

Managing Logistics Higher Education Using Logical Framework Analysis

Jian TONG

Abstract—Many Studies indicate that Germany is the world's logistics leader. One of its drivers is due to its brilliant logistics education. The purpose of the paper is to show an overview of logistics education in Germany and develop a strategic model for logistics higher education management, aiming to provide a guide for educators to manage logistics higher education. Based on a semi-systematic literature review, the innovative design and dynamical improvement of logistics education was been categorized into five interrelated stages. Using logical framework analysis (LFA) a strategic framework of logistics higher education management is developed. It is explored that the dynamic responsiveness of demand for logistics higher education from the labour market and feedback from the learners are the most important determinants for successful fulfillment of the goals for logistics higher education. Furthermore, the interrelations between the various logical stages for managing logistics higher education were explained. This paper is the first attempt to provide a logical systematic framework of logistics education with a strong focus in Germany. Replication in other countries should be undertaken to validate the framework in the future.

Index Terms—Higher education, Management, Logistics, Germany, LFA.

I. INTRODUCTION

Globalization, new information and communication technologies, the networked value chain and the standardization of goods and data exchange processes have changed the role of logistics radically. The growing requirement for logistics professionals rests on the rapid developments since the 1970s, where transportation, distribution, inventory management, operation, sales, finance and purchasing functions were isolated from each other [11]. Any company with substantial logistics activities is now facing the challenge to evaluate innovative solutions in transportation, communications, data collection and information processing on a commercial scale. The dynamics and complexity in the global context influence this praxis-oriented science in the logistics field. Previous work on this topic found that in recent years the offer of logistics courses has grown enormously worldwide as a result of the increasing demand for logistics professionals in numerous fields including economics and government [19].

Accordingly, lasting recent decades, logistics has developed into a cross-functional discipline with a higher

requirement for education and professional skills and the requirement for the instructional curriculum changes rapidly. Hoek (2001) indicated that rapid changes in these requirements in practice and further developments in research in the logistics field challenge educators to further upgrade their education system, their course programme and their teaching methods [35]. According to various studies the requirements for dynamic and substantial skills and knowledge are facing a big challenge and have not been satisfied by the current logistics education offering. Research into the current status of logistics education at college level has found it to still be very limited [19] [26]. As aforementioned, much research indicates that the quantity of logistics higher education courses rises permanently and meanwhile the market requires instant new knowledge and skills for logistics professionals because of the fast changing circumstances in the logistics field. But according to the best knowledge of the author, there are no useful tools for standards in logistics higher education which give an overall view of the topic. In our study, logistics and supply chain management are viewed as the same area, and the term logistics used throughout our paper also includes supply chain management-related courses [37].

In accordance with the limitations discussed above, the major purpose of this paper is to provide a comprehensive analysis of logistics higher education management. Based on German logistics higher education, the proposed logical framework analysis (LFA) developed a strategic framework, which gives a good understanding of the systematic structure of the logistics higher education system. It could be a tool to design, assess and improve logistics higher education dynamically and substantially. The main strength of the framework lies in its capability of response, through which the higher education system could respond to goals and purposes of higher education dynamically instead of continuing to do what has always been done. The framework could act as a helpful instrument not only for logistics educators to manage their logistics higher education system but also for learners to plan their logistics careers.

II. RESEARCH METHODOLOGY

A semi-systematic literature review is used to investigate the characteristics and problems in the field. First of all, a general overview of logistics higher education in Germany will be presented. Based on the results of the semi-systematic literature review, this study develops a strategic model for logistics higher education management using logical framework analysis (LFA).

LFA was first formally adopted in the early 1970s for project management in the USA. The LFA is a strategic

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objectives-oriented planning and project management methodology with wide applications [8]. It is robust and more disciplined than traditional expert-driven planning tools. It comprises an integrated package of tools for analysing and solving planning problems, and for designing and managing their solutions [8] [9]. Its effectiveness is systematic logical analysis of problems and application of a matrix in which development goals, activities and impact indicators are all logically related in a succinct organizational framework. This method is now widely used in a number of countries; it has since been widely accepted and successfully applied as a planning and management tool by a variety of new areas [8]. This is because it not only helps to provide a standardized summary and the logic of a project, but is also applicable to various functions of any organization [9] [29].

