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**Incorporating Customer Requirements in Designing Academic Graduate Program: A Case of Using Quality Function Deployment**

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**Abstract**

Course design is an important component in the success of academic programs. Design and execution of the academic programs according to the industry lead to the career success of university graduates. This study narrates the process through which the academic program Master of Science in Supply Chain Management (MS-SCM) was designed by a university in Pakistan based on customer demands, considering prospective employers as customers. In order to convert customer requirements into program courses, the technique of “Quality Function Deployment” (QFD) was used. The “House of Quality” (HOQ) was used to translate the customer requirements into courses to be offered in the program. A small-scale survey of the managers involved in the recruitment of new graduates in their respective supply chain related departments from a variety of organizations was conducted in order to learn about the voice of customer. Based on the demands of the managers, courses with suitable content were identified that meet the requirements of potential employers. This study shows how by using QFD, providers of higher education can customize their academic programs to meet the requirements of the customers.

**Keywords:** total quality management, house of quality, quality function deployment, QFD, supply chain management, education, academic programs, graduate programs, curriculum, universities, Pakistan,

**1. Introduction**

The concept of supply chain management has evolved over the past few decades to become one of the most significant areas of managing businesses. This area of management covers many aspects of the business in order to satisfy the customer needs in an appropriate manner. In the past, companies concentrated on their own individual interests only and thus ignored other members of their supply chain, resulting in high supply chain costs and hostile relationships between the supply chain partners (Fisher, 1997). However, in recent times focus has shifted from individual firm’s objectives to

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the supply chain wide objectives, leading to improved integration with the suppliers, distributors, retailers, and other members of the supply chain (Basnet et al., 2003). This has resulted in maximizing the benefits and competitive advantage of the supply chains (Christopher & Towill, 2002). This shift of focus requires support from the academic institutions that prepare future graduates having skills and capabilities to achieve high performance standards in supply chains. Higher education should result in development of skills set that enables individuals to become effective problem solvers (Hwarng & Teo, 2001).

Course design is an important component in the success of academic programs. The design and execution of the academic programs according to the demand of the industry lead to the career success of graduates. This study is about the design of “Masters of Science in Supply Chain Management (MS-SCM)” program in a Pakistani university that conforms to customer requirements. Main theme of this study is to develop the curriculum with respect to the customer’s voice. For this purpose, the technique of Quality Function Deployment (QFD) is used. QFD facilitates the organizations in acting according to the “voice of the customers” (Hauser & Clausing, 1988).

QFD has a widespread use among the companies all over the world (Zhang et al., 2014). It has been applied to a wide variety of activities, e.g., team building, decision making, product design etc. (Wolniak & Şedek, 2009) and industries, e.g., construction, transportation, electronics etc. (Vinayak & Kodali, 2013). Researchers have argued in support of the benefits of QFD in designing user friendly products, time reduction in product development, and improvement in product reliability and overall quality (Sivasamy et al., 2015).

This study demonstrates the manner in which educational policy makers can customize the academic programs to the requirements of the employers by using QFD. The remaining paper is organized in the following manner. Next section presents review of the relevant literature. Literature review is followed by research methods in section 3 and house of quality related to MS-SCM in section 4. Section 5 provides discussion of the results and conclusion for the study. Section 6 concludes the paper by pointing out the limitations of the study and direction of future research.

## 2. Literature Review

### 2.1. Supply Chain Management

Today when businesses are going global, companies are in continuous process of evolution and adoption of technologies to have an edge over their competitors. Attaining cost effectiveness, increased reliability, and higher responsiveness are few of the major challenges that the organizations are facing (Spekman et al., 1998). This brings the phenomenon of supply chain management to the forefront of decision-making process. Supply chain management includes management of all activities that

add value from the supply of raw materials to the delivery of finished goods to the customers (Basnet et al., 2003). This concept also includes the rapid and responsive logistics service, effective supplier management, customer relationship management, and effective usage of information technology (Christopher & Towill, 2002).

