Logistics Qualification: Best-Practice for a Knowledge-Intensive Service Industry

Matthias Klumpp

Abstract The logistics industry has undergone many significant changes in the last two decades—one of these being increasing knowledge requirements necessitated by technology implementation as well as global co-operation. Whereas in the past century many blue-collar occupations in logistics like e.g. truck drivers merely required a basic school education and rudimentary qualification levels, today due to improved technology interaction with e.g. barcode and RFID systems, fleet management or toll and truck steering concepts, competence requirements for such jobs have significantly increased. The same is true for many white-collar jobs in logistics, exemplified by the increasing number of university graduates, especially in specific fields like logistics information technology, contract logistics and innovative supply chain concepts ("supply chain design"). Accordingly, the first sector-wide evaluation of competences with 1.068 logistics employees in 2013 in the German ECLR project "WiWeLo" showed competence structures and also gaps according to the Berufswertigkeit measurement concept. In the light of expected changes due to demographic change as well as further technological implementation ("industry 4.0"), there are risks as well as opportunities embedded in such quantitative analyses of competences. These are outlined in this article and will lead to a new logistics qualification paradigm: whereas past education and training in human resource management was very much driven by formal qualifications and therefore "personnel clusters" (like white- and blue-collar), especially in logistics with "mixed entry" people (from other industries as well as countries), future HRM concepts may focus on an individual analysis of gaps and potentials based on quantitative evaluations as with the Berufswertigkeit concept.

Keywords Knowledge-based services · Logistics qualification · Berufswertigkeit · ESCO project

M. Klumpp (✉)
University of Duisburg-Essen (ZLV, PIM) and FOM University of Applied Sciences Institute for Logistics and Service Management (ild), Leimkugelstrasse 6, 45141 Essen, Germany
e-mail: matthias.klumpp@fom-ild.de

H. Zijm et al. (eds.), *Logistics and Supply Chain Innovation*,
Lecture Notes in Logistics, DOI 10.1007/978-3-319-22288-2_24

1 Introduction: Logistics Personnel and Logistics Qualification

In the last decades the logistics industry has become a major knowledge-intensive service industry, similar to e.g. the financial and the health-care service industries (Klumpp et al. 2007). While about 30–40 years ago mainly manual labor and very rudimentary qualifications were commonplace both in the blue-collar as well as the white-collar side of employment in logistics companies and processes, today the qualification requirements are not only different und significantly higher but also crucial for business success (Rao et al. 1998; Lancioni et al. 2001; Mangan and Christopher 2005; Wu 2007; Esper et al. 2007). This is brought about by technology changes and implementations as for example barcode, RFID, GPS and automated systems in the physical side of the logistics "coin". On the other side—and intertwined with this—the *overall complexity* of logistics processes has risen manifold, thereby making the task for the planning, management and control side of the logistics function even more demanding. This is due to global supply chains with a new multitude of actors and stakeholders as well as to increasing demands of customers regarding quality, sustainability, price and cost-efficiency, next to flexibility and speed in delivery (Klumpp et al. 2013, pp. 2–3). Therefore, the *qualification and competence requirements* have grown steadily regarding these complex tasks in logistics management—until the point where innovation and growth may be hampered due to missing competences and regulations regarding process standards, as demonstrated e.g. in the two cases of *electric mobility* (Klumpp et al. 2014, pp. 265–266) and *3D printing* (Rideout 2011; Self 2011).

In order to provide a *quantitative overview* some statistical data may serve as a starting point for the discussion on logistic qualification. In 2010, 2.65 million people were employed in the logistic industry within Germany. The functional distribution of this logistics personnel pool is shown in Table 1. Of these, 775,803 employees (compared to 805,688 in the previous year) are employed in the field of transport, 1,212,519 persons (previous year 1,277,021) are working in the fields of warehousing and inventory management, 199,532 employees (199,624 in the previous year) are responsible for administration and 455,074 employees (previous year 474,725) are employed in a sub-sector which doesn't directly concern logistic activities but regards support services such as financing and information technology.

As column 3 of Table 1 shows the number of full time employees, in column 4 the percentage of logistic activities is presented which is practiced in the professional group (column 2), e.g. line 5 indicates that 80 % of 766,378 full time employed truck drivers works within the logistics industry (613,102 full-time employees). Column 7 displays the total number of employees in the logistics industry, including full-time employees and entrepreneurs. The logistics industry compromises in fact many segments. In general it can be classified in two main groups. i.e. *blue-collar workers* and office clerks (*white-collar*). The information

Table 1 Personnel in the logistics industry (Klaus et al. 2010, p. 57)

	No.	Occupation group	Number SVP employees 2009	Fraction logistics in percent of column 3 (%)	Number SVP employees in logistics (column 3 * column 4)	Fraction in % of all SVP employees (%)	Extrapolation to all employees (1, 2 * SVP employees)	Factor for extrapolation of indirect employees in logistics	Entire logistic employees	Service provider (%)	Industry and trade (%)	Other economic sectors (%)	Service provider	Industry and trade	Other economic sectors
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	*Direct logistic occupations*														
2	711	Engine driver	35,372	20	7074	0.03	8489		8489	89	4	7	7581	329	579
3	712	Traffic controller (rail)	5359	20	10718	0.04	12,862		12,862	75	3	22	9612	400	2850
4	713	Other traffic controller	15,584	20	3117	0.01	3740		3740	42	17	42	1560	621	1560
5	714	Motor vehicle drivers	766,378	80	613,102	2.25	735,723		735,723	60	20	19	443,468	150,240	142,015
6	721	Nautical	7395	20	1479	0.01	1775		1775	73	5	22	1292	92	391
7	722	Technical ship's officer	5914	20	1183	0.00	1419		1419	51	20	29	725	289	405
8	723	Sailor	8599	20	1720	0.01	2064		2064	75	2	23	1546	38	480
9	724	Inland sailor	5939	70	4157	0.02	4989		4989	65	4	30	3251	217	1521
10	726	Aviation occupations	26,349	15	3952	0.01	4743		4743	85	3	12	4011	147	585
11	*Subtotal transport and traffic*								*775,803*	*61*	*20*	*19*	*473,045*	*152,373*	*150,386*
12	521	Quality inspector	120,647	20	24,129	0.09	28,955		28,955	8	77	15	2285	22,263	4408
13	522	Dispatcher	228,255	80	182,604	0.67	219,125		219,125	7	77	16	14,961	168,262	35,902
14	741	Storage managers	254,634	100	254,634	0.93	305,561		305,561	12	72	16	36,725	219,968	48,868
15	742	Forklift truck and other equipment	55,076	80	44,061	0.16	52,873		52,873	16	59	24	8570	31,437	12,866
16	743	Furniture remover	11,241	100	11,241	0.04	13,489		13,489	73	13	14	9858	1796	1835
17	744	Warehouse and transportworker	493,763	100	493,763	1.81	592,516		592,516	27	49	24	157,177	291,250	144,089

