Doctoral School of Business and Management

COLLECTION OF THESIS

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Competencies in the supply chain education

-Student and labour market perspectives-

Ph.D. Dissertation

Supervisor:

Krisztina Demeter
professor

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Department of Supply Chain Management

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1. Introduction

Due to the developments (IoT, AI, digitisation) and events (pandemic) experienced lately, current jobs are likely to change drastically in the coming years, some of the knowledge and skills required to fill them may become unnecessary, while the demand for new skills may increase. This constantly changing world imposes increasingly serious criteria on the lecturers and the potential employees (students) in order to become a successful and productive workforce in the labour market.

1.1. The relevance of the choice of topic

The changes taking place in the economy and within the logistics sector result in changes in the characteristics of students entering higher education, which also establish the change in expectations for education (changes in methodology are necessary). Among other things, this also makes it necessary to get to know the ideas of employers and students regarding the expected competencies, and according to the argument of Dubay et al. (2019), 'empirical research on the lack of skills in the supply change is scarce' (p.144), which also indicates the need for this kind of research. The competencies needed for an effective and successful presence on the labour market have so far only been examined from the perspective of the employer, and the two education levels (OKJ-MSc) have not been distinguished from each other. In addition to the professional knowledge needed to reach and sustain the competitiveness of a company, the so-called soft skills and the importance of their development are gaining more and more emphasis, which brings to the fore the cooperation of companies and higher education institutions.

The aim is to experience more prepared employees, less vacant jobs, less unemployed people, increasing competitiveness, minor migration, increasing satisfaction, and the narrowing of the gap existing between demand and supply in the economics.

Since there is no national research on these employer and student needs, my research is considered complementary research in the examined fields of the supply chain.

My goal is to map the differences between the competencies developed in education and those expected by employers in the SCM training, and to find possible ways to terminate the 'Gap'.

2. Research Framework

2.1. Research plan

The fast economic transformation and the daily changing expectations in the labour market are constantly challenging all three market participants (lecturers, students, and employers). In order to meet these expectations, all participants need to have, for instance, high degree flexibility, openness to learning and innovations, complex mindset, motivation, and agility (competency). Only those educational institutions that meet all these expectations can train students meeting the market requirements. It is important to see that lecturers taking part in training play a decisive role in this process, therefore, their information, updating of their preparedness, their educational methodological preparation and support came to the fore.

