

Key Competences of Logistics and SCM Professionals – The Lifelong Learning Perspective

ABSTRACT

Purpose

This paper (1) identifies specific qualifications and competences required within the field of logistics and supply chain management from the perspective of lifelong learning and hierarchical level and (2) subsequently reveals a hierarchy level-specific job profile for logistics and supply chain management jobs based on the European Framework for Key Competences and the German Federal Labor Market Authority.

Methodology

A review of the literature on competences and skills in the field of logistics is combined with an analysis of 832 job postings by means of content analyses and thematic mapping.

Findings

The academic literature discusses more than 280 skills and competences related to the job profile of logistics and supply chain managers. The majority of these skills represent social skills. Analyses of job postings show significant differences in the required portfolio of skills and competences depending on the hierarchical level of the position. Contrary to the literature, job postings include more cognitive competences and meta-competences than social skills.

Value

The first contribution of our research is that competences were examined from the perspective of lifelong learning, revealing how this is applied in the field of logistics. The second is that our conceptual framework can be utilised to compare skills and competences between different hierarchical levels. The third refers to the identification of a different set of skills and competences than was expected by employers based on academia and business practice.

Keywords: Logistics and supply chain management skills, qualifications of logistics and supply chain management personnel, human resource management, lifelong learning.

Article Classification: Research paper

Introduction

The demand for people in the field of logistics and supply chain management (SCM) is growing, and it is increasingly difficult to find qualified personnel for blue-collar work, white-collar work and knowledge work (Maku et al., 2005; Sohal, 2013).

The shift from an information society to a knowledge society is impacting the logistics industry as it copes with these changes to continue playing a major role in a globalised economy (Thai et al., 2011). North and Kumta (2014) thus refer to significant changes in labour relations as full-time employment in a company becomes more and more assisted as well as replaced by external third-party providers. This trend has already significantly affected various German industries in which the relevant share of logistics employees hired by manufacturing companies has steadily increased since the late 1970s (Goldschmidt and Schmieder, 2017).

Other megatrends, such as globalisation, resource scarcity and electronic delivery of goods and service, have significantly affected the logistics industry and have certainly led to further dynamic developments in the different professions of logistics (Kiessling and Harvey, 2014). For example, until the early 1970s, more than 70 different professional groups were involved in the loading and unloading of sea vessels, but automation and containerisation have drastically changed the job requirements for dock workers. Today's crane operators require more technical understanding than pure muscle power (Knief, 2013).

From a workforce perspective, these changes necessitate individuals' demonstration of lifelong learning competences (Sahin et al., 2010) and attain certain key competences in terms of knowledge, skills and attitudes that provide added value for the labour market and enhance flexibility and adaptability (European Commission, 2007). Taking this into account, the European Union developed and introduced the European Framework for Key Competences for Lifelong Learning, in which competences were defined "as a combination of knowledge, skills and attitudes appropriate to the context" (European Commission, 2007). The overall goal of this reference framework was to identify and define the key competences individuals needed to guarantee employability and minimise deficiencies related to training and personal development, critical in both "high skill" (Lloyd, 2002) and "low skill" sectors and working environments (Edwards et al., 2009). This issue, namely having the set of skills, knowledge, understanding and personal attributes that make one a match for a given profession, has been proved important (Dacre Pool and Sewell, 2007; Grugulis, 2003).

The logistics industry, however, faces a bright future when it comes to market developments. A recent study by (Doll et al., 2014) indicated a global market volume for logistics services surpassing €900 billion, and this is expected to grow within the next five years by up to 3% per year. Logistics service providers take a share of approximately 16% of this volume (Doll et al., 2014) and, according to (Kille and Schwemmer, 2014), companies such as Deutsche Post DHL, Maersk A/S and SNCF employ a couple hundred thousand employees around the globe. Given these positive market developments, experts expect the future to see a significant demand for qualified logistics personnel, especially in management positions (BVL, 2013).

Nevertheless, (Carter and Carter, 2007) as well as (Ellinger and Ellinger, 2014) expect a shortage of personnel with “the necessary skills, abilities, and aptitudes to fill important supply chain management roles”. This search for people is intensifying as companies are also facing the megatrend of an ageing society, a consequence of a demographic shift (Larsen, 2006; Z Punkt GmbH, n.d.). Specifically in the field of logistics, technology within the areas of material handling, order processing and scheduling is developing quite quickly, and this is also affecting the set of skills and competences required of workers. In broad terms, it seems to be getting more and more difficult to find adequately qualified people for the logistics sector (Von Randow, 2008). Given these societal developments, (Lorentz et al., 2013) claim that companies must change constantly, implying a changing set of skills required for executing logistics and supply chain activities which should comply with the competences for lifelong learning as suggested by the (European Commission, 2007).

Overall, it is vital for an organisation looking for logistics professionals to define an adequate job profile as a combination of skills and competences that permit changes to the job profile to be made quickly in an increasingly volatile environment. Thus far, academic research has presented catalogues and sets of skills and qualifications for logistics managers, which have been assessed and developed based on the experiences of logistics managers and/or students (e.g. Gammelgaard and Larson, 2001). Looking at the practitioner-oriented literature, the Association for Supply Chain and Operations Management (APICS, 2014) has published a competence model for distribution and logistics managers that corresponds with the professional knowledge and skills required to succeed in the job. The aim of this model is twofold, namely to guide individuals considering a career in logistics management and human resource managers hiring logistics managers. The (APICS, 2014) model consists of occupational and profession-oriented requirements and competences as well as foundational

competences. (Skelton and Winters, 2014) present an industry skills report for logistics, claiming that the skills required of supply chain managers comprise both hard and soft skills, including job-specific skills, communication and teamwork/interpersonal skills.

When examining the literature on the skills and competences of professionals in the logistics industry, we identified the following gaps. In previous research, there is insufficient discussion and empirical investigation of the competences required in the field of logistics and supply chain management within different areas and hierarchical levels. More specifically, previous studies are exclusively based on logistics managers—and even students’—self-reflection. Further, the identified skills and competences do not comply with the notions of lifelong learning. In summary, previous research does not provide logistics organisations with a sector-specific understanding and operationalisation of the requirements for logistics personnel in the fast-changing logistics environment. From a practical point of view, this gap is relevant for both employers and employees. Thus, this paper focusses on the following question: What are the key competences in logistics and supply chain management with respect to lifelong learning?

In answering this research question, we contribute to theory and practice in the following way: This work provides the perspective of lifelong learning with a particular focus on the logistics industry. More specifically, our research proposes a conceptual framework that can be utilised to compare skills and competences between different hierarchical levels. Finally, we reveal the different set of skills and competences expected by employers.

The rest of the paper is structured as follows. After this introductory section, we present a literature review followed by a discussion of the theoretical context regarding qualifications and competences. We then introduce a conceptual framework and describe the methodology guiding our empirical research. The results are then discussed as are the major implications for theory and practice. To conclude the paper, we provide avenues for further research.

Skills, qualifications and competences for lifelong learning and job levels

Based on the notions of (APICS, 2014) and (Skelton and Winters, 2014), occupational profiles for logistics and supply chain managers refer to a variety of qualifications, skills and competences.

Within a UK context, (Green, 2011) simply defines a skill as a person’s ability to perform a task. He highlights the struggle to define the term, as the German understanding of a skill is understood as the knowledge needed to perform a broader range of activities. The

complexity of defining the term is also broached by (Payne, 2000), who shows the historical development of skills from a technical ability used in crafting to a multidimensional construct consisting of personal characteristics, behaviours and attitudes. As (Green, 2011) recognises, it is the discipline that which defines the term. Lastly, different classifications of core/non-core skills as well as soft/hard skills further complicate the issue of finding a common understanding of what skills are and the different forms of skills that exist.

Following the categorisation of (Green, 2011), skills can be assigned to different domains, including the following:

- *Generic skills* refer to tasks that generally occur in a wide range of occupations. Generic IT skills are a typical contemporary example.
- *Specific skills* are tasks that usually occur in one or only a few types of occupations and cannot be described with generic indicators. An example is forecasting or scheduling skills (Sohal, 2013).
- *Cognitive skills* include tasks that require thinking activities, such as reading, writing or problem-solving.
- *Interactive skills* cover tasks that require all types of communication and cooperative work (McIntosh and Vignoles, 2001; Sohal, 2013).
- *Physical skills* represent tasks requiring dexterity or stamina.

To allow for the interpretation of skills with greater precision, we introduce the notions of distinct qualifications and competences.

(Tippelt and Schmidt, 2009) define a qualification as a certified and standardised skill. In order to gain a qualification, one has to pass an evaluated exam (Preißing, 2001). Thus, qualifications are recognised as tangible outcomes of training and document a person's acquired skill (Smith and Ridoutt, 2007). This ensures that a person can execute relevant actions within a certain profession to a predefined standard (European Commission, 2007; Smith and Ridoutt, 2007; Tippelt and Schmidt, 2009). Accordingly, a person who has acquired a certain certification is seen as having the necessary set of skills and knowledge as well the cognitive and practical ability to perform certain tasks.