(continued)

Table 1 (continued)

	No.	Occupation group	Number SVP employees 2009	Fraction logistics in percent of column 3 (%)	Number SVP employees in logistics (column 3 * column 4)	Fraction in % of all SVP employees (%)	Extrapolation to all employees (1, 2 * SVP employees)	Factor for extrapolation of indirect employees in logistics	Entire logistic employees	Service provider (%)	Industry and trade (%)	Other economic sectors (%)	Service provider	Industry and trade	Other economic sectors
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
18	*Subtotal storage and turnover*								*1212,519*	*19*	*61*	*20*	*229,576*	*734,974*	*247,968*
19	681	Wholesale and retail	512,790	10	51,279	0.19	61,535		61,535	1	85	14	613	52530	8392
20	701	Forwarding agent	101,236	100	101,236	0.37	121,483		121,483	78	14	8	94,842	17,337	9304
21	704	Estate agent	15,102	5	755	0.00	906		906	5	6	90	41	51	814
22	705	Renters, mediators, auctioneers	28,541	5	1427	0.01	1712		1712	5	11	84	83	189	1411
23	732	Postman	115,793	10	11,579	0.04	13,895		13,895	95	2	3	13,242	221	432
24	*Subtotal admin. functions*								*199,532*	*55*	*35*	*10*	*108,821*	*70,328*	*20,383*
25	*Subtotal "direct activities"*								*2,187,864*	*37*	*44*	*19*	*811,442*	*957,675*	*418,737*
26	*Indirect logistic occupations*														
27	75	Enterpriser, auditor			27,348	0.10		0.015	32,818						
28	77	Purchase accounting people			45,580	0.17		0.025	54,696				168,780	199,196	87,097
29	78	Office specialists and assistants			306,300	1.12		0.168	367,559						
30	*Subtotal "indirect activities"*				*379,228*				*455,074*						
31	*Total amount*								*2,642,927*				*980,222*	*1,156,871*	*505,834*

that can be extracted from the table is that in the logistics industry in Germany about 1,988,322 blue-collar workers (truck drivers, forklift drivers, warehouse personnel etc.) and 654,606 office clerks (administration, sales, transport planning, logistic management etc.) are employed.

The logistics industry is usually expecting a sector growth of about 1–2 % *above* the overall average economic growth per annum. This development is a good reason to pay special attention to education in the logistics industry: the enterprises need qualified personnel in the logistics field not only due to the described technology and supply chain organizational changes, but also in order to cope with the above-average growth while keeping the transport chains cost-efficient as well as sustainable for the customers and society at large. Therefore, besides the initial training in vocational as well as academic institutions also continuing education on all levels becomes very important: the logistic sector needs for example about 14,000 executives per year with an academic education (Hildebrand and Roth 2010). Table 2 highlights the importance of continuing education and *competence measurement* for personnel in the logistics industry, where 30.03 % of all full-time employees (324,299 out of 1,079,759) have an "unknown" education, 13.72 % (148,217) are totally *without* any vocational education and only 2.78 % (29,992) of all full-time employees possess an academic degree.

These figures result among other factors from the former bad image of the logistics industry (low wages, unpleasant working times and uncertain seasonal variations, unfavorable career chances, scarce qualified personnel and high workloads). In contrast, in Germany there are 43 universities, 71 universities of applied sciences and 14 universities of cooperative education that offer education programs to employees in the logistics sector (Roth 2008; Roth and Klaus 2008; Hildebrand and Roth 2010). Furthermore, there are continuing education facilities that also offer academic degree programs in logistics parallel to working employments (Roth 2010). These requirements as well as the very different education backgrounds and biographies of logistics employees are favorable for a competence measurement instrument like e.g. the "*Berufswertigkeit*" *concept which compares individual qualification profiles of persons with work requirements of business practice* (Klumpp 2007; Klumpp and Schaumann 2007). Knowledge management is one research field of the German national excellence research cluster LogistikRuhr, especially within the project "Wissenschaftliche Weiterbildung in der Logistik (WiWeLo)" conducted at the FOM Institute for Logistics and Service Management (ILD) and the University of Duisburg-Essen in Essen/Germany.