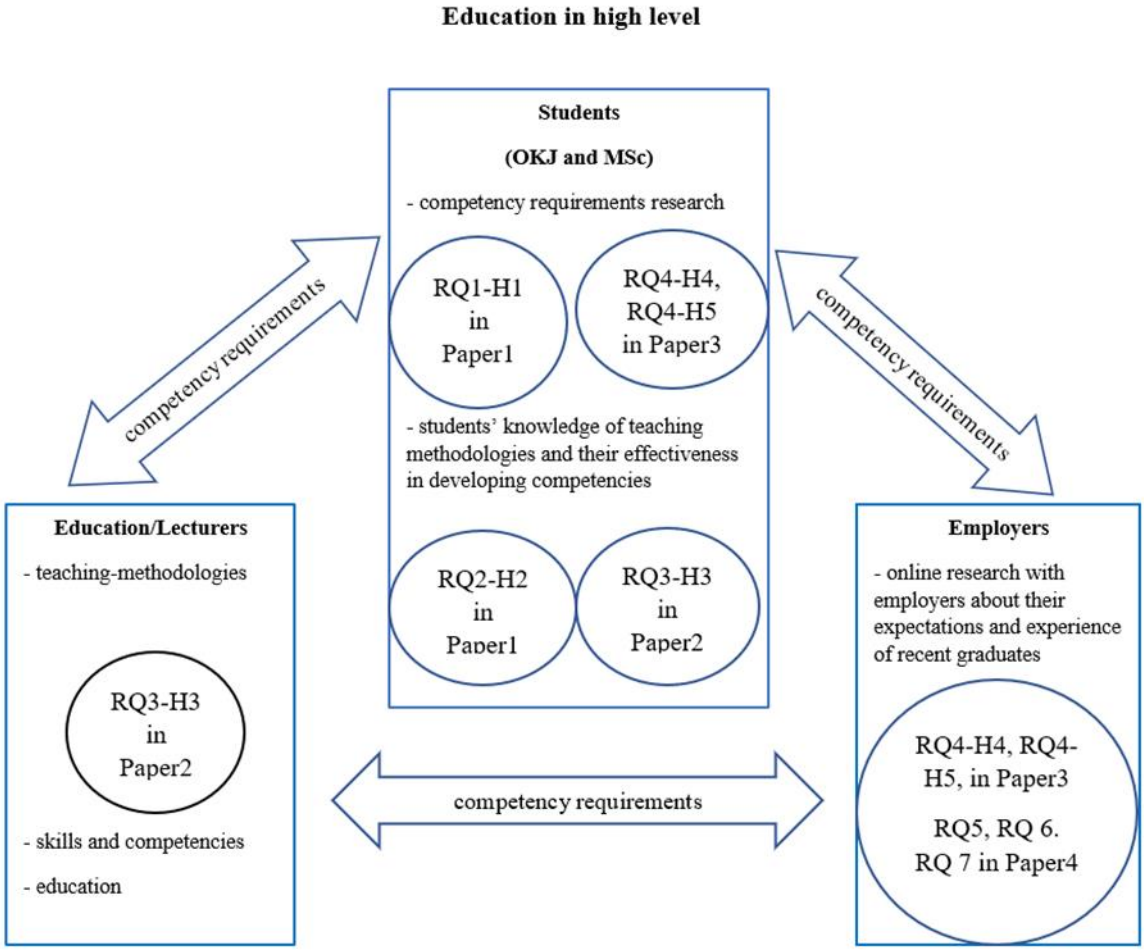
To realise the above-outlined research goals, as a first step, I determined the central research question, which is as follows. RQ: How can compliance with the labour market expectations be improved in the field of supply chain management, with the help of the competencies that must be developed according to the educational system? The 'smaller' research questions, hypotheses, methods used, and results from publications (Paper 1-2-3-4), – which can be read in the research method section, are built on each other and all serve to answer this research question (Figure 1.)

2.2. Research model

With the help of the following Figure 1. I present my research model, which illustrates the logical connection of the 'smaller' research questions and the hypotheses examined in the research plan presented above.

From the research model, it can be clearly seen that there is a close synergy between the topics, and therefore they all serve to answer the research question. Asking and analysing the students' opinions (RQ1, RQ4, H4, H5) about competency expectations and methods applied in education (RQ2, H1, RQ3, H3), as well as their evaluation of effectiveness (H2), are all important in defining the training structure (training and outcome requirements).

Figure 1. Research model



source: own compilation

To perform well in the labour market and maintain the competitiveness of companies, it is essential – both from the student and the lecturer side – to get to know the experience and expectations of employers, to monitor them and to adapt to them. The experiences and expectations of the managers working in the supply chain fields were asked after personal contact, using an online questionnaire, which gave answers to the questions RQ5, RQ6, RQ7.

2.3. Research method

First, as a summary, with the help of Table 1. I present the methodology used for the collection of necessary data, followed by the relevance and justification of the individual research questions and the techniques used for answering them.

Table 1. Summarised research methodology.

Methodology of data collection	**Application of the data**
Web-based questionnaire 110 OKJ-SCM-MSc Students (primer data)	Paper 1, 2, 3, 4
Web-based questionnaire 64 SCM-Employers (primer data)	Paper 4
Interviews with 5 Professionals (primer data)	Paper 4
Interviews with 3 Students (primer data)	Paper 1
Webinars, conferences, professionals, experts presentations (primer data)	Paper 4
Systematic Literatures review (secondary data)	Paper 1, 2,3,4

To find out the answers, we used mixed methods, which means the use of secondary and primary information, and qualitative and quantitive methods. We gathered the data with the help of online questionnaire (primary, quantitative), and literature analysis (secondary, qualitative). Our aim was to increase the reliability and validity of the data, by building the methods on each other and combining their advantages. Through an in-depth study of the literature, and interviews with experts we created the basis for the questions in the questionnaire, which help us to answer our research questions.