Qualifications are of vital importance when starting a professional career (Müller, 2008; Witt, 1999) and certify a person's ability to perform a certain job (Smith and Ridoutt, 2007). Nevertheless, workflows and job contents often change, and these changes gradually outpace qualifications (Kersten and Schröder, 2012). Consequently, gaining qualifications becomes

less important while the continuous development and preservation of competences becomes more critical (Müller, 2008). Competences are gained through application and problem-solving (North, 2007) and represent the motivation and ability to apply and develop personal skills in a self-reliant manner (Bergmann, 2007). Competences can be trained, that is people can learn to perform new tasks and learn through experiences in a job or by means of self-education and the use of specific training programmes (Müller, 2008); competences follow on from qualifications, enabling employees to perform their role effectively, even if workflows and job contents change (Bartram and Roe, 2005).

In general, job competences can be grouped into primary and secondary competences. The term “primary competences” refers to the content of the professional practice, while secondary competences enable the effective performance of a job (Bartram and Roe, 2005).

Based on the notions of (Mériot, 2005), (Heijde and Van Der Heijden, 2006), (Erpenbeck and Heyse, 2007) and (Fölsch, 2010), we identified four sets of competences to create a wider understanding of them:

- *Professional competences* comprise exclusively the basis of knowledge crucial for a profession.
- *Methodological competences* represent the capability and willingness to apply methods to tasks independently. They include handling and systemising information, recognising correlations, problem-solving, creating solutions and decision-making.
- *Social competences, sometimes referred to as soft skills*, involve the ability and willingness to communicate with other individuals in order to achieve objectives and implement concepts successfully. These competences subsume group- and relationship-orientated behaviour, communicative behaviour, cooperative behaviour, assertiveness and the ability and willingness to solve conflicts.
- *Personal competences* are related to the development of an individual’s own personality within a job role. This includes attributes such as the capability for self-reflection and self-organisation. These competences support motivation, talent and willingness to perform.

As in the discussion on skills, we are confronted by the same problem regarding defining the term competence. Deist and Winterton (2005) emphasise that “competence” is used inconsistently in the literature. Hence, they present a typology of competences including

conceptual (cognitive, knowledge and understanding) and occupational (functional, psychomotor and applied skills) aspects. Furthermore, they divide competences related to personal effectiveness into conceptual (meta-competence and learning to learn) and operational (social competence, including behaviours and attitudes) (see Figure 1).

INSERT FIGURE 1 HERE

To include multidimensionality in the examination of competences, Deist and Winterton (2005) suggest a holistic approach that distinguishes between cognitive, social and functional competences as well as meta-competences.

Cognitive, functional and social competences are consistent with the general understanding of knowledge, skills and attitudes as introduced above. Meta-competences, however, are described as different from the previous three insofar as meta-competences are concerned with supporting their acquisition.

In order to enable a standardised measurement of competences, instruments such as the European Framework for Key Competences for Lifelong Learning have been developed and introduced (European Commission, 2014, 2007). Here, key competences are identified as the combinations of skills, knowledge and attitudes that individuals need for personal fulfilment, development and employment (European Commission, 2007).

We synthesised our work around eight key types of competence (see Table 1, first column). These eight key competences are seen as a reference framework for policy makers, educators and employers (European Commission, 2014).

INSERT TABLE 1 HERE

The two competence models outlined in Figure 1 and Table 1 can be consolidated as shown in Figure 2.

INSERT FIGURE 2 HERE

Communication in one's mother tongue and mathematical/scientific competence are assigned to cognitive competences as they require a strong knowledge base. Learning to learn is described as a meta-competence insofar as it enables individuals to obtain other competences. Foreign language competence and digital competence are assigned to functional competences as the focus here is on the execution and application of related actions at work. A sense of initiative and entrepreneurship, social and civic competence and cultural awareness and expression are considered social competences because they all have a strong relation to individual attitudes and behaviour. The synthesis presented in Figure 2 underpins our empirical analysis.

Differentiating between hierarchical job categories can complement an assessment of the qualifications required for a post, as any firm will have different hierarchical management levels. At each level, different qualifications and competences are required, and the German Federal Labor Market Authority (GFLMA) distinguishes between the following four categories (GFLMA, 2011):

- *Experts* are characterised by having a high-level university degree (PhD or master's degree), and this education is needed to execute very complex tasks. Experts are typically highly skilled and usually have professional experience.
- *Specialists* are characterised by having a bachelor's degree and/or professional education with advanced training. The tasks performed by a specialist are complex and special within a well-defined area of expertise.
- *Skilled workers* are professionally educated but usually do not have an academic degree. They typically perform operative, routine or administrative tasks within their special area of expertise.
- *Assistant/unskilled workers* comprise employees without any kind of professional education. They usually perform group tasks that do not require professional experience or expertise, such as simple routine or manual tasks (GFLMA, 2011).

An alternative form of distinguishing between various types of work level is suggested by (Beruvides and Koelling, 2001). They distinguish between blue-collar work, white-collar work and knowledge work. These work dimensions differ in terms of the levels of uncertainty, endeavour, decision structure and maturity involved. While blue-collar work

tends to be manual or physical, the other two types can be of any nature. The inputs of knowledge work are rather difficult to define while, for the other two types of work, the respective inputs are clear or at least definable. Decision patterns and heuristics are becoming increasingly unstructured as more and more activities are related to knowledge vis-à-vis blue-collar work. All three types of work are performed in the field of logistics.

(Thai, 2012) has shown that, since qualifications and competences vary between positions depending on the hierarchical management level, there are perceived differences in skills between different management levels; this is also suggested by (Skelton and Winters, 2014), who present four different types of role (director, specialist, officer and trainee).

Overall, we see a relationship between the level of a position and the type of competences required. Furthermore, we identify key competences as important factors that describe the abilities an employee needed to satisfactorily fill a specific post. Thus, employers use such key competences in job advertisements to communicate the identified requirements to prospective employees. We conclude that the text of job postings are representations of a required set of cognitive, functional and social competences from a perspective of lifelong learning.

General consideration of skills, qualifications and competences in the context of logistics

Within the research domain of logistics, different authors have addressed the issue of skills, qualifications and competences. However, a focus on the identification of key competences related to logistics and/or SCM is missing.

(Van Hoek et al., 2002) discuss the importance of emotional capabilities within the traditional technical capabilities of supply chain managers by referring to the five dimensions of emotional intelligence (Goleman, 1998). Van Hoek *et al.* describe required changes in behaviour and thinking in regard to approaching problems, problem-solving, work relations, undertaking effort, leadership behaviour, recognition and organisation. They suggest incorporating such skill- and capacity-related approaches into SCM education and development.

(Knight et al., 2005) present a framework of team—but not individual—competences for managing interorganisational supply networks in the public sector. They find six themes linking different skill and knowledge descriptors: network understanding, development of

network position, strategy formulation and implementation, relationship management, learning and knowledge and knowledge management.

(Onar et al., 2013) analyse the knowledge and skills areas of 19 different European supply chain-related graduate programmes and group them, based on their findings, into focussed and diversified programmes. Focussed programmes place more weight on SCM skills, while diversified programmes offer more skills and knowledge other than SCM, such as IT or law modules. The authors pinpoint the importance of industry involvement in the development of such programmes in order to “deliver adequately skilled people”.

Finally, (Gibson et al., 2016) examine SCM learning as a response to the continuing shortage of skilled SCM personnel. They argue that change-management competences and soft skills are required as drivers of more holistic views and collaborative relationships; thus, they are vital for SCM. They appreciate, however, that many of these skills can be acquired on the job.

Key competences in the context of logistics

To explore and identify the required skills and competences in logistics, the use of surveys of logistics and supply chain managers and students has been the most common approach. Past research has also looked into academic education and investigated whether or not the analysed courses and programmes prepare workers adequately for the profession.

Within the logistics literature, (Poist, 1984) suggests three areas of skills one needs to be a successful logistics manager: (1) business skills, (2) logistics skills and (3) management skills (known as the “Business Logistics Management” [BLM] framework). This work includes more than 80 skills and knowledge areas and has been used in the context of skills analysis for logistics managers (Lorentz et al., 2013).

Likewise, (Christopher, 1988) identifies a broad range of logistic competences and qualifications required by companies in different industries at different stages of the supply chain. This research, however, does not reveal an explicit list of these skills. This is addressed by (Poist, 1984) and (Murphy and Poist, 1991a, 1991b), who develop a list of 18 logistics skills and show that traditional and non-traditional logistics skills differ significantly in terms of importance for the industry. They present a list of 32 management skills, 24 of which are rated of “outstanding importance”. Subsequently, they propose ten business skill areas for a logistics manager, including behavioural aspects, analytical abilities, business skills and some

logistics knowledge. Their work has been confirmed by later studies (Mangan and Christopher, 2005).

(Gammelgaard and Larson, 2001) investigate logistics skills and competences in a slightly different way, namely by developing a scale of 45 context-independent logistics skills areas subsequently tested using 124 supply chain managers. The 17 most frequently used areas refer to what (Murphy and Poist, 1991a, 1991b) term “management skills” (e.g. teamwork, decision-making, problem-solving, ability to see the “big picture” etc.). (Gammelgaard and Larson, 2001) condense these 45 items into three skill-area factors: interpersonal/managerial basic skills, quantitative/technological skills and SCM core skills.