Its main strength lies in its diagnostic and responsive capability. It provides a sound basis for identifying problems and for generating appropriate solutions and interventions to achieve specific objectives and goals [29]. However, according to the author's knowledge this study is the first attempt of LFA at managing logistics higher education dynamically.

III. LITERATURE REVIEW AND RESEARCH BACKGROUND

Many studies indicate that Germany is the world's logistics leader; one of the drivers is its excellent logistics higher education system. This study investigates the logistics higher education system in the German context to try to find a general model for logistics education management worldwide.

In the 1970s logistics started to become important for German firms and enterprises. In this decade logistics was recognized as a necessary evil [2]. It was limited to transportation, inventory management and the handling of goods as isolated functions. Over the past 40 years logistics has developed into a cross-functional discipline with implementation of global supply strategies and worldwide production plants [3].

The first German department for logistics higher education was founded in the 1960s [25]. Due to the remarkable changes in the logistics industry the discipline has been characterized by tremendous change since the early 1990s [28]. The quantity of logistics higher education courses on offer increased from 1995 to 2008 by 65 percent at universities of applied sciences and 25 percent at universities in Germany [30]. Today the offer ranges from technically oriented to business related studies. Baumgarten and Hildebrand (2008) included in their study of logistics higher education in Germany a total of 129 institutions with logistics content [4]. Most of them are situated in medium-sized and large cities all over Germany. A high density of institutions for logistics higher education is found in Berlin, Bremen, Nuremberg, Dortmund, Munich and Stuttgart [27].

The logistician's relevant skill set has likely risen as well [17]. The need for trained professionals in the logistics industry is rising in all sectors and thus represents a growing employment potential. The strategic importance of logistics increased and created new positions in middle and high-level management [5]. Today, logistics professionals should have functional skills, technical skills, leadership skills,

experience of global management and even intercultural understanding [12]. This new demand is attended by the enlargement of logistics higher education at universities, universities of applied sciences and universities of cooperative education [14][18]. Most of the degrees in logistics in Germany are business degrees with a proportion of 40 percent, followed by engineering degrees at 25 percent and IT degrees at 18 percent [27]. A total of 11,600 students completed studies with a logistics background in 2007, whereas 1,300 of them graduated in a full logistics programme [17]. As a result of the growing amount of logistics higher education an evaluation is necessary to ensure quality control. It is imperative that high standards are met in the provision of education services [6]. Despite a considerable amount of literature in this area there is still no consensus as to how quality is best managed with higher education. Scholars have proposed various models for the implementation of quality management in higher education, such as socio-political, organizational, pedagogical, business, political and power models [20][21].

Based on the dynamic global markets, the increase in complexity of technological applications and the new concepts in network management, logistics higher education have to form methodical, intercultural, social and analytical skills in professional education [12]. To meet the requirements of logistics development educators are forced to teach in various ways. Methods such as case studies, project work and practical exercises were used to impart logistics knowledge and necessary skills [4]. Hildebrand and Roth (2008) created a simplified overview of hierarchical levels for logistics activities, where they characterize that graduates from universities of applied sciences and universities of cooperative education mostly work in operative management and middle-management, while graduates from universities work rather in high-level management and at the academic level [17].

All of this literature discussed the offering and development of logistics higher education as well as the demand for skills for logisticians. Only Hildebrand and Roth (2008), Roth, A. (2009) briefly cover decision-making support [17] [30]. Furthermore, Millet and Zelman (2005) in Ohio worked out a logical model of public education, which shows the factors for higher achievement for all students [22]. No studies have been undertaken to provide a framework for logistics higher education to help logistics educators to design, assess and improve their higher education programmed or for readers with an overall picture of systematic logistics higher education for their career planning.