As an additional check, we did statistical tests e.g. Man-Whitney U test, content analysis, sign.analysis, principal component analysis, and interviews with students on the results, in order to support the reliability even more.

The following table 2. summarises the database of Paper1 és Paper2.

Table 2. Database for RQ1, RQ2, RQ3 and H1,H2,H3 in Paper1 and Paper2

			Gender		Age		
	Person	Person	Female	Male	18-26	27-30	30-
Data collection (2017)	OKJ:30 (35%), MSc:56 (65%)	86	61(72%)	17(28%)	77 (90%)	0	9 (10%)

Source: own research

In Paper1. 'Competencies of logistics and their potential for development', based on the competency expectation found in the literature, we have asked students in the logistics field about the expected competencies in the labour market, as well as about the familiarity and effectiveness of the educational methods used to develop competencies. Since the market expectations are constantly changing, and

students have to meet these expectations, for the realization of our subsequent process development goal, as a starting point, we found it important to get to know their opinion. As this kind of research has not been done yet, the results are suppletory. We defined two questions (RQ1, RQ2) and two hypotheses (H1, H2) for our research, and the data collection and data analysis methods used to answer them are shown in the following Table3 .

Our hypotheses (H1, H2) are connected to RQ2.

RQ1: According to the student, what competencies should a professional working in the fields of the supply change (procurement, manufacturing, warehousing, distribution) have?

Table 3. Methodology for RQ1

Methodology of data collection		**Methodology of data analysis**
Primer data	Secondary data (SD)	Content analysis
Web-based questionnaire (86)	Literatures review	Q method
		sig.analysis

Source: own research

RQ2: What kind of (digital) educational methods have the students met during training that helped them develop the competencies expected by the employers, and how efficient these methods were according to them?

H1: Master's degree students know the cooperative methods more, than OKJ students do.

H2: Master's degree students find the cooperative methods more useful, than OKJ students do.

Table 4. Methodology for RQ2 and H1, H2

Methodology of data collection		**Methodology of data analysis**
Primer data	Secondary data (SD)	Content analysis
Web-based questionnaire (86)	Literatures review	Q-method
Interviews with student (3)	KKK (learning outcomes criteria)	Mann-Whitney U test

Source: own research

It is extremely important to get to know the students' opinion regarding the educational methods and their effectiveness in order to achieve the subsequent process development goals. The adequate development of the necessary competencies can only be realized with the cooperation of the students. This also requires knowledge of this information. We chose the applied methodology based on what was described above, and we supplemented it here with personal student interviews to verify the results.

In Paper2. „Analysis of educational methods developing expected competencies in the logistics field by factor analysis", I examined whether the cooperative methods used in education (the familiarity and effectiveness of which we already know) could be arranged in groups based on the students' opinion, are they interchangeable, do they replace, support or complement each other. The answer is also important, because by knowing the ability of competency development of the listed methods and by making use of its variability (those who join the given group/component are able to develop the same competency) classes can be more colourful and interesting, in addition to the development of the expected competencies. This way both students and lecturers reach their goals easier.

RQ3: According to the students' opinion, how can the individual educational methods be grouped with the help of substitutability, interchangability, support ability, or complementability using principal component analysis?

Table 5. Methodology for RQ3, H3,

Methodology of data collection		**Methodology of data analysis**
Primer data	Secondary data (SD)	Content analysis
Web-based questionnaire	Literatures review	Q-method
		principal component analysis, Mann-Whitney U sig,

Source: own research

Since students from two different levels (OKJ-MSc) answered the questionnaire, which assumes that they do not have to meet the same expectations, I had the following assumption:

H3: There is a difference between OKJ and MSc students in the assessment of the methods belonging into the principal components.