(Razzaque and Bin Sirat, 2001) test the BLM framework proposed by (Poist, 1984) and identify seven skill-based factors that describe the skills portfolio of senior logistics managers: operational skills, basic business knowledge, economics and finance, communication skills, legal knowledge, analytical skills and general knowledge.

(Myers et al., 2004) also examine the impact of logistics skills on the value generated by logistics managers for their organisations and suggest four groups of general management skills: social, time management, decision-making and problem-solving.

Building on the aforementioned work, (Jim Wu, 2006) investigates the logistics skills required at different hierarchical management levels, identifying 10 skills areas: networking/computing, a second language, international trading/procurement, labour/customs/tax laws, human resource management and organisational planning, finance/cost control, quantitative analysis, planning/evaluation, logistics centre operational skills and others. In a second step, these areas are allocated to low, medium and high management levels, showing that different roles within the managerial hierarchy require different logistics skills. Likewise, (Thai et al., 2011) adapt the 68 skills proposed by (Murphy and Poist, 1991a, 1991b), revealing that management skills (managing client relationships, problem-solving ability, cost control, ability to plan) and personal attitudes (personal integrity) are most important, especially for those entering senior-management-level positions.

The academic literature has considered other perspectives too, including insights gained from managers at headhunting firms. For example, (Murphy and Poist, 2007) find that the most relevant areas of logistics knowledge for senior-level logisticians have not changed, though additional skills have been recognised, such as supply chain orientation and logistics

information management. Another perspective is provided by (Sodhi and Son, 2008) and (Sodhi et al., 2008). They approach the issue differently by analysing the content of job advertisements to show what employers expect from graduates in terms of SCM knowledge. They identify a catalogue of specific knowledge areas as well as non-SCM-related skills such as leadership, communication and project management. (Sodhi and Son, 2010) further analyse this data set and find the most important knowledge areas not to depend on industry sector.

Focussing on the challenges of globalised markets, (Thai, 2012) lists 68 skills and compares them to managers' perceptions of current and future job requirements, with the skills examined according to work experience and hierarchical level. For 11 of the 68 skills, there are significant differences between managerial levels.

Other academic studies have examined the skills offered in university programmes. For example, (Jim Wu et al., 2013) identify a set of 50 skills based on critical assessments made by participants in an executive MBA programme, and nine clusters emerge: personal skills, leadership skills, international perspective, logistics knowledge, resource integration, market/business knowledge, international trade, risk management and environmental awareness. They find significant differences between the importance assigned to the identified skills by the programme participants and the importance assigned by their educators. Similarly, (Lutz and Birou, 2013) examine the logistics syllabuses of 37 universities, formulating five skill classes (in partial accordance with Myers et al., 2004): social skills, decision-making skills, problem-solving skills, time-management skills and general knowledge. (Bourlakis et al., 2013) analyse the supply and demand of logistics graduates by analysing the content of job advertisements as well as the content of teaching programmes. They identify a gap between industry requirements in terms of logistics-related positions and the focus of degree programmes and illustrate the importance employers assign to non-SCM-related soft skills such as leadership, communication, project management and team-related skills.

On balance, a critical reflection on the literature shows that most studies determine the skills required of logistics managers based on self-reflection done by logistics managers and/or students. Moreover, and crucially, these studies do not indicate whether the presented skills and competences comply with the notions of the key competences for lifelong learning as shown in Figure 2 in connection with various hierarchical management levels. This amounts to a major gap in the research, one we addressed in our empirical research.

Methodology

Research design

To identify the key competences for lifelong learning in logistics and their association with different hierarchical management levels, we utilised different data sources and forms of analysis (see Figure 3).

INSERT FIGURE 3 HERE

Using our literature review, we created a catalogue of 283 identified skills. For our empirical investigation, we examined 1,000 job advertisements that had been posted on German online job portals (Stepstone, Jobpilot and Xing). We focussed on online job portals because almost 40% of all job vacancies are advertised online (Brickwedde, 2012); the three online job portals chosen are the most important in Germany. (Parry and Tyson, 2008) and (Weitzel et al., 2012) support such an approach by indicating the increasing importance of online job portals for companies.

(Todd et al., 1995) analyse job advertisements for information technology positions, Den (Den Hartog et al., 2007) those for leadership positions and (Sodhi and Son, 2008, 2010) and (Bourlakis et al., 2013) those for SCM positions. These authors combine content with statistical analyses to identify skills requirements from job advertisements. However, none of those studies examined a set of predetermined skills and competences for different hierarchical organisational levels and/or job categories.

The advertisements we analysed for this research were all posted within our research period of four months. Each was copied into a text file and characterised using variables for the date and title of the job advertisement, the name of the employer, the ID of the vacancy, the job location and the occupational category. The documentation of the vacancy ID was necessary as some companies would post a given job vacancy in several online job portals. The sample was reduced because 168 advertisements were either listed more than once in the job portal or referred to job categories that were not included in our analysis.

Analysis 1: Content analysis of literature-based skills and competence catalogues

We characterised the 283 skills identified and reported in the literature based on explanations found in relevant literature sources. Next, we compared this set of skills to a set adapted from the recommendations of the European Parliament (European Commission, 2007): (native and foreign) language competences, mathematical and basic natural sciences competences, basic computer competences, advanced computer competences, learning-to-learn competences, social and civic competences, sense of initiative and entrepreneurship competences and cultural awareness competences.

To ensure the reliability of the coding process, four researchers independently coded and interpreted the qualitative data (Creswell, 2009). Following the notions of (Krippendorff, 2004), each coder was equipped with clear instructions and the coding scheme. The coding outcomes were compared and disagreements between coders discussed. The coders then agreed on a final coding set.

Analysis 2: Thematic mapping of job advertisements

To explore and conceptualise the textual data from 1,000 job advertisements, we followed a thematic mapping technique using the software Leximancer (Angus et al., 2013). This computer-assisted text analysis uses machine-learning procedures, while the semantic analysis performed by the software is based on Bayesian theory. By analysing word frequency and co-occurrence of families of terms, this software supports the examination of the interconnectedness of central themes and concepts through automated processes to reveal contextualised content in textual data (Smith and Humphreys, 2006). In general, the themes and concepts derived correspond to those derived by qualitative researchers (Rooney, 2005).

Analysis 3: Content analysis of job advertisements

In the next step, we coded our data manually in order to identify different sets of qualifications and skills required in the job advertisements by means of the same coding scheme described in the section “Analysis 1”. Furthermore, we measured the occupational category identified in each job advertisement on an ordinal scale from 0 to 4; numbers 1 to 4 referred to the classification of professions by the (GFLMA, 2011) into four different qualification levels, and we also included a level 0 because we initially planned on including advertisements for trainee positions in our analysis:

- requirement level 0 = trainee position
- requirement level 1 = assistant; unskilled worker
- requirement level 2 = skilled worker; professional education
- requirement level 3 = specialist; university degree or professional education or professional education with experience and advanced training
- requirement level 4 = expert; high-level university degree

In the end, we eliminated the trainee and assistant/unskilled worker positions from our further analyses.

Results

Analysis 1: Content analysis of literature-based skills and competence catalogues

Our search revealed 283 skills presented by 12 papers as being relevant for a logistics, operations and/or supply chain professional (details can be found in the supplementary material in Appendix 1).

Regarding the overall character of an individual skill, some researchers refer to the BLM framework (Poist, 1984). Other researchers differentiate between social skills, decision-making skills, problem-solving skills and time-management skills (Myers et al., 2004). Yet others rely on a combination of these two approaches (Sodhi and Son, 2008). However, some authors introduce certain skills that are not related to any literature-based skills framework. Examples include the ability to make profits, the ability to see the big picture, ambition, adventure and appearance, as suggested by (Gammelgaard and Larson, 2001), (Jim Wu, 2006) and (Jim Wu et al., 2013). The largest group of skills is business related ((n=56), followed by management-oriented (n=41), logistics-related (n=29) and decision-making (n=25) skills.

Overall, there is no consistency in the classification of the identified skills, with some identical individual skills classified differently by different authors. The most overlap is seen between (Jim Wu, 2006) and (Jim Wu et al., 2013), who do not refer to the BLM classification. Table 2 shows the results of transforming the 283 individual skills into lifelong learning competences as well as the results of placing them in a combined competence model (see the previous section) following the notions of (Deist and Winterton, 2005).

INSERT TABLE 2 HERE

Most skills were related to a sense of initiative and entrepreneurship competences (n=179), followed by social and civic competences (n=70), cultural awareness competences (n=60) and basic competences in science and technology and mathematics (n=48). Generally speaking, an explicit allocation of an individual skill to one of the eight competence sets is not always possible due to a lack of clear description of the skill.

When undertaking the competence perspective outlined in Figure 2, we found that most of the reported skills represented social competences (n=310), followed by functional competences (n=77). Cognitive competences as well as meta-competences (n=14; n=13) were represented less frequently. These results indicate the importance of a management dimension in the field of logistics.

Analysis 2: Thematic map of job advertisements

Based on 832 advertisements, we produced a thematic and conceptual map. However, before doing so, we removed generic terms such as “important”, “work” and “successful”, as well as firm names. Figure 4 depicts the outcome of the analysis and represents a heat map that ranks the importance of each theme using colours—red indicates the most important, orange the second most important and so on. Furthermore, the diameter of each circle indicates the theme’s size in terms of the concepts it encompasses (Leximancer, 2011). To make the results as meaningful as possible and simple to grasp, we focussed on the most important 50% of themes (see circles) showing all concepts (see points) that emerge from the data (Leximancer, 2011). The map provides a global picture of the most important concepts in the textual data and how they are linked in terms of themes (Rooney, 2005).