This chapter is structured as follows: Sect. 2 outlines the basic concepts and terminologies used regarding competence measurement and qualification analysis, including outlines regarding the German qualification systems. Subsequently Sect. 3 adds the challenges and requirements in today's logistics qualification and Sect. 4 provides the details of the empirical survey according to the Berufswertigkeit analysis concept in Germany (2012/2013). Section 5 presents research results as well as options for further analysis from the survey results. Additionally, Sect. 6 provides an insight into the international standardization efforts by the European Commission (ESCO project) regarding qualifications in logistics and transportation. Section 7

Table 2 Personnel qualification in the logistics industry

Economic sectors 2008		Number of employees covered by social insurance entire federal territory					
		A total of	Thereunder				
			With vocational training	Without vocational training	University of applied science degree	University degree	Vocational training unknown/no allocation possible./n.s.
		1	2	3	4	5	6
All occupations (*DE*)		*27,710,487*	*16,042,187*	*3,856,768*	*1,075,093*	*1,865,276*	*4,871,163*
Sum logistics occupations, thereof		1,079,759	577,251	148,217	16,088	13,904	324,299
Transport of goods in railway traffic	492	17,995	12,598	3972	491	423	511
Transport of goods in road traffic, moving transport	494	199,431	91,694	19,649	706	609	86,773
Transport through pipelines	495	157	932	79	172	280	107
Transport of goods in ocean and coastal shipping	502	1961	9986	1138	2569	858	5059
Transport of goods in inland water shipping	504	2991	168	300	50	40	921
Transport of goods in aviation and astronautics	512	459	206	105	9	12	127
Warehousing	521	71,792	38,104	16,407	1218	1142	14,921
Provision of other services in traffic	522	558,503	308,254	804	9902	9134	150,813

(continued)

Table 2 (continued)

Economic sectors 2008		Number of employees covered by social insurance entire federal territory					
		A total of	Thereunder				
			With vocational training	Without vocational training	University of applied science degree	University degree	Vocational training unknown/no allocation possible./n.s.
		1	2	3	4	5	6
Postal services of universal service providers	531	154,523	97,978	19,285	668	1077	35,515
Other postal, courier and express services	532	52,885	15,819	6882	303	329	29,552

Federal Labour Office (Bundesagentur für Arbeit) (2011)

outlines further application venues in business practices and finally Sect. 8 provides an outlook regarding the field of logistics knowledge management.

2 Qualification Terminology and Education Systems

Definitions regarding qualification and competence measurement as well as continuing education are hard to come by. The term *continuing education* is also used as further education (Hanft and Knust 2009). In 1970 the German Education Council (Deutscher Bildungsrat) acknowledged and determined continuing education in the German education structure: it can be defined as *continuation or resumption of learning after a first degree*; continuing education therefore usually might begin after entering the workforce (Bildungsrat 1970). Furthermore, continuing education includes formal, informal and non-formal learning. *Formal learning* means a regulated and structured continuing training which is organized by institutions and where students have the chance to gain acknowledged degrees and certificates. *Informal learning* indicates continuing education in project groups, networks and coaching without acknowledged degrees or certificates. *Non-formal* learning is learning by doing or learning on the job without even standardized or organized learning environments and processes. The German Ministry of Education and Research (BMBF) distinguishes continuing education into *general* (not practice- and profession-oriented), *vocational* (practice- and profession-oriented by deepening practical experience) and *higher* (education at universities and universities of applied sciences). In general, through continuing education an advantage for all involved stakeholders can be achieved. These advantages can be clustered in

economic and social categories, with three tiers each (European Centre for the Development of Vocational Training 2011):

- *Macro*: *Profit for a whole society*
  - Economic profit: Economic growth and labor-market outcomes
  - Social profit: Crime reduction, social cohesion, health and intergenerational benefits
- *Meso*: *Profit for enterprises and groups*
  - Economic profit: Firms performance and employees productivity
  - Social profit: Inclusion disadvantaged groups
- *Micro*: *Profit for individuals and oneself*
  - Economic profit: Employment opportunities, earning and career development
  - Social profit: Life satisfaction and individual motivation.

In Germany, there exist 16 different *vocational education* programs for logistics such as professions in business administration, truck or train drivers, warehouse oriented professions and professions in CEP (courier, express and parcel delivery services) and moving freight service in the logistics sector (Roth and Klaus 2008). Generally, there are three ways to achieve competences in relevant fields for logistics: After a school qualification students have the option to begin directly in programs of *vocational education training* in the mentioned logistic professions and after achieving the qualification continue the education for specific competences or to begin an academic training at the university or university of applied sciences.

Furthermore, the logistic sector is also characterized by many people changing career tracks and industries and for these types of newcomers there are also ample possibilities within *continuing education* facilitating the acquisition of specific logistics skills (Berufswelt Logistik 2014). To continue education with many years of business practice experience (minimum one year) in the logistic sector there are two different ways to extend individual competences in Germany: through *academic* continuing education programs at universities (part-time or full-time) that offer an academic degree, or through practice-oriented continuing *professional* education.

In order to support success in continuing education and to motivate the current generation suitable tools of learning such as *e-learning* platforms developed within the 21st century: Because information and communication technologies find their way into everyday life, like e.g. smartphones and notebooks, e-learning is nowadays a serious concept, especially for lifelong learning scenarios. The main advantage of e-learning is the possibility of receiving information anytime and anywhere. Besides e-learning scenarios without physical presence in a classroom, blended learning concepts have been realized in which traditional face-to-face learning situations are combined with e-learning elements (Wache 2003).

Table 3 Differences between e-learning 1.0 and e-learning 2.0

E-learning	1	2
Learning environment	A closed area **in** the internet supporting content and tools	An open platform **to** the internet supporting tools for generating content
Teachers	Transfer all known resources into this closed area	Define boundaries and offer resources
Students	Consume the given content	Configure their personal learning environment (PLE) to generate own content

Most educational institutions offer their students e-learning platforms to support the face-to-face learning sessions with additional information. Two main software concepts are Moodle, which was developed at the University of Cologne. According to a definition of Web 2.0 in 2005 e-learning technologies were also developed to stimulate an active participation of the learner. Social software has been conveyed into learning environments, like wikis, podcasts or blogs. The boundary between teacher and learner disappears and collaborative learning scenarios gain in importance so that new technologies evolved (Blees and Rittberger 2009). Table 3 displays an overview of the differences between e-learning 1.0 and 2.0.