Based on the earlier gathered data, I complemented the image of the cooperative educational method with principal component analysis. I also checked the significance level of the Man-Whithney test. As a result, we can say that it was worth to make the analysis and to create the components, because the hypothesis was only partially confirmed. Based on this, we can state that the methods of online applications, situation game, short videos, teamwork, project method, conversation with educational purposes, debate and group home work were rated as more effective by OKJ students from the aspect of developing competencies that important to employers.

In Paper3 „Competencies required for the implementation of an efficient supply chain from the perspectives of students and the labour market", my aim is to expand the horizon of students with comparing their opinion with national and international research results. The importance of the examined question (RQ4) is proven by the fact that changing or supporting student opinions can greatly help shape the training of the previously mentioned marketable student, both in the terms of the output and training requirements, their competencies to be developed, as well as the applied

methodology. If the student knows the expectations of the market and the methods for meeting these expectations, according to experience shows more commitment in his/her studies.

Therefore, RQ4 is: Is there any difference in the assessment of the competencies expected in certain fields of the supply chain between recent international labour market research (EU, ESCO) and students in supply chain management training at Corvinus University of Budapest (CUB)?

We questioned 110 supply chain management (SCM) master's degree (MSc) students from CUB and performed a significance test on their answers.

Table 6. Database for RQ4 and H4, H5 in Paper3.

			Gender		Age		
	%	Person	Female	Male	21-23	24-26	27-30
I. data collection (2017)	49	54	40	14	10	44	0
II. data collection (2020)	51	56	35	21	28	26	2
Sum	100	110	75 (67,6%)	35 (32,4%)	38 (34,6%)	70 (65,38%)	2 (0,02%)

Source: own research

Table 7. Methodology for RQ4 and H4, H5

Methodology of data collection		**Methodology of data analysis**
Primer data	Secondary data (SD)	Content analysis
Web-based questionnaire	Literatures review	Q-method
	EU, ESCO	sig.analysis

Source: own research

In order to answer the hypotheses (H4, H5) compared to the data found in the literature, significantly more was achieved, since the students had to give their answers on a scale from 1 to 100, which can also be called suppletory. The significance test conducted on the data helped with the comparability of the results and the support of the hypotheses, which were as follows: H4 Students know that the most important labour market expectations of a logistics manager are systems approach and management/leadership skills, which stand out significantly even compared with the assessments of the other managerial positions.

H5 Students know that the most important labour market expectations of a purchasing manager are negotiation and communication skills, which stand out significantly even compared with the evaluation of other managerial positions.

In the light of our results, we accepted the H4 hypothesis. Furthermore, after a significant decrease in value assessment was shown in communication skills, negotiation skills, conflict management and networking skills compared to the purchasing manager, we also accepted the H5 hypothesis formulated in relation to the requirements placed on the purchasing maanger. Therefore, the significantly higher values of negotiation and communication skills for the purchasing manager support the students' awareness of the labour market expectations.

In Paper4 "Student competencies in Supply Chain Management: Expectations and reality", I examined the following research questions:

RQ5: Which competencies do employers expect from graduated students?

RQ6: Which competencies are experienced by employers?

RQ7: Where do employers see discrepancies between their expectations and the current competencies of graduated students?

The constant and synchronous labour market shortage and unemployment in the fields of the supply chain management created the relevance of the research. Its significance is even more increased by the fact that national research is not available regarding this topic, even though the importance of cooperation between industry and education is increasingly coming to the fore. Taking into account the results of this research, the gap between supply and demand in the industry can perhaps be reduced to a small extent. For the research, I interviewed managers working in certain fields of the SCM with an online questionnaire after contacting them personally. The chosen managers often manage at the same time several fields, which gives their answers even more weight. There was altogether 101 answers, the distribution of which you can see in table 12. The applied methodology is shown in table 13.