INSERT FIGURE 4 HERE

By relying on connectivity values, we were able to identify five themes. The description of each theme is based on the interpretation of the references related to the concepts it encompasses. The most important one refers to *sense of initiative and entrepreneurship* (100% relevance). This includes concepts related to management areas, i.e. analysis planning, organisation, implementation, coordination, collaboration, control and development, support

services and projects. The second most important theme relates to the specific expertise required for a role (65% relevance), referring to *basic competences in science* (specifically with regard to logistics in this case). This theme includes concepts such as logistics, procurement, production and warehousing, though it also includes the concepts of work experience and international experience. The third theme refers to *language as well as basic and advanced computer and software competences* (23% relevance). The fourth theme relates to learning to learn (13% relevance) and includes concepts such as a university degree and training. The fifth and final theme that emerged from the advertisements refers to teamwork skills (5% relevance).

In light of these analyses, we can conclude that the job advertisements reflect a focus on management and industry-specific skills. Interestingly enough, job experience, as part of a basic competence in science (understood here as logistics), is seen as an important issue. Language and basic and advanced computer competences are loosely connected to the core themes. Finally, teamwork skills and learning-to-learn skills seem to be important, yet they are isolated from all other themes and concepts emerging from the textual data. Thus, it was interesting that a primary qualification such as a university degree showed up.

Analysis 3: Content analysis of job advertisements

Looking at the professional categories within our job-posting sample, we can identify the following pattern. The largest group is that of experts (33.2%), followed by skilled workers (27.0%) and specialists (23.0%). The remaining two groups, assistants and trainees, represent a much smaller share of the sample, which might be due to the fact that organisations utilise online job portals more frequently to advertise higher-ranked job vacancies. We thus focussed on the three major professional categories of experts, skilled workers and specialists.

Next, we looked at the required primary qualifications and noticed that the majority of positions required a university degree (n=331), followed by a requirement for professional education (n=266), a university degree/professional education (n=211), an apprenticeship and qualification training (n=20) and no skills requirement (n=50). By applying a χ^2 test, we found a significant association between the professional category and the primary qualification required ($\chi^2_{(8)}$, 1657.906; p, .000). Expert positions required a university degree significantly more often than the other position types, whereas skilled-worker positions

required professional education more often than the other position types. In line with the notions of (Hildebrand and Roth, 2008), expert positions required a university degree or professional education.

Figure 5 presents the results of our qualitative coding process, which we used to translate the communicated skills into lifelong learning competences.

INSERT FIGURE 5 HERE

As already illustrated by our thematic map of job advertisements, one requirement found in almost all job postings was professional/job experience. With regards to the key competences for lifelong learning, (foreign) language, sense of initiative and entrepreneurship, social and civic and basic computer competences were mentioned most often, followed by advanced computer competences. Mathematical and basic science and technology competences, cultural awareness and expression, and learning to learn came up less often. In addition to professional experience, we identified flexibility as another requirement for logistics positions, one which had not emerged from our review of the existing literature.

In comparing these results to our findings from the content analysis of the literature-based skills catalogue, we see that managerial competences play the most important role in both cases. We again tested for an association between the membership in a professional group and the different competences, including professional experience as well as flexibility (see Table 3).

INSERT TABLE 3 HERE

A series of X^2 tests showed statistically significant results for professional experience ($X^2_{(2)}$, 14.828; p, .001), foreign language competence ($X^2_{(2)}$, 8.145; p, .017), basic computer competence ($X^2_{(2)}$, 28.989; p, .000), advanced computer competence ($X^2_{(2)}$, 7.280; p, .026),

mathematical and basic natural science competence ($X^2_{(2)}$, 88.897; p, .000) and cultural awareness ($X^2_{(2)}$, 21.527; p, .000). By investigating the frequencies between the different professional groups, we can say that professional experience is a more important competence for an expert position than it is for the other two categories. Specialist positions require more sense of initiative and entrepreneurial competences than the other two categories. Basic computer skills seem to be more important for skilled-worker positions, while language, advanced computer and mathematical competences and intercultural experience are very much sought after for the expert positions. Differences in the remaining categories were not significant.

We repeated this procedure with the synthesised model and merged the lifelong competences with the (Deist and Winterton, 2005) competence model. We found significant differences between cognitive competences ($X^2_{(2)}$, 88.897; p, .000) and meta-competences ($X^2_{(2)}$, 13.293; p, .001). Expert job postings included a greater share of these two competences than the other job postings.

Conclusions

Key competences within the context of logistics/SCM and lifelong learning

In our literature analysis, we identified more than 280 skills describing the required set of skills for logistics managers. From the point of view of key competences for lifelong learning, we can see that sense-of-initiative and entrepreneurship competences dominate. However, an unambiguous allocation of each of the presented skills to one of the eight key competences proved difficult. However, it should be noted that a clear-cut differentiation between the required skills and the hierarchical level of the management position was not featured in the related literature either.

When analysing our sample of job advertisements, we identified two competences, sense of initiative and entrepreneurship, as important skills. The job advertisements communicated two requirements that were not mentioned by the academic studies at all, namely professional experience and flexibility. The need for professional experience, as a prerequisite for employability, shows that occupations in logistics require a specific skill set and thus require trained and educated people. This confirms the expectations of professional logistics associations, which forecast their industry's need for highly qualified personnel

(Rudy, 2012). Also, many of the analysed job advertisements specified the requirement of a university degree. Most interestingly, a combination of professional education and certified and advanced training offers significant career possibilities in the field of logistics.

When it comes to flexibility, this may be attributable to the wide variety of logistics tasks as well as the changing circumstances that affect the execution of logistics tasks. In that context, (Pearson, 2015) emphasises that exception management becomes the rule rather than the exception within logistics.

Differences in hierarchical levels

We further found significant differences in the required set of key competences depending on the level of the position advertised. When it comes to expert positions, professional experience, languages, mathematical and advanced computer competences and basic competences in natural sciences (understood as logistics) are more frequently sought. Skilled-worker positions require more flexibility, basic computer skills and social and civic competences. Our thematic and conceptual map shows that these competences constellate around the core job profile of a logistician. Only specialist positions differ significantly in terms of the core area of skills identified; in particular, these skills were a sense of initiative and entrepreneurship. When comparing our empirical results with those of existing studies, we identified differences that are likely rooted in the differing perspectives chosen. Contrary to the very specific skills presented in the academic literature, job advertisements reflect the views of companies, communicating the required set of skills in a rather superficial style. This may be due to their desire to attract a wider range of applicants for their posts. As such, we observed that job advertisements did not specify competences with the same level of detail as that reported by, for example, (Murphy and Poist, 1991a, 1991b) or (Thai et al., 2011). In those studies, as well as in (Gammelgaard and Larson, 2001), logistics managers were asked to reflect subjectively on the competences they required to perform their job. Job advertisements present the required job profiles in a much more general manner. Overall, however, both perspectives reveal the significant variety in qualifications and competences required.

Key competences in job advertisements

The results of our second analysis showed that the set of required skills and competences is manifold. In fact, this is supported by the findings of our first analysis. We found that job postings for specialists and experts demanded, in particular, language skills,

mathematical competences, specific computer knowledge and initiative. These lifelong learning competences seem quite important beyond the perspective of the societal megatrends, such as technological change and acceleration, that affect logistics managers' daily work (Kotzab and Unseld, 2009). The unexpected findings from the initial step, though, could be due to the rather general phrasing used in the job postings studied. Here, it seems that the companies seeking to fill these positions (and their respective human resources departments responsible for the postings) may not be aware of these changes in society.

We found an interesting gap between the academic discussion on the required competences for logistics and SCM and the results of our job-posting analysis (i.e. our synthesised model). Our empirical results confirm the importance of functional and social competences for logistics jobs as well as the importance, though to a lesser extent, of cognitive competences. However, the contents of the job postings in our sample reflect an emphasis on meta-competences that was significantly higher than what is implied by the academic discussion. We thus conclude that development on the job, in terms of building up new competences, is an important issue in the logistics sector. The academic world must include this issue in future discussions.

Practical implications

To investigate the practical relevance of our findings, we conducted semi-structured interviews with three human resource managers in the field of logistics using our results as prompts in our interview guide. In essence, our interviewees agreed on the importance of developing a standardised operationalisation of job requirements and skills and the need to communicate these standardised requirements/skills through job postings. The reason for this is seen in the different uses of technical terms and the lack of coordination between departments and human resource management teams.

In that respect, the interviewees consider the practical contribution of this research particularly in the structuring and comprising of skills required and operationalising key competences in the logistics sector. The value of the catalogue of skills presented in this paper is considered more applicable to operational jobs than managerial jobs, for there the former set of jobs entails more complex and company-specific requirements for employees. Therefore, the catalogue of skills presented can be used as a starting point to frame the requirements of a job and help communicate them through job adverts. As such, this catalogue of skills can serve to begin the operationalisation of the hierarchy of specific job

profiles insofar as it helps determine more general, essential requirements of the job, such as educational and professional qualifications, experiences, job-related skills and achievements as well as further specific particulars relevant for the job. During the application process, such an agreed-upon list can serve during the preselection and interview phases to arrive at a full and comparable picture of candidates to guide the final selection of applicants, allowing for rankings of candidates.