3 Competence Requirements in Logistics

Competence is a major asset when measuring logistics industries competitiveness—as also demonstrated by the *Logistics Performance Index* (LPI) published by the Worldbank, where it is one out of six indicators regarding a country-specific competence level in logistics and transportation (Worldbank 2014). Especially from the perspective of logistics practice there are several *major trends* to be recognized and reviewed for future management concepts in relationship with competence and knowledge management (Wimmer 2011, p. 16):

- Globalization: Open Supply Chains and scattered production plants demand for reliable logistic processes.
- Digitalization: High integration of information systems such as telematics, mobile handhelds, tracking and tracing, etc.
- Knowledge management: The success of logistic service providers are often intimately connected with the employees' knowledge.
- Volatility of economic development: The logistics industry experiences a more severe impact of economic fluctuations than other industry sectors.
- Security: For example attacks by pirates on ship as well as disruptions due to civil wars and natural disasters.
- Sensitivity in ecological and sustainability questions: Carbon and other emissions as well as energy and resource consumption of logistics.

Additional to these identified main subjects most high-wage countries (i.e. in Europe and America) are affected by the *demographic change* in their population. Especially the baby-boomer generation with age cohorts from the 1950s and 1960s implicate that after 2020 many employees will withdraw from economic activity because of reaching their retirement age (SBGE 2011). By regarding the identified trends and the development of the aging structure in logistics it is obvious that innovative logistics learning solutions have to be designed by offering employees *possibilities for lifelong learning*. The offer of logistics study as well as qualification and training programs increased in the last 20 years: today, in many European countries universities provide specific logistics studies as well as economic or technical programs with significant logistics content (Hildebrand and Roth 2008; Keuschen and Klumpp 2011). But the main challenge is to provide learning possibilities for employees without leaving their job. Employees have to increase their knowledge to tackle the tasks of logistics management in a global high-velocity supply chain environment. Therefore, flexible e-learning scenarios offer the possibility of knowledge acquisition on the job and account for the above mentioned dependency on current trends. The integration of technical solutions underlines the employees' capability to acquire knowledge within an e-learning scenario.

The capability of logistics learning mechanisms depends on *four components*: temporal components, cultural components, structural components and relational components. The consideration of these four components is a major requirement for a successful learning process. The cultural component can be seen as a basis of learning because the entire logistics sector and supply chains are internationally oriented. The structural component regards the specifications of the employee's organization to realize learning activities on-the-job: flexible in time and position. Relational components assist the collaboration and communication within a strongly cross-linked company structure and the temporal component supports the velocity of changes within the logistics sector and synchronizes them with the learning process (Esper et al. 2007). The goal of learning is to match an employee's knowledge with the needs of the logistics industry. The needs can be displayed as the shape of a 'T' (Fig. 1): The horizontal level displays specific logistics know-how and the vertical level displays the understanding of other company departments with connection to logistics, for example process management, engineering (R&D), production, sales or controlling. In a best case scenario, operations personnel with practical experience has been equipped with management tools and competence and therefore develop into "logistics managers of the future".

For designing education courses in logistics for working persons not only requirements on content have to be regarded. Also, *structural requirements* gain in importance because of the development of the sector. These aspects are relevant because the logistics industry is characterized by several special peculiarities: high speed and flexibility of services, significant shares of small and medium-sized companies and a typically high level of personal *tacit knowledge* leads to the structural requirements listed in Fig. 2.

Competence is thereby defined as "the ability to successfully meet complex demands in a particular context. Its manifestation, competent performance (which

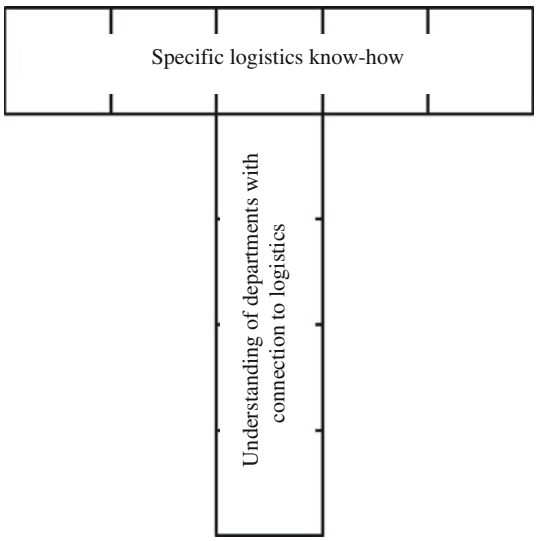

Fig. 1 Employee capabilities for logistics (Mangan and Christopher 2005)

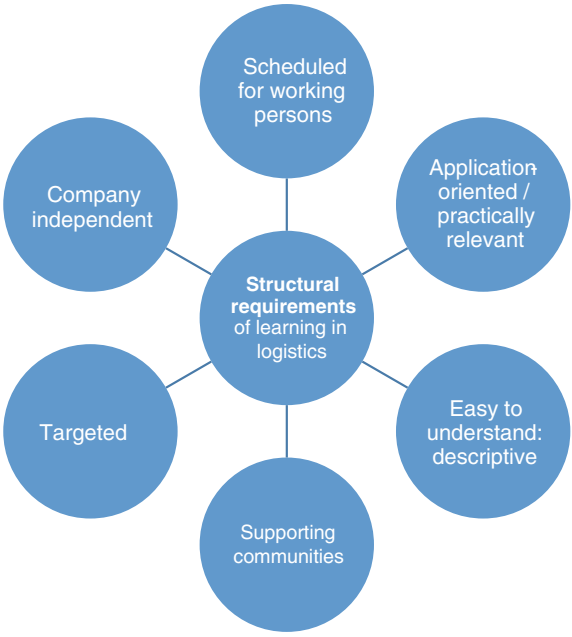

Fig. 2 Structural education requirements for the logistics industry

one may equate to effective action), depends on the mobilization of knowledge, cognitive and practical skills, as well as social and behavioral components such as attitudes, emotions, values and motivations" (Hakkarainen et al. 2004). Competence demonstrates also the level of student achievement in a science

education context; competence is therefore not only skill, qualification or knowledge but all these factors together constitute the basis for the competence of an individual person (Liu 2009).