Table 8. Database for RQ5, RQ6, RQ7 in Paper 4.

Procu-rement	Ware-house	Manufac-turing	Distri-bution	Reverse	Logistics and distribution managers	Other fields of SCM	Sum
12 (12%)	20 (20%)	10 (10%)	17 (17%)	2 (2%)	27 (26%)	13 (13%)	101 (100%)

Source: own research

Table 91. Methodology for RQ5, RQ6, RQ7

Methodology of data collection		**Methodology of data analysis**
Primer data	Secondary data (SD)	Content analysis
Web-based questionnaire	Literatures review	Q-method
Interviews with professionals	EU, ESCO	sig.analyse
Webinars, conferences, professional's presentations		

Source: own research

Since the willingness of the surveyed sector to answer is very low, it was necessary to visit them personally, as a result of which they managed to fill in the online questionnaire. The round table discussions, lectures and personal interviews held at the conferences all strengthened and supplemented the information found in the literature. This supported the relevance of the competencies examined in our questionnaire and helped answer the research questions. With the significance test performed on the results, we achieved the comparability of the data and the answer to our research question.

The following table 10. helps to review the method of participation of the stakeholders in the research.

Table 10. Research methods from the aspect of the stakeholders

Questioning of the students	**Questioning of the employers**	**Educational system, Activation of lecturers (plan)**
With online questionnaire (sharing the link of the questionnaire in FB groups and Teams)	With online questionnaire (Sending in e-mail, sharing on LinkedIn)	Students' opinion about the educational methods Personal presentation of the research results: on research forums, meetings, round table discussions.
With personal interview	With personal visit, guest lecturers, thinking together	With sharing the research results orally and through publications
Plan: thinking together		Plan: thinking together, planning the development processes with the active participation of lecturers

Source: own research

I will use thinking together and the development and creation of processes in the field of „action research", as a further possible step in the research. The thinking together with students – lecturers – employers, the round table discussions, participation in fourms all served as validation of the research results.

3. Conclusions

Based on my researches I arrived to the following conclusions.

Most of the expected competencies revealed by literature can be developed in education, which justifies the knowledge and use of these and the cooperative teaching methods also in teaching circles. Master's degree students are also familiar with the examined methods, which helps them acquire the skills and abilities expected in the labour market. The methods can be flexibly adapted to all levels of training, e.g. OKJ-MsC, since most of the examined competencies can be considered general. Based on the opinion of students, with online learning applications the problem is not necessarily with the methodology, but rather with its application method and possibilities. As a result of successful pairing (competency to be developed – method) the required competency is attainable at an appropriate level, and since the methods belonging to each component are interchangeable, they can be used as a supporter and complement of each other, providing the user with a high degree of flexibility. According to the assessment of master's degree students, the methods belonging to the first main component for the development of competencies related to comprehensive logistics within the company (teamwork, situation game, short videos, project method, debate, conversation with educational purposes, online – study supporting – applications, group homework) are less suitable for the development of expected competencies and only here we can observe a differentiated assessment of the effectiveness of the methods. In my opinion, if these methods were used more often in classes, students could re-evaluate the effectiveness of thesse methods and the efficency could be moved in a positive direction. Our results showed the discrepancy between the expected competencies and the competencies that were thought to be expected. Presentation skill showed the most surprising result. So there are fields and competencies, the importance of which students should be made aware of and developed in order to become marketable employees.

The competencies determined by ESCO can be classified under the 17 competencies we examined from the fields of procurement, manufacturing, warehousing, distribution and logistics. So the 17 competencies function as umbrella terms. Thus, these groups have become inclusive of several operations/activities, with the development of which we can help our students achieve success in several fields in the labour market. Most of the examined competencies are skills and abilities, which can be said to be generally expected from managers, therefore in secondary and higher education institutions, more and more attention must be paid to educational methodological issues. By clarifying these, the development of increasingly important soft skills can be realized even more.