## **2.2. Quality in Education**

Universities are always in need of creating and disseminating knowledge in the emerging disciplines of management. Supply chain management is becoming an important field in the current era. Universities now face the challenge to produce such graduates that will become the future leaders in this field. This raises the need to provide quality supply chain education to the students (Owlia & Aspinwall, 1996; Srikanthan & Dalrymple, 2003; Tsinidou et al., 2010). In order to move forward and attain quality in education, the concept of quality management must be applied in designing and delivering the curriculum of higher education (Jaraiedi & Ritz, 1994). Continuous quality improvement in academic institutions means exploring the needs and expectations of the customer base, including faculty, students, staff, future employers, and other stakeholders in the community (Cruickshank, 2003).

## **2.3. Quality Function Deployment**

In the past few decades, quality has evolved from the notion of mere inspection of the products to a comprehensive set of activities resulting in total customer satisfaction. Quality improvement tools include on-line techniques such as statistical process control, as well as off-line methods such as QFD (Temponi, 2005). The use of QFD started in 1970s when Japanese companies started using it to improve the design of their products. QFD coordinates skills within various functional departments of an organization. The first step is to design the product, the second is to manufacture it, and the final one is to market the product that customers are willing to purchase. The basis of the QFD is the notion that the products should be designed according to the customer demands, and an organization should not undermine the perceived quality of the customer in order to provide value (Liu et al., 2013). To achieve this goal of designing and making a product according to the customer requirements, all the functional departments must work closely. This process uses a series of matrices, commonly known as the “House of Quality” (HOQ), to study and analyze the relationships, the importance, and the trade-offs between various factors of customer requirements and product characteristics (Hauser & Clausing, 1988). The purpose is to translate customer requirements into activities that result in the development of products and services according to the customer requirements (Carnevalli & Miguel, 2008).

## **2.4. QFD in Service Industry**

Quality measures are as important to the services as they are to the manufactured products. However, the application of quality tools to services sector is more challenging due to lack of tangibility of services. Service process has to continue

regardless of the complaints from “unskilled customers” (e.g. students, patients) who are actually an integral part of the manufacturing (or delivery) process. In this regard service organizations can greatly benefit from tools and techniques that can help them in developing design and delivery systems for their services (Griffin, 1992). QFD is a useful tool for the service organizations that helps them in achieving this goal. It provides managers with tools that help them to design effective service strategies (Stuart & Tax, 1996). QFD contributes to the design of effective services resulting in higher competitiveness (Andronikidiset al., 2009). The table given below briefly describes the use of quality management tools in the education sector.

Table 1  
Use of Quality Tools & QFD in Education Sector

Authors	Research Findings
Liu et al.(2013)	Applied QFD to the design of industrial design curriculum
Mukaddes et al (2012)	Used QFD to translate the requirements of engineering school students into teaching methodologies
Temtime & Mmereki,(2011)	Used Kano model to guide and develop educational services by including the Voice of the Customer using QFD
Gonzalez et al.(2008)	Designed a supply chain management academic curriculum using QFD and benchmarking
Temponi,(2005)	Used the main elements of continuous improvement (CI) in higher education and discussed the concern of academia’s stakeholders in the implementation of this method
Aytac & Deniz,(2005)	Reviewed the curriculum of the “Tire Technology Department” at a vocational school using QFD
Duffuaa et al. (2003)	Suggested the use of QFD in designing courses and demonstrated its use in the designing of a basic statistics course
Lam & Zhao,(1998)	Used QFD for improving the quality of teaching in a university
Owlia & Aspinwall,(1996)	Studied the conceptual models proposed for different environments for consistency with higher education and presented a new framework for the dimensions of quality in higher education
Pitman et al.(1996)	Demonstrated how the QFD methodology can be used to measure customer satisfaction in educational institutions
Mazur,(1996)	Used quality function deployment for designing total quality management course

In this study, the most important customer requirements (Voice Of Customer) for supply chain management curriculum development are adopted from the study conducted by Gonzalez et al.(2008), who used QFD and benchmarking for designing supply chain management curriculum. They gathered information regarding customer expectations by conducting a survey of the managers involved in various functions of supply chain. A total number of 1595 customer requirements were gathered from this survey. The Dynamic Analysis Reduction Process (DARP) was used for reduction of this number. The DARP determined 29 variables/ expectations that related to supply chain management.