4 Research Question and the Berufswertigkeit Method

In the logistics industry, the access for everyone—and in particular the career changers—for continuing education should be improved. Furthermore, the logistics industry requires specialists, meaning that the access to specialize personal skills also has to be simplified. One major aspect is the demographic change in Germany, which has to be counteracted with more flexible continuing education offers in which the practical on-the-job experiences of employees have to be acknowledged. All these reasons call for a *competence measurement concept* which is precise, practicable and compatible in every economic sector and in particular the logistics sector. This leads directly to the research question of the results reported here:

> *RQ*: How can a quantitative analysis of logistics competences be implemented in order to support the offer and conduct of qualification measures in logistics?

One measurement concept which was developed since 2007 is the German "Berufswertigkeit" concept (Klumpp 2007; Klumpp et al. 2011). It fulfills the needs of a general competence measurement instrument as it is connected to the concept of *employability*. The main idea of "Berufswertigkeit" is a concept of competence measurement of persons with different education degrees. The criteria for an effective competence measurement regarding demands of real-world companies and work processes are *empirically evaluated and selected* from business practice (Klumpp and Schaumann 2007). With these criteria, persons with different education backgrounds and degrees can be objectively compared while the results are output-oriented (no input and curriculum analysis and comparison but competence outputs of different qualification measures). It includes *36 qualification requirement criteria* that represent the modern daily work which are used to individually measure (on a scale of 1-best to 5-worst) and calculates the aggregate "Berufswertigkeitsindex". The qualification requirement criteria are:

- Efficiency
- Independence and own initiative
- Flexibility and adaptability
- Work virtues
- Stress resistance
- Motivation and ability to lifelong learning and maintain to own competence profile
- Coordinate the work- and lifetimes
- Creativity
- Loyalty

- Risk-taking
- Charisma
- Ability to write and speak in German
- Knowledge of foreign language
- Ability to apply modern information- and communication technologies
- Communication and rhetoric
- Assertiveness
- International and intercultural competence
- Costumer focus
- Skills in mathematics and statistics
- Preparation of cost estimates and quotations
- Planning, implementation and documentation of orders and projects
- Negotiations capacity
- Analytical problem-oriented work
- Quality management (optimization of processes and products/service quality)
- Conceptual and strategic implementation of industry-specific knowledge
- Identification with the company
- Strategic orientation
- Understanding solutions of complex technical problems
- Basic knowledge of business administration
- Perception of functions of management and organization
- Conceptual analysis and work
- Planning and control procurement and logistics processes
- Staff requirements and staff mission planning/staff development
- Team, staff and leadership
- Improving responsible care
- Legal knowledge

The Berufswertigkeitsindex (BWI) value is calculated by a summed and unweighted index of an individual personal evaluation of all the 36 qualification requirement criteria. The value range of the index begins by 0 and ends at 100 (0 = evaluation of all criteria with poor and 100 = evaluation of all criteria with very good). In this way, the output-oriented measuring concept "Berufswertigkeit" serves as a basic field-evaluation concept for the development of e.g. an European Qualification Framework for the logistics industry and integrates the required investigation of competences.

A field survey with 1068 persons from the German logistics industry to be evaluated by this concept was conducted in 2012. It was executed as a telephone survey in the German states of North Rhine-Westphalia and Hesse (743 persons in North Rhine-Westphalia and 257 persons in Hesse). Both states have a significant logistics industry cluster environment, i.e. around the inland port of Duisburg (North Rhine-Westphalia) and around the airport of Frankfurt (Hesse). In that survey existing skills and competences of persons in the logistic industry are described. Additionally, traditional formal degrees in vocational and academic education can be classified according to evaluated practical competence levels.

5 Research Findings and Potential Further Analysis

The described information regarding the qualification profiles and levels of logistics personnel can be analyzed and used in different approaches, two exemplary ones are outlined here:

(a) As a *benchmarking approach*, the overall data can be used to compare individual profiles as well as unit and company average values with the total industry average or also specific averages of age cohorts and regions (Alstete 2008). One such benchmarking analysis detail is depicted in the following figure describing the comparison of different age groups within the survey population. The use of the axes in the Berufswertigkeit Index value (BWI) graph is explained as follows for different competence distributions of comparative groups. Taking the first group of up to 25 year-olds, the first value to be shown on the left side of the graph indicates that about 6 % (y axis) of the total group are featuring a BWI value of up to 65 % (out of 100 % maximum)—therefore on the left side of the graph the lower levels of qualification are to be found. Then next about 11 % of the indicated group are evaluated with a BWI level of 65 to up to 70 % and so on. The last section of the graph on the right side indicates that only about 2.5 % of this group has a BWI competence level of 95–100 %. As can be seen, in most cases (given enough individual persons embodied in the analysis groups) a normal distribution can be recognized as may be expected from a general perspective. It should be emphasized that especially not the "maximum" value of the individual graph (in the example group a value of about 28 % of the group featuring a BWI level of between 75 and 80 %) is most relevant and interesting, but the relative position of each graph to other groups regarding the distribution between the left-hand side (lower qualification levels) and the right-hand side (higher qualification levels). For example the comparative group of the "56 years and older" group displays a distribution graph which has a distinctively lower "maximum" value (only 21 % of this group show a BWI level of between 75 and 80 %) but is shifted to the right side of the figure compared to the younger age group (especially regarding the higher qualification levels). This indicates that this group has *higher competence levels* on average (Fig. 3).
Three benchmarking approaches are now feasible in this example: (i) First individuals can be compared to their specific age cohort: If we analyze and counsel for example a 24-year-old employee in a logistics company, we can compare his individual BWI value (say for example 81 %) to the age group distribution and conclude that his individual value is above the group average. (ii) Second the age profile of a complete company can be compared to the overall averages shown here as aggregate values for the company. (iii) Third in an overall industry analysis the group cohorts can be compared as indicated below.