Following the notions of Laurillard (2005), we expect a tremendous increase in information technology use in order to obtain the necessary lifelong competences for logistics and supply chain management occupations as adapting and learning can be done in an efficient manner either besides the job or in parallel with other activities. We expect companies to develop online tutorials or other social-media streams through which employees can gain this particular knowledge. As for university training and education, our findings show that university students need to acquire the fundamental skills and competences and to be open to continuous learning on the job. Furthermore, academic institutions can develop, in close cooperation with logistics companies, postgraduate studies or other forms of executive training in order to train people to match the changing needs of the field.

Limitations and future avenues for research

The identification of the qualifications and competence profile examined in our study was based on the frameworks for key competences and occupational groups provided by the European Union and GFLMA. This should facilitate comparison with future data, though it does limit comparison with (Murphy and Poist, 1991a, 1991a), (Gammelgaard and Larson, 2001) and (Thai et al., 2011), whose catalogues of skills were much more detailed. Another limitation is related to our sample of job advertisements. The selected online job portals only included job advertisements for higher-level positions. This meant that we disregarded advertisements from companies looking for people to fill lower-ranked positions as well as companies using different communication channels (e.g. more regionally oriented media). Future research could look at qualifications and competence profiles for jobs in other countries but also in a logistics company such as Deutsche Post DHL, Maersk, UPS, DB Schenker or Kuehne+Nagel; moreover, future research could examine whether these profiles differed from the existing results.

When supply chain managers were asked to present the portfolio of skills required to perform their daily work, they presented a wide variety of different tasks and required

competences. However, this was not reflected in the job postings examined. The question that arises is whether human resource departments communicate effectively enough with the specific departments seeking personnel to accurately determine the set of skills to be included in a job posting. At present, the posted competences and skills do not necessarily reflect daily work life. Therefore, we suggest that job postings for those working in logistics include more logistics-specific descriptions rather than general wording. This could also lead to improved applicant preselection (i.e. candidates whose qualifications better match the profile), in turn helping identify the right person for the right job. The latter represents a key implication for managers in human resource and in logistics.

Another limitation is that our data collection and analysis do not take subsector-specific differences into account. Future research could try to identify differences in terms of competences and skills in the different logistics and supply chain areas.

Another suggestion for future work is the analysis of logistics-related educational and occupational training and study programmes (including their content) on a Europe-level scale with regard to language, computer-based and entrepreneurial skills. Such programmes would prepare the logistics manager of the future to meet tomorrow's challenges in the field of SCM.

REFERENCES

- Angus, D., Rintel, S., Wiles, J., 2013. Making sense of big text: a visual-first approach for analysing text data using Leximancer and Discursis. *International Journal of Social Research Methodology* 16, 261–267. doi:10.1080/13645579.2013.774186
- APICS, 2014. Supply chain manager competency model.
- Bartram, D., Roe, R.A., 2005. Definition and Assessment of Competences in the Context of the European Diploma in Psychology. *European Psychologist* 10, 93–102. doi:10.1027/1016-9040.10.2.93
- Bergmann, B., 2007. Selbstkonzept beruflicher Kompetenz“ [“Self-concept of professional competence“], in: Erpenbeck, J., Von Rosenstiel, L. (Eds.), *Handbuch Kompetenzmessung: erkennen, verstehen und bewerten von Kompetenzen in der betrieblichen, pädagogischen und psychologischen Praxis* [Handbook on Measuring Competence]. Schäffer-Poeschel, Stuttgart, pp. 194–233.
- Beruvides, M.G., Koelling, C.P., 2001. An investigation of the work characteristic composition in blue-collar, white-collar, and knowledge work. *International Journal of Human Resources Development and Management* 1, 283–303. doi:10.1504/IJHRDM.2001.001011
- Bourlakis, M., Sodhi, M.S., Son, B.-G., 2013. The relative emphasis on supply-chain/logistics topics by UK industry in hiring postgraduates and by UK universities in teaching and research. *International Journal of Logistics Research and Applications* 16, 506–521. doi:10.1080/13675567.2013.841134
- Brickwedde, W., 2012. Wer sind Deutschlands beste Jobportale?“ [“What are Germany’s best job portals?“]. *Personalwirtschaft* 11, 16–17.
- BVL, 2013. Logistik ist... [“Logistics is”] [WWW Document]. Tag der Logistik. URL <https://www.tag-der-logistik.de/logistik-ist-mehr/logistik-ist> (accessed 5.26.13).
- Carter, P.L., Carter, J.R., 2007. Organization+talent. *Supply Chain Management Review* 11, 37–43.
- Christopher, M., 1988. SEEKING A PROFESSIONAL QUALIFICATION. *Logistics World* 1, 25–27. doi:10.1108/eb007411
- Creswell, J.W., 2009. *Research design: qualitative, quantitative, and mixed methods approaches*, 3rd ed. ed. Sage Publications, Thousand Oaks, Calif.
- Dacre Pool, L., Sewell, P., 2007. The key to employability: developing a practical model of graduate employability. *Education + Training* 49, 277–289. doi:10.1108/00400910710754435
- Deist, F.D.L., Winterton, J., 2005. What Is Competence? *Human Resource Development International* 8, 27–46. doi:10.1080/1367886042000338227
- Den Hartog, D.N., Caley, A., Dewe, P., 2007. Recruiting leaders: an analysis of leadership advertisements. *Human resource management journal* 17, 58–75.
- Doll, A., Friebel, D., Rückriegel, M., Schwarzmüller, C., 2014. *Global Logistics Markets* [WWW Document]. URL https://www.rolandberger.com/publications/publication_pdf/roland_berger_global_logistics_markets_2.pdf (accessed 5.10.15).

- Edwards, P., Sengupta, S., Tsai, C.-J., 2009. Managing low-skill workers: a study of small UK food manufacturing firms. *Human Resource Management Journal* 19, 40–58.
- Ellinger, A., Ellinger, A., 2014. Leveraging human resource development expertise to improve supply chain managers' skills and competencies. *European Journal of Training and Development* 38, 118–135.
- Erpenbeck, J., Heyse, V., 2007. *Die Kompetenzbiographie: Wege der Kompetenzentwicklung* [The Competence Biography: Ways to Develop Competence], 2. ed. Waxmann Verlag GmbH, Münster.
- European Commission, 2014. Measuring digital skills across the EU: EU-wide indicators of digital competence. DG Connect F4 May 2014.
- European Commission, 2007. Recommendation of the European Parliament and of the Council on key competences for lifelong learning. *Official Journal of the European Union*.
- Fölsch, T., 2010. *Kompetenzentwicklung und Demografie, Schriftenreihe Personal- und Organisationsentwicklung* [Development of competence and Demography, Research Paper Series on Human Resource and Organisational Development], 9. University Press, Kassel, DE.
- Gammelgaard, B., Larson, P.D., 2001. Logistics skills and competencies for supply chain management. *Journal of Business Logistics* 22, 27–50.
- GFLMA, 2011. *Klassifikation der Berufe 2010: Systematischer und alphabetischer Teil mit Erläuterungen* [Classification of Jobs 2010]. Bundesagentur für Arbeit, Nürnberg.
- Gibson, T., Kerr, D., Fisher, R., 2016. Accelerating supply chain management learning: identifying enablers from a university-industry collaboration. *Supply Chain Management: An International Journal* 21, 470–484. doi:10.1108/SCM-10-2014-0343
- Goldschmidt, D., Schmieder, J.F., 2017. The Rise of Domestic Outsourcing and the Evolution of the German Wage Structure. *Q J Econ* 132, 1165–1217. doi:10.1093/qje/qjx008
- Goleman, D., 1998. *Working with emotional intelligence*. Bantam Books, New York.
- Green, F., 2011. *What is skill? An inter-disciplinary synthesis*. Centre for Learning and Life Changes in Knowledge Economies and Societies.
- Grugulis, I., 2003. Putting skills to work: learning and employment at the start of the century. *Human resource management journal* 13, 3–12.
- Heijde, C.M.V.D., Van Der Heijden, B.I.J.M., 2006. A competence-based and multidimensional operationalization and measurement of employability. *Human Resource Management* 45, 449–476. doi:10.1002/hrm.20119
- Hildebrand, W.-C., Roth, A., 2008. Führungskräfte für die Logistik—Akademische Ausbildung in Deutschland, in: *Das Beste Der Logistik*. Springer, pp. 69–79.
- Jim Wu, Y., 2006. Skill requirements for logistics license in Taiwan. *Supply Chain Management: An International Journal* 11, 415–424. doi:10.1108/13598540610682435
- Jim Wu, Y., Kevin Huang, S., Goh, M., Hsieh, Y., 2013. Global logistics management curriculum: perspective from practitioners in Taiwan. *Supply Chain Management: An International Journal* 18, 376–388. doi:10.1108/SCM-04-2012-0145