In view of the above, there is a need for a uniform model for the logistics higher education system which provides all the aspects (structure, processes and outcomes) of quality improvement from concept to implementation in order to perform better. Because of the practice-oriented logistics discipline, the development of logistics higher education is characterized by dynamics and complexity. Hence, it is very important that the correlations due to the dynamics and complexity are responded to early by educators within the higher education system. Education organizations need to foster a quality culture, which could identify problems in the system dynamically, suggest solutions to those problems and

develop a framework for implementation of those solutions [8].

IV. RESULT AND ANALYSIS

The framework based on logistics higher education in Germany, the LFA, gives a standardized summary and systematic logical analysis of problems for the higher education system and applies logical stages of decision-making support and improvement for the logistics higher education system in which the assessment such as input, activities, outcome and quality management are all logically related in a succinct organizational framework. (Fig. 1.)

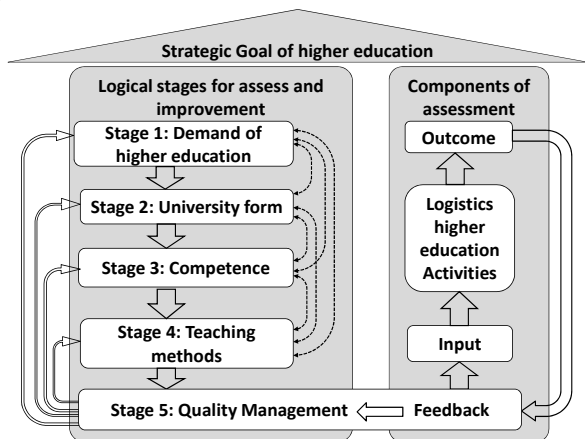


Fig. 1. Strategic Framework of Logistics Higher Education Management (Source: author)

A. Strategic Goal / Purpose

The goal of the framework is to structure the strategic management of logistics higher education. First of all, it is very important to define the strategic goals and purposes of an education system. Under the goals and purposes, the framework includes two columns, in which the logical thinking or information flow for the decision support or assessments go in opposite directions. Using a semi-systematic literature review, the evolution, design and dynamic improvement of a logistics higher education system was accordingly categorized into the following five interrelated stages: demand for higher education, type of university, competence, teaching methods and quality management. Other logical thinking is about performance assessment of the educational system, which is structured in the right-hand column of the framework.

B. Stage 1: Demand for higher education

Education activity could be analysed from the perspective of the demand-supply relationship. In order to structure an optimal education system, it is very important to dynamically observe the demand for education from the labour market. In other words, the output of education activity must correspond to the demand for higher education. Since logistics has played an important role for firms in recent years, the quantity and quality of demand for highly qualified specialists in the logistics field has grown enormously in Germany. Because of the economic climate and the many crises around globalization, green logistics, sustainability etc., it is essential to educate highly qualified logisticians with

sound know-how and social skills [34].

As shown in Table I, at management levels methodical and primarily social skills are more in demand than professional skills and know-how. This leads to institutions for logistics higher education having to follow this demand and modulate their courses and teaching methods to the needs of economy. Table III shows a range of teaching methods and their effects on skills.

Universities and universities of applied sciences have to adapt their programmes to the new occupational profile of a logistician [32]. The number of universities of applied sciences increased by 65 percent from 1995 to 2008 and this type of higher education in particular is specialized in educating professionals for logistics middle management [17][30]. This development clarifies that institutions for logistics higher education have to follow the trends in logistics economics. The demand for highly qualified logisticians will also be accommodated in future due to the attempt to enlarge the quantity and to advance the quality of logistics higher education [30].

TABLE I: IMPORTANCE OF COMPETENCES [32]

Competence	Hierarchical level	
	Middle management	High-level management
Professional competence	2	3
Methodical competence	2	2
Social competence	1	1
1 = very important, 2 = important, 3 = less important.		

