same time, the inflow of logistics professionals is declining, strengthening personnel shortages. Furthermore, to be able to compete in the marketplace customisation and personalisation of products and services as well as customer relationship management is expected to grow in importance. In this regard, the use of omni-channel strategies will be important for organisations to improve customer/user experience.

Additionally, respondents indicate that collaborations between companies and their stakeholders will continue to grow in importance in order to be able to keep up with the rapid developments in their business environment. In response to technological developments, changing customer demands and the prevalence of societal issues, new business models will be created and some companies might combine different business strategies. Respondents expected that the trends they observe and expect to develop will provide more opportunities to increase the efficiency of operations, enable shorter lead-times and further optimize supplychains

Table 2 Findings of technological and social & business trends.

Technological trends	Automation, robotisation, drones
	Information- and data-driven technologies, big data
	IT technology (e.g., blockchain, artificial intelligence)
	Digitalisation of operations
Social and business trends	Importance of sustainability
	Increasing stakeholder expectations
	Personalisation and customisation of products and services
	Demand for highly skilled logisticians
	E-commerce
	Customer relationship management
	Sharing economy and sharing logistics
	Omni-channel strategies
	Complexity of supplychain structures
	Standardisation of logistics operations, controlled by large enterprises
	Quality control

Table 3 Findings of competency requirements (knowledge, skills, attitudes) for logistics graduates. Additions to the preliminary framework are indicated in italics

Knowledge about	Skills		Attitude
	Hard skills	Soft skills	
Basic logistics	Analytical	Business communication	Flexibility
Basic technology and innovation	Planning	Collaboration	Constructive
Data Science	IT and database * Data Science * ERP systems * Excel, MS Office	Strategic	Openness
General business	Foreign language	Teamwork	Proactive
IT and software		Problem solving	Curious
Sustainability		Time management	Adaptive
Process management		Intercultural management	Reliable
Change management		Leadership	
		Innovation and entrepreneurship	
		Managerial	

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Competency requirements

The findings on competency requirements of logistics bachelor graduates are provided in Table 3. The table indicates the knowledge, skills and attitude aspects that experts in our study identified as important for bachelor graduates in logistics in the near future. Additions and changes to the preliminary framework are indicated in italics. In sum, knowledge and skills related current technological developments such as robotics, blockchain, the internet of things and artificial intelligence were indicated to be important. At the same time, respondents underlined the increasing importance of soft skills compared to hard skills. Next, we discuss the findings on important knowledge, skills and attitude requirements in more detail. We do so by relating them to the trends and developments that are identified, and expected to develop, in logistics practice.

Knowledge

Respondents acknowledge that basic logistics knowledge, such as knowledge on warehouse and inventory management, incoterms, customer service, trade law, forecasting, e-commerce and process optimisation remain essential knowledge for young logisticians. Furthermore, technological trends play an important role in the logistics sector. Trends such as digitalisation, robotics, blockchain, internet of things, artificial intelligence and developments in the field of Data Science change, and will continue to change, the way

jobs are performed and work is organized. Some jobs will change in task content, others will disappear and new jobs will arise. For logisticians it is important that they are able to work with these new technologies and tools, hence, knowledge about such technologies and related IT/software is essential to be able to function on the job. Therefore, logisticians should have a basic understanding of such technological developments and innovations and on how to apply these tools in practice.

In addition, respondents expect sustainability to become a more important knowledge area for logisticians. Sustainability is an important issue that concerns the society as a whole. In the field of logistics efforts are taken, and have to be taken, to make supplychains more sustainable. In addition, stakeholder expectations regarding sustainability increase. Therefore, junior logisticians should have knowledge about green logistics/sustainability and innovations and developments in this area. In this regard, one may speak about understanding of the circular economy, an economy 'that is restorative by design, and which aims to keep products, components and materials at their highest utility and value, at all times' (Webster, 2017, p. 17). Also, our respondents indicated that it is important for future logistics graduates to have a proper understanding of the entire business process. Because of, amongst others, the globalisation of supplychains and business operations, the business environment becomes more complex. Maintaining and improving efficiency and optimizing the use of resources becomes more complex. At the same time, logistics is linked more and more to the strategic business processes of companies and organisations. Therefore, it is important that logisticians are able to take a broader perspective, to see linkages and be able to cooperate with other departments/functions. Hence, it is vital that logistics graduates gain knowledge about general business (e.g., finance, marketing and sales, operations management). Relatedly, knowledge about business processes, including business process management, analysis and improvement, is essential.