This study uses future employers as the primary customers of the graduate program in supply chain management. Many previous studies have used employers as the customers of universities (e.g. Aytac & Deniz, 2005; Duffuaa et al., 2003; Gonzalez et al., 2008; Mazur, 1996). Potential employers know what combination of skills and knowledge will best equip the graduates for the world of work and are appropriate for providing the voice of customer in QFD analysis.

### **3. Research Methodology**

This study uses QFD as a methodology for synchronizing customer requirements with the program design. In terms of methodology, QFD is applied through a set of matrices called the House of Quality (HOQ) (Andronikidis et al., 2009). Typical structure for HOQ consists of four matrices. These matrices translate customer requirements into design characteristics House 1: design characteristics into specific components, House 2: specific components into production process, House 3: production process into quality plan, House 4:(Heizer & Render, 2008). This structure is modified into 2-3 matrix structure for services (Andronikidis et al., 2009; Ermer & Kniper, 1998). The first incorporates the customer perspective while the remaining two matrices help in identification of critical service measures, design characteristics, and quality plan (Ermer & Kniper, 1998). This study presents the HOQ that is first matrix for the design of MS-SCM program. Information on customer expectations was collected from potential employers. A questionnaire was distributed among managers of various organizations working in the areas of supply chain management. The respondents were supply chain managers, purchasing managers, plant managers, warehouse managers, and logistics managers. Information was collected regarding the relative importance of the 26 customer requirements adopted from Gonzalez et al.(2008). From these questionnaires, managers highlighted the skills that were important for performing the job in supply chain department effectively. The questionnaire consisted of three sections; the first section consisted of 26 questions related to customer expectations, the respondents had to convey the degree of importance for each skill. The second section was an open-ended question for the respondents that asked them to mention if they expected any other skills from the executives working in the field of supply chain. The last section consisted of the

personal information of the respondent. After the collection of data, the research team thoroughly evaluated the supply chain program and customer expectations and constructed HOQ for designing MS-SCM program shown in Figure 1. Following section explains the construction of HOQ in detail.

#### 4. House of Quality for MS-SCM

This study uses HOQ to translate customer/employer requirements into the courses of the program. The study identifies potential employers as the institution's primary customers. The institution's objective was to design a quality MS-SCM program in order to satisfy the requirements of its customers. This motivated the researchers to use the HOQ to develop internal measures for quality and excellence in specific and identified area, and redesign the MS-SCM program.

Figure 1 shows the HOQ for MS-SCM program. The first column on the left side of the HOQ shows the customer requirements. The column next to the customer requirements demonstrates rating (average) given by the potential employers to each critical variable. The row on the top is the list of the courses currently offered by the university in MS-SCM program. The central part of the HOQ depicts the strength of relationship (Strong, Moderate, Weak) between customer requirements and the courses offered by the university. The last column on the extreme right is weighted average calculated using the formula (Importance Average  $\times$  Sum of all the relationship strength) for example for Production and operation Knowledge  $[4.59 \times (9 + 9 + 9 + 1 + 1)] = 152$  where the numeric scores for relationship strengths are assigned as: Strong = 9, Moderate = 3, Weak = 1. The row on the bottom of HOQ is the accumulated importance of the courses offered by the university. This is calculated by (Sum of all the relationship strengths) i.e. for Managing Supply Chains  $(9 + 9 + 9 + 1 + 1 + 9 + 1 + 1 + 3 + 9 + 9 + 3 + 3 + 3 + 9 + 3 + 3) = 85$  where the (Strong = 9, Moderate = 3, Weak = 1). The roof of the HOQ shows the internal relationship between the different courses. This highlights the highly correlated courses.