(b) A further approach would be a *gap analysis*, searching for competence potential in the direction of further development of individuals as well as groups in

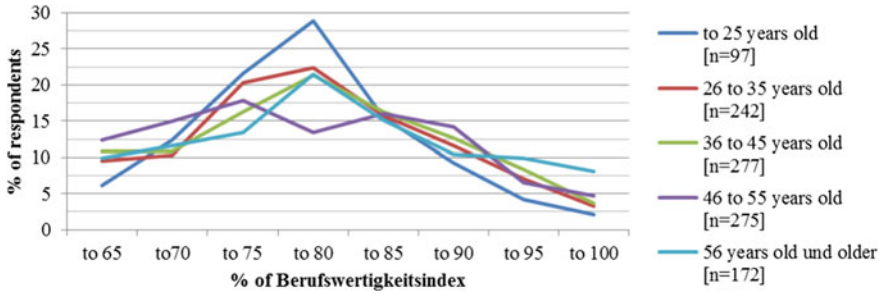

Fig. 3 Berufswertigkeit results based on the age of respondents

logistics. In the following figure different employment groups within logistics are compared to each other. Due to now significant lower numbers per groups, the picture is a little bit more "fuzzy" (not the "smooth" normal distribution). But it can be observed that for example for the interesting group of "blue collar" workers (yellow), there is an unexpectedly high value in the right part of the graph, indicating for example that about 8 % of this group features a BWI competence level of 90–95 % ("hidden talent"). This can be explained by quite a high share of "unusual" entrants into this group, e.g. from people with an even academic education especially when entering the workforce in Germany from abroad (migration background). This would make it interesting to identify these individuals and probably to train them for further purposes and tasks within logistics processes as they provide a high competence level to start with—which is currently most likely not used to its full advantage, neither for the individual employee nor for the company employer (Fig. 4).

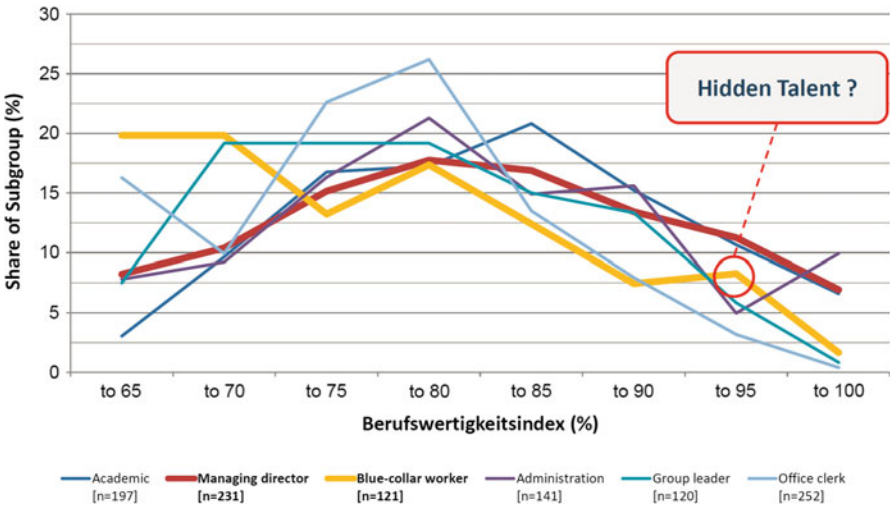

Fig. 4 Berusfwertigkeit results based on the occupational position of respondents

6 European Standardization: The ESCO Project

The ESCO initiative of the European Commission stems from the observation that many institutions—namely public and private agencies with the task of labor market matching—are missing a *common European description and system of occupations and qualifications* across industry sectors. Therefore, in 2011 the project "European Skills/Competences, Qualifications and Occupations" (ESCO) was launched and expert reference groups for different industries were established. The following figure provides the basic structure and mission of ESCO (Fig. 5).

In 2013, the ESCO reference group '*transportation and storage*' was founded and a first expert meeting took place in April in Brussels. The basic definition from this European expert group regarding transportation is as follows:

> The ESCO reference group 'transportation' deals with all occupations and required skills, competences and qualifications **addressing in a major part** the efficient, transparent, sustainable and effective **transport of persons and cargo** via the transport modes air, water, rail, road and pipelines as well as the related logistics services of transport planning and forwarding, transshipment, storage, logistics projects, reverse logistics and value added services. (ESCO Transportation 2013, p. 4)

Early results from the ESCO meetings in 2013 are interesting because a first level structure for all occupations and *qualifications* in the transportation and logistics sector was discussed and agreed upon. This structure is segmented along the transport modes air, water, rail and road as well as additional logistics services (transshipment, warehousing, project and contract logistics services etc.). Further prototyping regarding specific occupations within these top-level groups were

Fig. 5 ESCO Mission and Structure (Le Vrang 2013)