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However, knowledge about the business and how to do things should be complemented with knowledge about change management. In order to implement initiatives, to bring about change, to be able to improve, the status quo has to change. People have to do things differently or have to do different things. To realise this, knowledge about change management is considered highly important.

Skills

To adequately function on the job, knowledge or understanding alone is not sufficient. Knowledge should be applied appropriately to successfully perform tasks and activities, i.e., one should have the right skills. Respondents in this study indicate that whilst hard skills remain important, soft skills will become more important in the future.

Hard skills

With more possibilities to collect and store increasing amounts of data, and more possibilities to analyse data, digital and data analysis tools will be applied more often in business activities. Therefore, having appropriate IT and data science skills are becoming more important for logistics graduates. It has been acknowledged that graduates are able to work with IT systems, for instance ERP systems that are used in practice. Relatedly, it becomes more important to have data science skills to be able to process data to distil relevant information and understand and interpret results. In this regard, analytical skills, i.e., the ability to analyse information, to be able to detect patterns, to make sense of data, to think critically, are highly important. Respondents indicate that, as MS Excel is often used in logistics business to analyse and plan logistics activities, respondents stress the relevance of having sufficient MS Excel skills. Furthermore, respondents indicate that speaking one or more foreign languages is also relevant for logistics graduates.

Soft skills

Experts in our study emphasized the increasing importance of soft skills. The business environment becomes more complex and cross-border logistics activities will increase. To operate in such an environment, logisticians must not only have good communication skills, but also good intercultural management skills to be able to work with people with different cultural backgrounds. Our respondents acknowledge the importance of leadership and management skills but indicate that these are skills that can, and typically, are being developed through experience, hence, they can be developed at a later stage and are not necessarily must-haves for bachelor graduates in logistics. Moreover, time management, i.e., being able to prioritize tasks to get the job done in time, as well as problem-solving skills are also considered to be important skill requirements.

Attitude

Our respondent acknowledges the importance of a professional attitude. This is particularly important in the field of logistics given the way in which work is arranged. Often logisticians work independently, without close proximity to supervisors. Such a working environment brings about responsibility. Indeed, reliability was indicated as an important attitudinal trait. Senior professionals in our study believe the work performance of logistics graduates could be highly influenced by their attitude. Based on observations and evaluation of logistics graduates' working performance, these professionals indicate that the ones who are enthusiastic, flexible and motivated are more likely to adapt their working environment faster, learn more new knowledge at work and perform better than the ones who are demotivated, rigid and passive. Professionals indicated that attitude aspects play an important role in the recruitment process.

In addition, our respondents indicated that logistics graduates should be proactive and curious. Given the fast changing business environment they need to be flexible with working routines and know-how to adapt to changes in the working environment. On the top of this, logistics graduates need to maintain a constructive attitude; they need to be open to new ideas, support the team and be helpful in tackling problems.

Discussion

To keep up with the fierce competition in the field of Logistics and SCM, companies require employees with the appropriate competencies to fulfil their job successfully. With the rapid societal and technological developments companies face, the role as well as the required knowledge and skillset of logisticians is changing. To deliver logistics professionals that can fulfil their job adequately, it is important to update curricula of educational programs in Logistics and SCM on a regular basis.

However, while competencies have received increasing attention in Logistics and SCM research (Hohenstein et al., 2014), there are no or limited recent and solid studies that provide insight on competencies that graduates starting as entry-level logisticians should possess. Therefore, in this study, we examined developments in the field of Logistics and SCM and analysed the competency requirements of bachelor graduates in logistics now and in the near future. To do so, we conducted a literature review complemented with in-depth interviews with professionals and academics.

The findings indicate the importance of technological trends such as digitalisation, automation and robotics, and data-driven logistics, blockchain and artificial intelligence. These trends may help companies to reduce logistics-related costs, increase margins, improve operational processes and shorten lead times and optimize supplychains. Additionally, the impact of social and business trends such as the focus on sustainability, increasing customer expectations, more personalisation and customisation and the growth of e-commerce should be taken into account. The complexity of supplychains increases, they become more agile and relationship-focused, different stakeholders are involved and customers have higher expectations leading to more personalisation and responsiveness (Kersten et al., 2017). To keep up with the competition and developments in the business environment, quickly applying and/or adapting to these developments is vital. To enable this, employees should have the appropriate competencies (Wagner et al., 2019).