- Kersten, W., Schröder, M., 2012. *Qualifizierung in der Logistik: Anforderungen am Standort Hamburg*. Hamburg.
- Kille, C., Schwemmer, M., 2014. *Die Top 100 der Logistik 2014/2015. Executive Summary*.
- Knief, A., 2013. *Bevor Container und Gabelstapler kamen* [“Before Containers and Fork Lifts have arrived”] [WWW Document]. *Weser Kurier*. URL http://www.weser-kurier.de/bremen_artikel,-Bevor-Container-und-Gabelstapler-kamen-_arid,652178.html (accessed 5.20.15).
- Knight, L., Harland, C., Walker, H., Sutton, R., 2005. *Competence Requirements for Managing Supply in Interorganizational Networks - ProQuest*. *Journal of Public Procurement* 5, 210–234.
- Kotzab, H., Unseld, H.G., 2009. *Megatrends für den Gütertransport*. *Wirtschaftspolitische Blätter, Wirtschaftspolitische Blätter*. - Wien: Manz, ISSN 1605-8704, ZDB-ID 5361060. - Bd. 56.2009, 1, S. 59-72 56, 59–72.
- Krippendorff, K., 2004. *Content Analysis: An Introduction to Its Methodology*. Sage, Thousand Oaks, CA.
- Larsen, G., 2006. *Why megatrends matter - Copenhagen Institute for Futures Studies, Futurists, future research*. *Future Orientation* 5, 8–23.
- Laurillard, D., 2005. *Rethinking university teaching: a conversational framework for the effective use of learning technologies*, 2. ed. ed. Routledge, Oxfordshire, England New York.
- Leximancer, 2011. *Leximancer manual, Version 4*. University of Queensland, Brisbane.
- Lloyd, C., 2002. *Training and development deficiencies in ‘high skill’ sectors*. *Human Resource Management Journal* 12, 64–81. doi:10.1111/j.1748-8583.2002.tb00064.x
- Lorentz, H., Töyli, J., Solakivi, T., Ojala, L., 2013. *Priorities and determinants for supply chain management skills development in manufacturing firms*. *Supply Chain Management: An International Journal* 18, 358–375. doi:10.1108/SCM-03-2012-0111
- Lutz, H., Birou, L., 2013. *Logistics education: a look at the current state of the art and science*. *Supply Chain Management: An International Journal* 18, 455–467. doi:10.1108/SCM-08-2012-0269
- Maku, T.C., Collins, T.R., Beruvides, M.G., 2005. *On the path to excellence: The impact of human interaction on supply chain management practices*. *Performance Improvement* 44, 26–33.
- Mangan, J., Christopher, M., 2005. *Management development and the supply chain manager of the future*. *The International Journal of Logistics Management* 16, 178–191. doi:10.1108/09574090510634494
- McIntosh, S., Vignoles, A., 2001. *Measuring and assessing the impact of basic skills on labour market outcomes*. *Oxford Economic Papers* 53, 453–481.
- Mériot, S.-A., 2005. *One or several models for competence descriptions: does it matter?* *Human Resource Development Quarterly* 16, 285.
- Müller, K., 2008. *Europäischer und deutscher Qualifikationsrahmen*. *Wirtschaft und Berufserziehung* 60, 13–18.

- Murphy, P., Poist, R.F., 2007. Skill requirements of senior-level logisticians: a longitudinal assessment. *Supply Chain Management: An International Journal* 12, 423–431. doi:10.1108/13598540710826353
- Murphy, P.R., Poist, R.F., 1991a. Skill Requirements of Senior-level Logisticians: Practitioner Perspectives. *International Journal of Physical Distribution & Logistics Management* 21, 3–14. doi:10.1108/09600039110004025
- Murphy, P.R., Poist, R.F., 1991b. Skill Requirements of Senior-Level Logistics Executives: An. *Journal of Business Logistics* 12, 73.
- Myers, M.B., Griffith, D.A., Daugherty, P.J., Lusch, R.F., 2004. Maximizing the Human Capital Equation in Logistics: Education, Experience, and Skills 25, 211–232.
- North, K., 2007. Kompetenzrad und Kompetenzmatrix“ [“Competence wheel and competence matrix“], in: Erpenbeck, J., Von Rosenstiel, L. (Eds.), *Handbuch Kompetenzmessung: erkennen, verstehen und bewerten von Kompetenzen in der betrieblichen, pädagogischen und psychologischen Praxis* [Handbook on Measuring Competence]. Schäffer-Poeschel, Stuttgart, pp. 175–186.
- North, K., Kumta, G., 2014. On the Way to a Knowledge Society, in: *Knowledge Management, Springer Texts in Business and Economics*. Springer, Cham, pp. 1–29. doi:10.1007/978-3-319-03698-4_1
- Onar, S., Aktas, E., Topcu, Y., Doran, D., 2013. An analysis of supply chain related graduate programmes in Europe. *Supply Chain Management: An International Journal* 18, 398–412.
- Parry, E., Tyson, S., 2008. An analysis of the use and success of online recruitment methods in the UK. *Human Resource Management Journal* 18, 257–274.
- Payne, J., 2000. The unbearable lightness of skill: the changing meaning of skill in UK policy discourses and some implications for education and training. *Journal of Education Policy* 15, 353–369. doi:10.1080/02680930050030473
- Pearson, M., 2015. Pearson on Excellence: Exception management is becoming the rule [WWW Document]. URL http://www.logisticsmgmt.com/article/pearson_on_excellence_exception_management_is_becoming_the_rule (accessed 9.14.15).
- Poist, R.F., 1984. Managing logistics in an era of change. *Defense Transportation Journal* 40, 22–30.
- Preißing, D., 2001. Erfolgreiches Personalmanagement im demografischen Wandel [Successful Human Resource Management during the Demographic Change]. Oldenbourg Verlag, München.
- Razzaque, M., Bin Sirat, M., 2001. Skill requirements: Perception of the senior Asian logisticians. *International Journal of Physical Distribution & Logistics Management* 31, 374–395.
- Rooney, D., 2005. Knowledge, economy, technology and society: The politics of discourse. *Telematics and Informatics* 22, 405–422. doi:10.1016/j.tele.2004.11.007
- Rudy, P., 2012. Ten Reasons You Should Consider a Career in Logistics [WWW Document]. URL <http://www.supplychaindigital.com/top10/2512/Ten-Reasons-You-Should-Consider-a-Career-in-Logistics> (accessed 4.10.12).

- Sahin, M., Akbasli, S., Yelken, T.Y., 2010. Key competences for lifelong learning: The case of prospective teachers. *Educational Research and Reviews* 5, 545.
- Skelton, A., Winters, G., 2014. Industry skills report: Supply chain, Skills for Logistics (SfL). Milton Keynes, UK.
- Smith, A.E., Humphreys, M.S., 2006. Evaluation of unsupervised semantic mapping of natural language with Leximancer concept mapping. *Behavior research methods* 38, 262–279.
- Smith, C.S., Ridoutt, L., 2007. The importance employers attach to employee qualifications. *Asia Pacific Journal of Human Resources* 45, 180–199. doi:10.1177/1038411107079115
- Sodhi, M.S., Son, B.-G., 2010. Content analysis of OR job advertisements to infer required skills. *Journal of the Operational Research Society* 61, 1315–1327. doi:10.1057/jors.2009.80
- Sodhi, M.S., Son, B.-G., 2008. ASP, The Art and Science of Practice: Skills Employers Want from Operations Research Graduates. *Interfaces* 38, 140–146. doi:10.1287/inte.1080.0342
- Sodhi, M.S., Son, B.-G., Tang, C.S., 2008. ASP, The Art and Science of Practice: What Employers Demand from Applicants for MBA-Level Supply Chain Jobs and the Coverage of Supply Chain Topics in MBA Courses. *Interfaces* 38, 469–484. doi:10.1287/inte.1080.0377
- Sohal, A.S., 2013. Developing competencies of supply chain professionals in Australia: collaboration between businesses, universities and industry associations. *Supply Chain Management: An International Journal* 18, 429–439. doi:10.1108/SCM-07-2012-0228
- Thai, V.V., 2012. Competency requirements for professionals in logistics and supply chain management. *International Journal of Logistics Research and Applications* 15, 109–126. doi:10.1080/13675567.2012.694859
- Thai, V.V., Cahoon, S., Tran, H.T., 2011. Skill requirements for logistics professionals: findings and implications. *Asia Pacific Journal of Marketing and Logistics* 23, 553–574. doi:10.1108/13555851111165084
- Timothy Kiessling, Michael Harvey, 2014. Human resource management issues associated with the globalization of supply chain management and logistics. *Int Jnl Phys Dist & Log Manage* 44. doi:10.1108/IJPDLM-05-2014-0115
- Tippelt, R., Schmidt, B., 2009. *Handbuch Bildungsforschung. Arbeit, Qualifikation und Kompetenzen*. Verlag für Sozialwissenschaften, Wiesbaden.
- Todd, P.A., McKeen, J.D., Gallupe, R.B., 1995. The Evolution of IS Job Skills: A Content Analysis of IS Job Advertisements from 1970 to 1990. *MIS Quarterly* 19, 1. doi:10.2307/249709
- van Hoek, R.I., Chatham, R., Wilding, R., 2002. Managers in supply chain management, the critical dimension. *Supply Chain Management: An International Journal* 7, 119–125. doi:10.1108/13598540210436568
- Von Randow, M., 2008. Güterverkehr und Logistik als tragende Säule der Wirtschaft zukunftssicher gestalten“ [“Transportation and Logistics as Central Pillars of an Economy“], in: Baumgarten, H. (Ed.), Springerprofessional.De. Springer, Berlin, pp. 47–53.