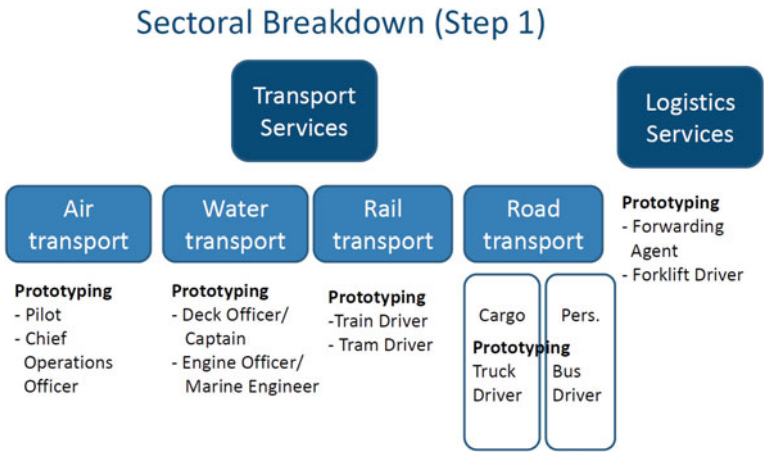

Fig. 6 ESCO reference group transportation—first level structure

decided (e.g. pilot, truck driver, forklift driver; according to ESCO Transportation 2013, p. 5) (Fig. 6).

Such elaborate *prototyping* will show whether the general ESCO approach to link occupations, skills/competences and qualifications is feasible in general and specifically for the logistics industry. In 2016 a final recommendation of the reference group regarding the whole transportation sector in Europe shall be commenced. This will also be based on a further structural outline for a second and third level of the ESCO structure (e.g. within air transportation).

It should be recognized that this development and high-level project will (i) change many structures and processes in logistics personnel management (HR) regarding personnel search, evaluation and identification as well as knowledge management and further qualification and (ii) is basically output-oriented and attempting to standardize as well as to quantify the core asset of knowledge and competences in the logistics industry (as well as in other industries across Europe). This can be linked to the further establishment of a common Industry Qualification Framework (IQF) for the Logistics industry in Europe based on the European Qualifications Framework (EQF) (Abidi et al. 2011; European Parliament 2008).

7 Applying the Findings in Logistics Practice

The following items can be outlined in order to support the further transfer and implementation of quantitative competence analyses such as the Berufswertigkeit index into logistics practice:

(a) First of all, it has to be mentioned that in general, traditional resentments towards quantitative analysis regarding education and competence in logistics have to be

renounced. Though it is important to take criticism into account, a complete neglect is no longer feasible as concepts as the Berufswertigkeit concept prove to be more and more useful and the logistics and transportation sector increasingly requires professional competence management as explained.

(b) As the traditional borders between blue- and white-collar logistics employees become more permeable in the long-run, also quantitative analysis regarding competences may help: identification of potentials (blue-collar) of individuals rather than groups in order to apply educational resources has to be given priority in order to enhance the overall qualification and competence of the logistics workforce. Besides the overall competence level, such a measurement as for example with the Berufswertigkeit index scale can also identify specific competence fields with strengths and weaknesses. Therefore, especially for blue-collar workers as shown above, interesting potentials and possibly also untraditional educational measures—such as a management part-time study program—may be applicable as the individual tests provide such detailed information. In the described empirical research for example we found PhD graduates driving trucks in German logistics companies: they had been immigrating from Eastern European countries and the formal academic qualifications were not acknowledged in the German labor market—but still these people ascertain high skill and competence levels, justifying a totally different approach in further training and development than standard stereotypes regarding blue-collar workers in logistics.

(c) Finally, especially in logistics also quantitative competence information as shown with the results from the Berufswertigkeit survey in logistics can be used to flexibly source "ad hoc"-teams as e.g. needed for logistics projects in contract logistics, ramp-up-management or other large project setups. In these cases, structured qualification information may provide an easy option in sampling the necessary competences and therefore personnel inside one company and possibly throughout supply chains if shared among supply chain partners. This would enable logistics and supply chain performance to increase due to shorter lead times in preparing and setting up projects and processes in global value chains.

8 Conclusion and Outlook

This contribution has shown that especially in the logistics industry as internationally oriented, knowledge-intensive service industry *professional knowledge and qualification management tools are required*, in particular in the face of current trends and future challenges from technology as well as societal and organizational directions. This includes state of the art methods for competence measurement (using an empirical and quantitative approach), information sharing regarding competences in logistics as well as learning in modern social and communicative

learning environments. These fields have for long been neglected by logistics research and are now in high demand especially after the economic crisis and with companies looking out for high-qualified personnel. The overall objective in these management fields is to identify, analyze and enhance logistics and practical management knowledge individually for each and every person employed in this sector. It is not limited to a specific group (formal qualification level or age group) but addresses all people within logistics and even those who want to enter future occupations in the industry (ESCO project). Altogether, these endeavors may be able to increase the attraction of the logistics industry as employer as well as supporting its innovation capacity for other industries and society as a whole—as innovation requires advanced knowledge levels.

Further research as for example in the German national research excellence cluster LogistikRuhr has to show how feasible toolkits and methods can be used in logistics by a broad share of employees and companies—keeping in mind that the majority of logistics companies are small and medium-size enterprises. Therefore, especially *individualized online processes* in qualification measurement as well as training will play an important role in the future in this industry. It can be safely assumed that those companies who are going to embrace this development and will implement analysis and training tools based upon these quantitative analysis and individual matching instruments will have a *competitive advantage* in the long run, especially due to impacts of demographic change in the sector.