Technological developments like automation and robotisation significantly impacts logisticians jobs. Some jobs change in terms of content, others disappear and new ones arrive (Chung et al., 2018; Wilkinson & Barry, 2020). For example, the automation of warehouses makes human order pickers unnecessary. However, employees are required

to monitor the automated processes, to act when the technology fails and to handle exceptions (Pals, 2019). At the same time, technological developments will also enable the improvement of the quality of jobs as they take over repetitive and/or labour intensive tasks (Wilkinson & Barry, 2020). Note that technological advancements are also necessary given the increasing shortage in skilled logisticians on the one hand, and e.g., a growth in e-commerce purchases and related pressure to shorten order fulfilment and delivery times on the other hand (Chung et al., 2018).

With these technological advancements, operational tasks are being automated more, with, for instance, the use of AI to automate back-office tasks. This requires employees who have a monitoring role, who have a proactive attitude and possess problem-solving skills, who are creative and pragmatic to act on exceptions and problems that arise. Thereby, the focus of the logistician shifts from the operational to the strategic level (de Vries et al., 2019). Whereas in logistics traditionally the focus was on efficiency and economies of scale, the focus will be more on being smart (Pals, 2019).

60 The logistician of the future will be for a large part an analyst and hard skills remain important. As a result of technological developments, possibilities to collect, store and analyze data, increase, enabling data-driven decision-making. For instance, telematics systems that continuously collect data about vehicle locations or RFID technology enabling the tracking of products in warehouses and from door to door offer opportunities for, amongst others, optimisation of transport planning or order picking. To seize those opportunities and reap the benefits, companies require employees who have basic knowledge about technology and innovation, about IT and software and data science but also hard analytical skills, IT and data science skills to transform data to information that can be used for decision-making. Analytic skills are important to understand business processes and optimally use IT tools (de Vries et al., 2019). Interestingly, Wilkinson and Barry (2020) report that about 90% of the jobs now require IT skills but that there are over 60 million people in the EU that have insufficient basic skills in this area.

Besides the technological developments, the social context is becoming more important in logistics. Amongst others, strategies will focus more on (long term) relationships than (short term) transactions, there is more customisation and more internal and external (international) collaboration. These developments ask for logisticians who possess soft skills such as collaboration skills and communication skills but also intercultural management skills. Furthermore, technological innovations play an important role and potentially have a large impact. However, their success largely depends on the successful adaptation and implementation by employees. It means that employees have to have a flexible, adaptive attitude and are open to lifelong learning to function in a continuously evolving environment. To realize change, soft skills such as change management and leadership skills and being able to motivate and coach people are becoming more important.

To summarize, having a T-shaped profile, possessing specialist- and general knowledge and skills, is, and will be, important for logisticians (de Vries et al., 2019). Logistics employees should be specialists and generalists at the same time. Specialist knowledge and skills are required for e.g., process optimisation and the functioning in specific links in the chain. As logistics is the linking pin between different parts of the company/the supplychain, general knowledge about other business areas and an interdisciplinary perspective are required to be able to communicate and understand the functioning of different parts of the chain. This study has some limitations and offers directions for further research. First, this study focussed particularly on competency requirements of logisticians in the Netherlands. Because logistics demands may vary depending on the logistics region, a direction for further research is to include other countries/regions in the study. In this regard, this study offers a starting point. Furthermore, this study is based on 18 in-depth interviews. While this was sufficient given the exploratory nature of this study, a suggestion for further research is to develop a survey to obtain more representative insight in the importance of KSA's, to assess their relative importance and compare findings across countries or regions. The findings of this study can be used as a starting point.

Conclusion

In this study we developed a framework listing the competency requirements for bachelor graduates in logistics given the trends and developments within the logistics sector. This framework provides insight for bachelor logistics education programs to develop their logistics and supplychain management curricula so they are tailored to the future competency requirements in the sector. We conducted a literature review that was complemented with in-depth expert interviews. Technological developments like automation and robotisation significantly impact logisticians jobs and their competency requirements. With these technological advancements, operational tasks are being automated more and decision-making will be more data-driven. Logisticians will take on more monitoring roles. As a result, analytical and problem-solving skills, a proactive, adaptive and flexible attitude, knowledge and skills regarding technology and innovation, IT and software, and data science are becoming more important. At the same time, the social context will become more important. On the one hand, strategies are more relation-focused, there is more customisation and collaboration. On the other hand, technological developments are to be adapted and implemented by employees in order to reap the benefits. A flexible, adaptive attitude will become important and communication and collaboration skills, change management, managerial and leadership skills to realize change will be more important. Having a T-shaped profile, i.e., being a specialist and a generalist, remains vital for graduate logisticians in the near future.

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