- Weitzel, T., Eckhardt, A., Maier, C., Laumer, S., von Stetten, A., Guhl, E., 2012. Recruiting Trends - Ein Rückblick auf 10 Jahre [Recruiting trends: looking back on 10 years].
- Witt, C.E., 1999. Needed: Skills in Warehousing. Material Handling Engineering August, 39–42.
- Z Punkt GmbH, n.d. Megatrends als Strategie- und Innovationstool [WWW Document]. URL <http://www.z-punkt.de/themen/artikel/megatrends> (accessed 1.27.17).

Figure 1: Typology of competences (Le Deist and Winterton, 2005)

	Occupational	Personal
Conceptual	Cognitive competence	Meta competence
Operational	Functional competence	Social competence

Figure 2: Holistic model of competences (Le Deist and Winterton, 2005)

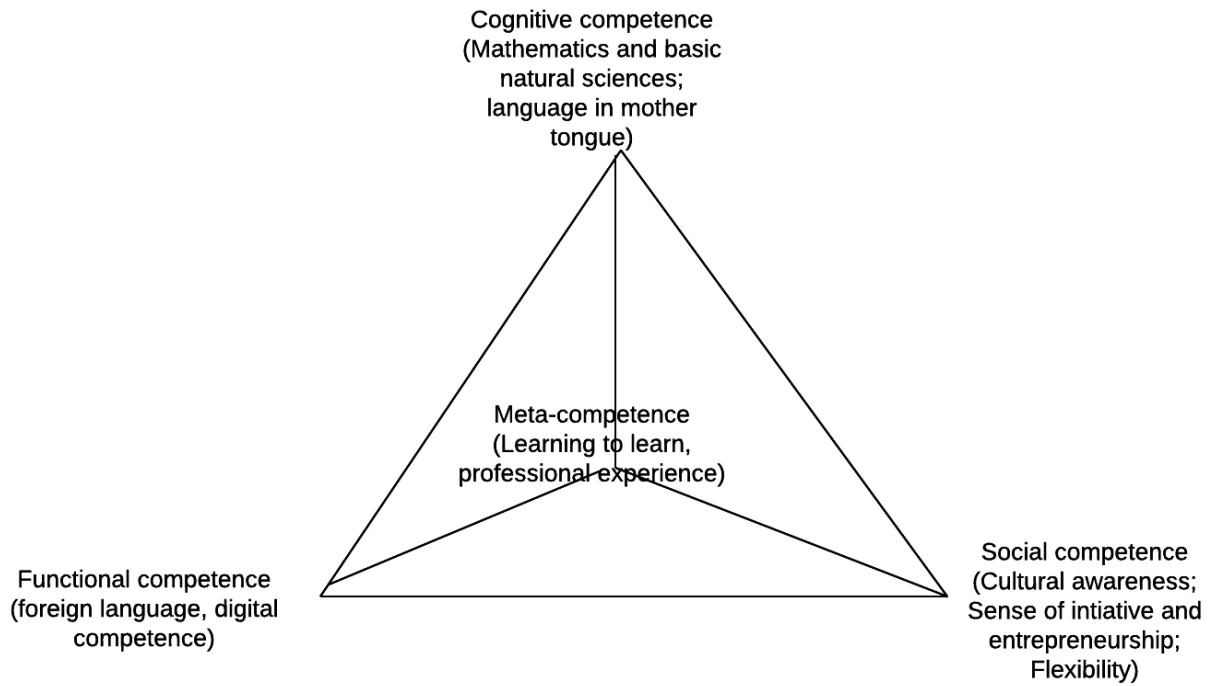


Figure 3: Methodological approach

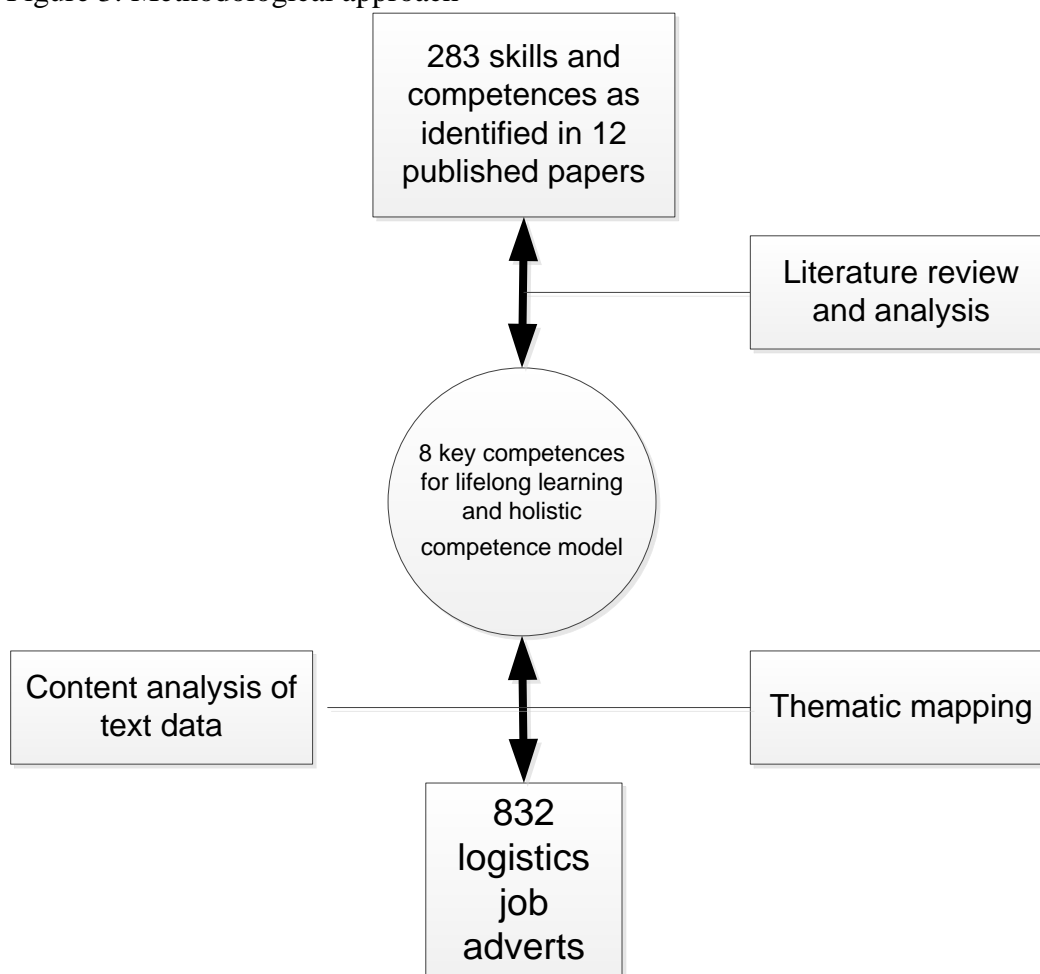


Figure 4: Thematic and conceptual map of job advertisements

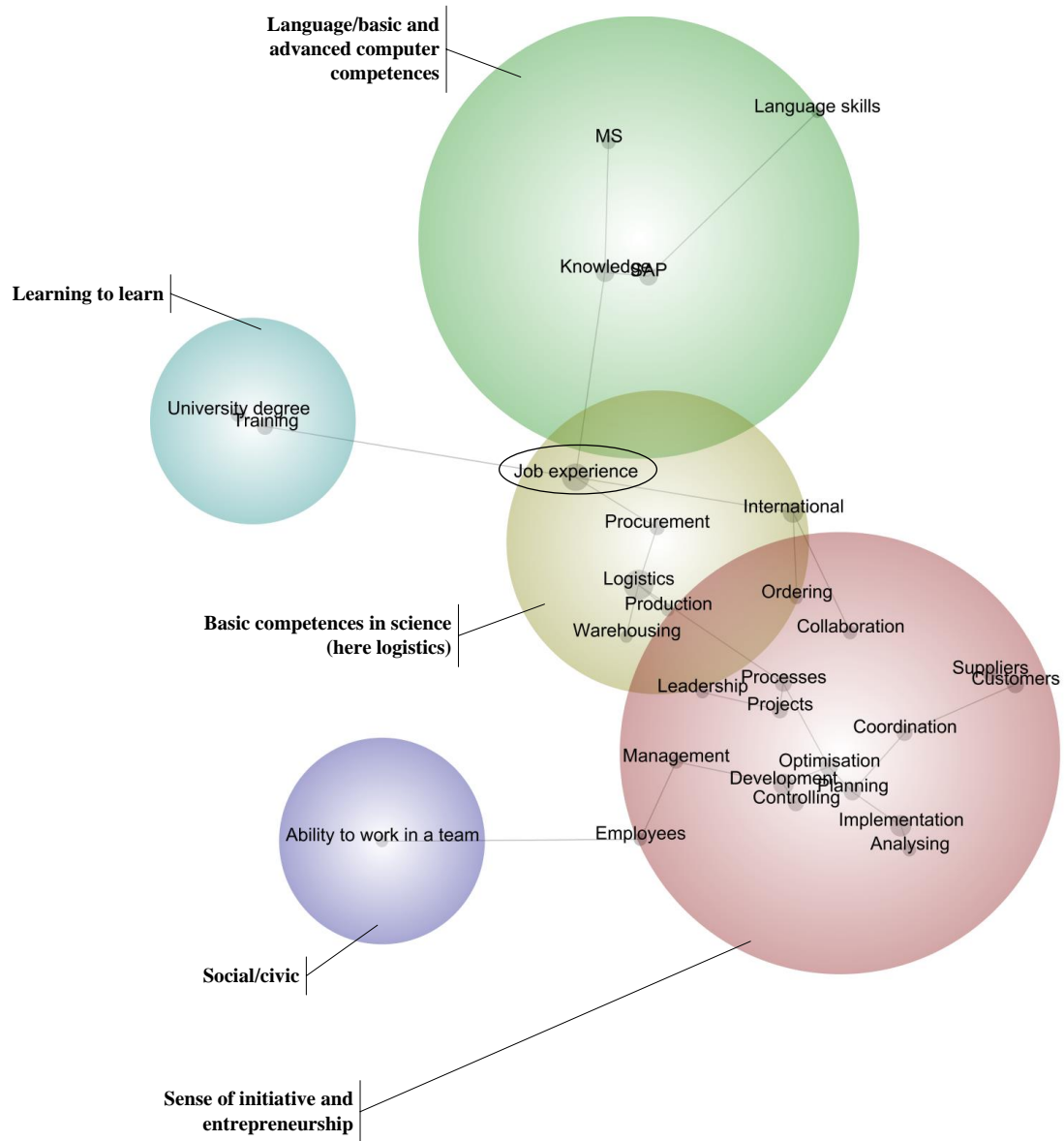


Figure 5: Relative frequency of lifelong key competences within the sample of job advertisements

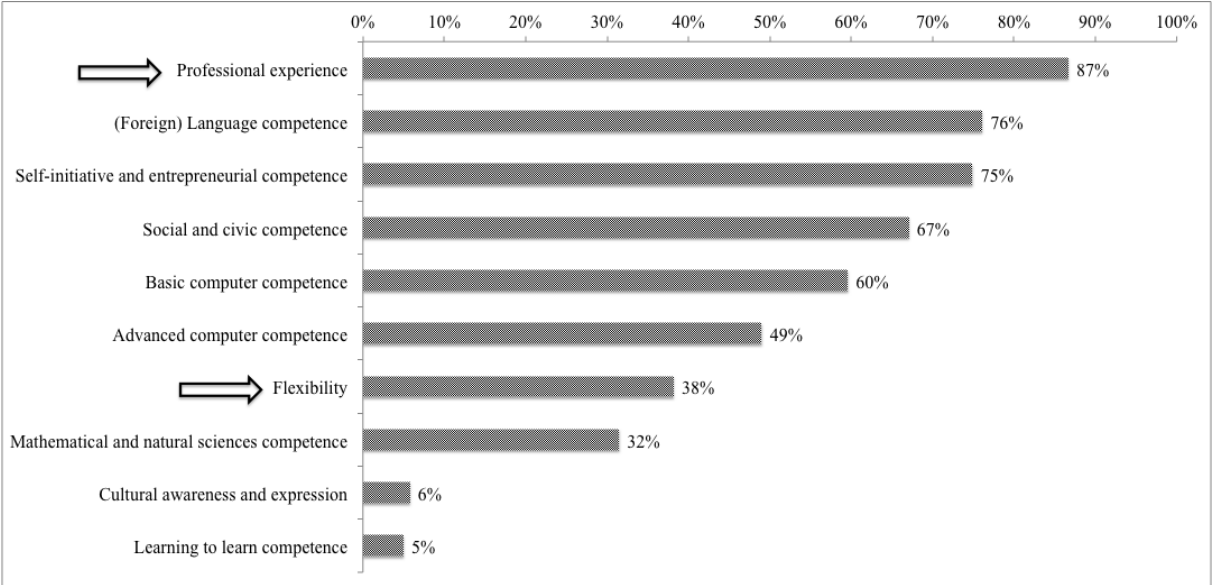


Table 1: Key competences for lifelong learning (based on European Commission, 2007)

Key competence	Definition
Communication in mother tongue	Communication in mother tongue is the ability to express and interpret concepts, thoughts, feelings, facts and opinions in both oral and written form (listening, speaking, reading and writing), and to interact linguistically in an appropriate and creative way in a full range of societal and cultural contexts; in education and training, work, home and leisure.
Communication in foreign languages	Communication in foreign languages broadly shares the main skill dimensions of communication in mother tongue: it is based on the ability to understand, express and interpret concepts, thoughts, feelings, facts and opinions in both oral and written form (listening, speaking, reading and writing) in an appropriate range of societal and cultural contexts (in education and training, work, home and leisure) according to one's wants or needs.
Mathematical competence and basic competences in science and technology	<p>Mathematical competence is the ability to develop and apply mathematical thinking in order to solve a range of problems in everyday situations. Building on a sound mastery of numeracy, the emphasis is on process and activity, as well as knowledge. Mathematical competence involves, to different degrees, the ability and willingness to use mathematical modes of thought (logical and spatial thinking) and presentation (formulas, models, constructs, graphs, charts).</p> <p>Competence in science refers to the ability and willingness to use the body of knowledge and methodology employed to explain the natural world, in order to identify questions and to draw evidence-based conclusions. Competence in technology is viewed as the application of that knowledge and methodology in response to perceived human wants or needs. Competence in science and technology involves an understanding of the changes caused by human activity and responsibility as an individual citizen.</p>
Digital competence	Digital competence involves the confident and critical use of Information Society Technology (IST) for work, leisure and communication. It is underpinned by basic skills in ICT: the use of computers to retrieve, assess, store, produce, present and exchange information, and to communicate and participate in collaborative networks via the Internet.