References

Abidi H, Klumpp M, Keuschen T (2011) Industry qualifications framework logistics: explicit and tacit knowledge and qualifications in the logistics industry. In: Blecker T, Jahn C, Kersten W (eds) Maritime logistics in the global economy—current trends and approaches. Köln, Eul, pp 327–341

Alstete JW (2008) Measurement benchmarks or "real" benchmarking? An examination of current perspectives. Benchmarking Int J 15(2):178–186

Berufswelt Logistik (2014) Berufe in der Logistik. Available from internet sources: http://www.berufswelt-logistik.de/?weiterbildung_logistik. Accessed on 08 July 2014

Blees I, Rittberger M (2009) Web 2.0 learning environment: concept, implementation, evaluation. eLearning Papers 3(15)

Bildungsrat Deutscher (ed) (1970) Empfehlungen der Bildungskommission, Strukturplan für das Bildungswesen. Eigenverlag, Bonn

ESCO Transportation (2013) Meeting minutes 29.04.2013. ESCO Transportation, Brussels

Esper T, Fugate B, Davis-Sramek B (2007) Logistics learning capability: sustaining the competitive advantage gained through logistics leverage. J Bus Logistics 28(2):57–82

European Parliament (2008) Recommendation of the European parliament and the council of 23 April 2008 on the establishment of the European qualifications framework for lifelong learning. Official J European Union, 2008/C 111/01, Brussels

European Centre for the Development of Vocational Training (ed) (2011) The benefits of vocational education and training. Publications Office of the European Union, Luxemburg

Hakkarainen K, Palonen T, Paavola S, Lehtinen E (2004) Communities of networked expertise: professional and educational perspectives. European Association for Research on Learning and Instruction, Amsterdam, Oxford

Hanft A, Knust M (2009) Continuing higher education and lifelong learning—an international comparative study on stuctures, organization and provisions. Oldenburg, München
Hildebrand W, Roth A (2008) Führungskräfte für die Logistik—Akademische Ausbildung in Deutschland. In: Baumgarten H (ed) Das Beste der Logistik. Innovationen, Strategien, Umsetzungen. Springer, Berlin
Keuschen T, Klumpp M (2011) Logistikstudienangebote und Logistiktrends. FOM ild Schriftenreihe Logistikforschung Band 11. FOM, Essen
Klaus P, Hartmann E, Kille C (2010) Die Top 100 der Logistik. Ausgabe 2010/2011, Hamburg
Klumpp M (2007) Begriff und Konzept Berufswertigkeit. Arbeitspapiere der FOM Hochschule für Oekonomie & Management No. 5, 07/2007, Essen
Klumpp M, Abidi H, Marner T (2014) Qualification hurdles and chances for e-mobility. Int J Transport Traffic Eng 4(3):253–268
Klumpp M, Clausen U, ten Hompel M (2013a) Logistics research and the logistics world of 2050. In: Clausen U, ten Hompel M, Klumpp M (eds) Efficiency in logistics., Lecture Notes in LogisticsSpringer, Heidelberg, pp 1–6
Klumpp M, Dilger B, Kriebel K, Diart M (2011) Studie "Berufswertigkeit konkret"—Vergleich der Berufswertigkeit spezifischer beruflicher Weiterbildungsabschlüsse und hochschulischer Abschlüsse, Abschlussbericht. Paderborn, Eul
Klumpp M, Kandel C, Wirsing E (2013b) Cargo telematics for operational transport excellence and strategic knowledge management. In: Kreowski H-J, Scholz-Reiter B, Thoben K-D (eds) Dynamics in logistics. Lecture Notes in Logistics Series, Springer, Heidelberg, pp 71–84
Klumpp M, Krol B, Zelewski S (2007) Knowledge intensive service production analysis (DEA). In: Conference proceedings 14th international working seminar on production economics. Innsbruck, vol 1, pp 193–206
Klumpp M, Schaumann U (2007) Requirements for leadership personnel and the concept Berufswertigkeit. Kölner Blätter für Wirtschaftspädagogik 12:3–50
Lancioni R, Forman H, Smith MF (2001) Logistics and supply chain education: roadblocks and challenges. Int J Phys Distrib Logistics Manage 31(10):733–745
Le Vrang M (2013) ESCO vision and business cases. Presentation 29.04.2013, Brussels. Available from internet sources: http://prezi.com/vgvyappjudll/esco-vision-business-cases. Accessed 13 July 2014
Liu X (2009) Linking competence to opportunities to learn: models of competence and data mining. Springer, New York
Mangan J, Christopher M (2005) Management development and the supply chain manager of the future. Int J Logistics Manage 16(2):178–191
Rao K, Stenger AJ, Wu H-J (1998) Integrating the use of computers in logistics education. Int J Phys Distrib Logistics Manage 28(4):302–319
Rideout B (2011) Printing the impossible triangle: the copyright implications of three-dimensional printing. J Bus Entrepreneurship Law 5(1):6
Roth A (2008) Aus- und Weiterbildung in der Logistik. In: Klaus P, Krieger W (eds) Gabler Logistik Lexikon. Gabler, Wiesbaden
Roth A (2010) Der Logistikbildungsmarkt 2020—Bedarfsgerechte Bildungsangebote für die Logistikwirtschaft in der Logistik. Hamburg, DVV
Roth A, Klaus P (2008) Bildungsmarkt Logistik. Hamburg, DVV
Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung (SBGE) (2011) Herausforderungen des demografischen Wandels, Expertise im Auftrag der Bundesregierung. Statistisches Bundesamt, Wiesbaden
Self JA (2011) The use of design tools in industrial design practice. PhD thesis, Kingston University, London
Wache M (2003) E-learning—Bildung im digitalen Zeitalter. Bundeszentrale für politische Bildung, Bonn

Wimmer T (2011) Trends in der Logistik. In: Schenk M, Zadek H, Müller G, Richter K, Seidel H (eds) Proceedings of the 16th Magdeburger Logistiktage 2011, pp 15–18
Worldbank (2014) Logistics performance index global ranking. Available from internet sources: http://lpi.worldbank.org/. Accessed on 23 July 2014
Wu YCJ (2007) Contemporary logistics education: an international perspective. Int J Phys Distrib Logistics Manage 37(7):504–528