After the detailed discussion/analysis on the relationship between the critical variables and the courses, the researchers found that the courses in Managing Supply Chains (85), Production Planning and inventory Control (93), Purchasing and Sourcing (60) and Supply Chain Strategies (63) are the most important courses offered in the MS-SCM program. These courses cover critical skills rated highly by the employers. These four courses are the backbone of this program. Whereas Strategic Distribution Network (50), Supply Chain modeling (49) and Forecasting in Supply Chain (49) have a moderate value. Supply chain Finance (28), Enterprise Resource planning (31), Logistics Management (32), Customer Relationship Management (32), Project management (36) and Thesis (32) have a weak relationship with the skills identified by the employers.

Data also showed that future employers have expectations that their employees should have knowledge about the following areas; Knowledge of Regional/ Local supply chain (4.68), Supply chain management knowledge (4.64), Production and Operation Knowledge (4.59), Forecasting skills (4.59), Inventory management skills (4.50), Supplier relation knowledge (4.45), Logistics knowledge (4.41) and Procurement knowledge (4.36). Completed HOQ is shown in Figure 1. Table 2 shows the potential employers rating and the weighted average of the courses currently offered in the MS-SCM program. The two most important aspects i.e. employee’s knowledge of regional/ local supply chain and Supply chain management are well covered by the current MS program. The current program is also covering the other skills provided in table 2.