Learning to learn	Learning to learn is the ability to pursue and persist in learning, to organise one's own learning, including through effective management of time and information, both individually and in groups. This competence includes awareness of one's learning process and needs, identifying available opportunities, and the ability to overcome obstacles in order to learn successfully. This competence means gaining, processing and assimilating new knowledge and skills as well as seeking and making use of

	<p>guidance. Learning to learn requires learners to build on prior learning and life experiences in order to use and apply knowledge and skills in a variety of contexts: at home, at work, in education and training. Motivation and confidence are crucial to an individual's competence.</p>
Social and civic competences	<p>These include personal, interpersonal and intercultural competence and cover all forms of behaviour that equip individuals to participate in an effective and constructive way in social and working life, and particularly in increasingly diverse societies, and to resolve conflict where necessary. Civic competence equips individuals to participate fully in civic life, based on knowledge of social and political concepts and structures and a commitment to active and democratic participation.</p>
Sense of initiative and entrepreneurship	<p>Sense of initiative and entrepreneurship refers to an individual's ability to turn ideas into action. It includes creativity, innovation and risk taking, as well as the ability to plan and manage projects in order to achieve objectives. This supports individuals, not only in their everyday lives at home and in society, but also in the workplace, in being aware of the context of their work and being able to seize opportunities, and is a foundation for more specific skills and knowledge needed by those establishing or contributing to social or commercial activity. This should include awareness of ethical values and the promotion of good governance.</p>
Cultural awareness and expression	<p>Appreciation of the importance of the creative expression of ideas, experiences and emotions in a range of media, including music, performing arts, literature, and the visual arts.</p>

Table 2: Allocation of the literature-based skills catalogue to key competences for lifelong learning

Competence(s)	Relative frequencies (n=283; multiple responses)
Sense of initiative and entrepreneurial	63.5
Social and civic	24.8
Cultural awareness	21.3
Mathematical and basic natural sciences	17.0
Advanced computer	12.4
Basic computer	4.6
Language	6.4
Learning to learn	4.6
Social competences	74.9
Functional competences	18.6
Cognitive competences	3.3
Meta-competences	3.1

Table 3: Competences sought in relation to professional groups

Competences	Total (n=832 / %)	Professional groups			Δ
		Expert (n=332/%)	Specialist (n=230/%)	Skilled worker (n=270/%)	
Professional experience	86.7	91.0	87.8	80.4	**
Language	76.1	79.2	78.7	70.0	*
Sense of initiative and entrepreneurship	74.9	73.5	76.5	75.2	n.s.
Social and civic	67.1	63.9	66.5	71.5	n.s.
Basic computer	59.5	50.3	58.3	71.9	***
Advanced computer	48.9	52.7	51.3	42.2	*
Flexibility	38.2	38.0	35.2	42.2	n.s.
Mathematical and basic natural sciences	31.5	46.4	34.3	10.7	***
Cultural awareness	5.8	9.9	5.2	1.1	***
Learning to learn	5.0	3.9	6.5	5.2	n.s.
Cognitive competences	31.5	46.4	34.3	10.7	***
Functional competences	92.2	90.4	93.9	93.0	n.s.
Social competences	78.0	77.7	77.8	78.5	n.s.
Meta-competences	87.6	91.6	88.7	81.9	***

Note: Δ , association between membership of professional group and competences; n.s., non-significant, $p > .05$; *, $p < .05$, **, $p < .01$; ***, $p < .001$