C. Stage 2: University type

In Germany logistics higher education is offered mainly in three types of university: universities, universities of applied sciences and universities of cooperative education. In 2008 there are a total of 129 institutions for logistics higher education, whereof 34 percent were universities, 55 percent were universities of applied sciences and 11 percent were universities of cooperative education [4].

German logistics higher education is characterized by a diversity of profiles and courses, which is often shown in the description of institutions, e.g. Institute for Transport Planning and Logistics (University of Hamburg-Harburg), chair in administration and logistics (TU Darmstadt) or Institute for Material Flow and Logistics (Fraunhofer IML Dortmund). Degrees and profiles in logistics higher education are management, technology, methods and integrated orientation. Only in a few cases can the field of activity be allocated to one topic. In fact logistics higher education in Germany is identified by the combination of two or even more profiles with varied characteristics, whereas universities tend to offer logistics higher education as one part of the studies while universities of applied sciences offer logistics as a particular degree course [4] [34].

Another criterion for differentiation is compulsory attendance, which in contrast to universities of applied sciences is not obligatory at universities. This leads to better time management of students, which is an important skill for their later career. Universities also differ from universities of

applied sciences in teaching methods: whereas universities particularly use lectures, universities of applied sciences in contrast urge their students to active cooperation by using teaching methods such as seminars, project work and case studies for imparting knowledge [34].

To start a career in logistics, studies such as industrial engineering, business management, traffic engineering, information management and engine construction provide the best foundation, whereas industrial engineering creates versatile career prospects [4]. Not only the choice of graduate programmed, but also the choice of university type is essential for a career. In fact, at universities generally knowledge is taught in addition to logistics as a key course element; however, universities of applied sciences mostly focus on logistics as their main programmed. That is, university programmers are adequate to fill high-level management positions, while graduates of universities of applied sciences mostly find work in middle management.

D. Stage 3: Competence

In the present dynamic economic climate, a logistician has to be equipped with a wide range of competences and skills, where skills cover general, content-independent knowledge, and competences refer to experience-based and content-dependent knowledge [13]. A logistician should have more than the ability to operate a warehouse [31]. The need for various competences depends on the various hierarchical levels of logisticians and on the other hand determines teaching methods accordingly. In the structure of the higher education system, designing university type or defining competence are long-term strategic activities. These activities are the key factor for the successful fulfilment of the goals of the higher education system [34].

Hildebrand and Roth (2008) [30] mapped out an overview which shows the interrelations between university types, hierarchical levels and methodological and professional requirements of a logistician (see Table II). The interrelations between competences and teaching methods will be presented in Table III.

TABLE II: METHODOLOGICAL AND PROFESSIONAL REQUIREMENTS [30]

University Type	Hierarchical Level	Methodological and professional requirements (examples)
University of applied science	Operative administration	Implementation of optimization potential, leading competences
	Middle management	Interface management, extensive knowledge of logistics networks and processes, ability to set up and operate a logistics system
University	High-level management	Holistic and integrative rationales, diagnostic and structural thinking, conceptual and generalizing abilities
	Academic level	Creativity, innovative ability, judgement, ability for future development

E. Stage 4: Teaching methods

Like the inputs of logistics higher education in the framework, teaching methods are best articulated by answering the questions, “what is the purpose of higher education?” and “what are the best ways of achieving these purposes?” In this stage, learners are one of the most important determinants of higher education quality, in which the interactions between teachers and learners play a big role. Nowadays there exist mainly the following teaching methods

in logistics higher education: lectures, case studies, individual and group projects, seminars, “guest” report, internships and excursions. Lectures are a common method at universities but are only adequate to impart expert knowledge and theoretical background. In addition to logistics know-how highly qualified logisticians have to be equipped with methodological, intercultural, analytical and social skills [24]. Hence educators are forced to teach in various ways in order to fulfil the purpose of higher education [34] [36]. Table III shows the interrelation between various teaching methods and the educated competences and skills.