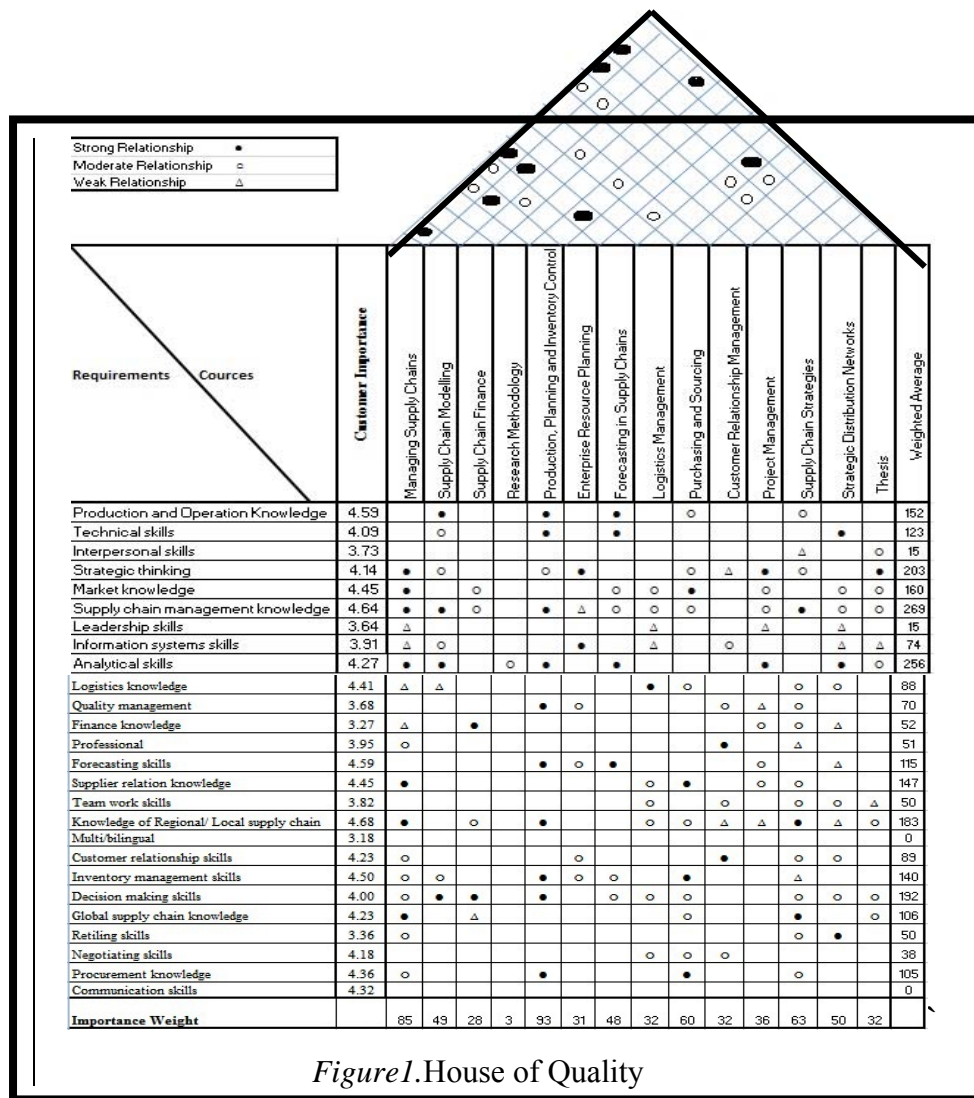


Figure 1. House of Quality



Table 2  
Customer Importance Ratings

Courses	Customer Importance Rating	Weighted Average
Knowledge of Regional/ Local supply chain	4.68	183
Supply chain management knowledge	4.64	269
Production and Operation Knowledge	4.59	152
Forecasting skills	4.59	115
Inventory management skills	4.50	140
Supplier relation knowledge	4.45	147
Logistics knowledge	4.41	88
Procurement knowledge	4.36	105

After the detailed discussion/analysis on the relationship between the critical skills and courses, data collected from the potential employers provided evidence about many skills that are marginally important or not important at all. These include; Communication skills (0), Multilingual (0), Leadership Skills (15), Inter-personal Skills (15) and Negotiation Skills (38). Table 3 shows the customer rating and the weighted average of the weak areas.

Table 3  
Customer Requirements

Customer Requirement	Customer Importance Rating	Weighted Average
Communication skills	4.32	0
Negotiating Skills	4.18	38
Inter personal Skills	3.73	15
Leadership Skills	3.64	15
Multilingual	3.18	0

None of the other universities in this particular region is offering MS-SCM program, therefore comparative analysis for competitors could not be done in this study.

### 5. Discussion and Conclusion

This research is an important contribution as it suggests a mechanism for designing academic programs in accordance with the customer expectations. The requirements of potential employers can be incorporated in the program at the early

design stage. This study translates the customer expectations that are known as “What’s” in the QFD terms into “How’s” through the use of HOQ. This study indicates many action plans to satisfy the customer expectations regarding supply chain graduates. Based on the results, the study proposes that university should offer the MS-SCM program with two options; thesis and non-thesis. This is based on low rating for “Research Methodology” course, which is mandatory only because it prepares the participants for thesis. Students with work experience in the industry and intention to continue working as practitioners can opt for non-thesis option with no requirement of course in Research Methodology. On the other hand, students with interest in research and future plans to be in academia can opt for the thesis option, which will require them to take the course in Research Methodology.

There is also a need to increase the course content related to the knowledge of regional/ local supply chains although the existing program is already covering it; it needs to be strengthened for enhanced customer satisfaction as it is on the top priority of potential employers. The revised MS-SCM program should accommodate the course content related to Forecasting skills, Logistics knowledge and Procurement knowledge. These three expectations are in the top eight important expectations hence the content related to these expectations will be divided into different courses in an overall mission to delight the customers by the new MS-SCM program.

The new MS-SCM program must focus on the soft skills needed in the industry. The present program is very weak in polishing the soft skills of the students like communication skills, multilingual (foreign languages), leadership skills, interpersonal skills, and negotiation skills. The study suggests a new course by the name “Skills and Personality Development” that will include the content related to the soft skills. This new course of Skills and Personality Development can replace the course of Research Methodology, for the students opting for Non-Thesis option.

University should devise a mechanism to evaluate customer expectations periodically in order to deal with the ever-changing business environment. As discussed earlier, there is no other institution in the region currently offering MS-SCM program. Therefore, improvement in this program will provide the case university a significant competitive advantage. Revised MS-SCM program will be better aligned with the customer requirements and will strengthen the position of graduates in the corporate sector.

## 6. Limitations and Future Research

This research study has some limitations. The study uses only the employers as the voice of customers. Further studies may include the voice of other stakeholders such as students, their parents, faculty, etc. as pointed out by Cruickshank (2003). Another limitation of this study is that it is confined to the construction of the first house of quality in the application of QFD in designing the MS-SCM program. Future studies

may extend this to include construction of other HOQs to make the application of QFD more comprehensive and hence further increase its effectiveness.

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