According to the research conducted in the labour market, we can say that the most expected competencies are positive attitude, agility, motivation, openness to innovation and change, scheduling skills, (work related) time management, curiosity, ability to use softwares and IT tools, ensuring of

cross-department cooperation. These expected competencies reflect the dynamic changes in the environment, which require flexibility and fast adaptation from the employees. In addition, computer skills have become highly important due to the digital transformation of the entire economy. The least expected qualities were mainly managerial qualities, such as ability to train people, ability to make forecasts (financial, dividend, economic trends), management skills, ability to build professional networks, ability to create contracts, ability to facilitate recruitment. In our opinion, these competencies are best developed on the job, and recent graduates usually do not start as managers, so these skills are not expected of them.

According to the experience of the employers, students showed the best performance in terms of ability to use softwares and IT tools, curiosity, positive attitude, agility and openness to innovation and change. It is an important result that self-confidence is also relatively strong. Based on the significance test, with the exception of six competencies (ability to facilitate recruitment, ability to administrate, self-confidence, ability to make forecasts, ability to create contracts, ability to build professional networks) there is a significant difference between expectations and experiences.

In the following, you can read some suggestions in view of the use of the results.

4. Recommendation

Based on our research results, it is worth considering paying more attention to educational methodological issues, since today's students expect something completely different – mainly immediately usable knowledge – in an attention-grabbing way. If we involved them in the rethinking of the training output requirements, or in the development process of competencies (e.g. workshops), their horizons might broaden even more and their commitment to learning would increase. The suggestions and ideas made by them would not only require a deeper level of knowledge of educational methodologies, but also an overview of the results conducted on the labour market. Therefore, I would first inform them of the information necessary to make recommedations, such as research results, and educational methodology. The proposals would be evaluated individually and jointly by lecturers and company specialists (from the fields of supply change management), and the best could be implemented in the curriculum.

The involvement of lecturers in the transformation process (e.g. with round table discussions, thinking together), after the presentations of the results, can on the one hand help them to choose and apply the competency development methods used in the classes, on the other hand, it can increase the effectiveness of the training and help adapt the students' ideas to market expectations, so it would be easier to create harmony between the parties. In the meantime, the methodological support of the lecturers would be continuous.

It would be extremely important to involve the dual partners and other relevant company managers in the development process, because if the goal is to train marketable graduates, then on the one hand, they should know the students' perceptions regarding what is expected of them, and on the other hand, they could make their real expectations known to the students. There are countless forms of networking, such as guest lecturers, company visits, open days, involvement of company experts in the curriculum, solving company case studies, joint problem exploration, analysis, solution, workshops inclucing company experts, gamification, participations in professional competitions at university, national and international level etc. Thesec an help broaden students' horizons about expected expectations, and employers can prepare to welcome newly graduated students, e.g. with targeted trainings and a mentor program.

The following suggestions are aimed for the further development and addition to the conducted research.

5. Further research

One further step of the research examining the competencies could be including the bachelor's degree (BA), or the supply chain specialization, which would create an opportunity to learn about the differencies between bachelor's and master's level training. In this way, we could find out why it would be worth for a student to stay in training for another two years after completing the bachelor's degree. It would also help employers to let young employees go to the master's level, or enroll them, or to pay higher salaries to those coming from there.

It would also be interesting to examine the impact of artificial intelligence, IoT and digitisation on the development of competencies, and labour market expectations. Questioning the fellow lecturers and voicing their experiences about students' competencies and market expectations is also a possible way to further develop research. The promotion of cooperation between industry and education could be possible by continuously monitoring the market and comparing the experiences of lecturers and students, even within the framework of research.

The employer research could also be extended to either educational levels or to the levels of filled positions, both on national and international level. It would be important to know the expectations according to the educational levels.

Finally, in the next section, you can read my publications published so far in the topic, which are the basis of the research framework presented earlier.

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7. List of Papers

7.1. Refereed scientific journals

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