TABLE III: TEACHING METHODS AND SKILL [1] [24] [34]

Teaching method	Learned skills and competences (examples)
Lecture	Expert knowledge, theoretical background
“Guest” lecture	Up-to-date practical knowledge and experience
Exercise	Applied knowledge
Individual and group projects	Self organization, teamwork, practical knowledge, social competence
Case studies	Decision-making ability, practice in identifying priorities, interdisciplinary skills
Seminar	Generating ideas, presentation skills, discussion skills, research skills
Internship	Social competence, practical knowledge and experience
Excursion	Practical knowledge and experience
Discussion	Skill of discussion, skill of communication

F. Stage 5: Quality Management

Against the background of shortage of capital, the constant increase in numbers of students, increased competition as well as the demand for transparency, internal and external evaluation in higher education is essential for quality control as well as a possibility to figure out where there is room for improvement. Thus, quality management reflects the goal of the framework, namely the dynamic and substantial improvement of the higher education system. Quality management is also the important link between educators and learners. Thus the feedback from the objective of higher education or learners guarantees the successful fulfilment of the goals and purposes of logistics higher education. Policy makers in higher education organizations have to foster a quality culture, which could identify problems in the higher education system dynamics, suggest solutions to those problems and implement those solutions [34].

Today there is a range of theories and models proposed to help higher education policy makers improve their quality systems, which include socio-political, organizational, pedagogical and business models. In the middle of the 1990s higher education institutions started to implement quality management according to the quality award of ISO in Europe and all over the world [21].

Specifically, evaluation in higher education has become a critical issue for academics, administrators and politicians in recent years [7]. In addition to this, evaluation should provide accountability. In Germany systematic evaluation in higher education has existed since the mid-1990s. In the meantime there are a couple of evaluation alliances in Germany which arrange multilevel methods for evaluation in higher

education [23].

G. Components of assessment

Performance assessment of a logistics higher education system is arguably the most significant of the factors affecting successful fulfilment of the goals for logistics higher education. Assessment is not a measurement but a process of judgement of learning outcomes [33]. It ought to provide feedback to improve the quality of education. The tasks of assessment have the power to reinforce the strategic goals of logistics higher education [6]. Overall, a quality programme in logistics higher education should be characterized by an assessment system that has: a holistic and systematic approach to the planning of education activities, application of knowledge in the logistics field through learning outcomes, and transparent expectations through a feedback mechanism [6][7].

The right-hand column of the strategic framework (see Fig. 1) is made as a means for continuous quality improvement of logistics higher education; it includes four components of assessment: input, logistics higher education activities, outcome and feedback. Specifically the feedback is a part of quality management, which is the important link between educators and learners and the interface for managing the education system and assessing the outcome of education performance.

V. CONCLUSIONS

The strategic framework of logistics higher education management in this study is based on logical framework analysis (LFA) and provides a summary of the interrelated logical stages and objectives of assessment for designing, assessing and improving a logistics higher education system.

The framework includes two columns, in which the logical thinking or information flow for decision-making support or assessments goes in opposite directions. According to a semi-systematic literature review, the left-hand column for improvement process has been categorized into five logical stages: demand for higher education, type of university, competence, teaching methods and quality management. As means for continuous quality improvement, the right-hand column covers four components of assessment: input, logistics higher education activities, outcome and feedback.

The structure of the strategic logistics higher education system in the framework shows the offering for logistics higher education could respond dynamically to the demand for education from the labour market. Thus it is explored that the dynamic response of demand for higher education from the labour market and the feedback from the learners are the most important determinants for successful fulfilment of the goal of higher education. Furthermore, the interrelations between the various stages for assessing and improving a dynamic and substantial logistics higher education system are explained. The framework can be of major interest to both educators and learners, it could also be a benchmark for logistics higher education in developing countries.

This paper is limited; it is the first attempt to provide a logical systematic framework of logistics education with a strong focus in Germany. Replication in countries should be undertaken to validate the framework in the future.

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