



# Designing a supply chain management academic curriculum using QFD and benchmarking

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## Abstract

**Purpose** – The purpose of this paper is to utilize quality function deployment (QFD), Benchmarking analyses and other innovative quality tools to develop a new customer-centered undergraduate curriculum in supply chain management (SCM).

**Design/methodology/approach** – The researchers used potential employers as the source for data collection. Then, they used QFD and benchmarking to develop a Voice of Customer matrix. Using information from the matrix, a new customer-oriented SCM undergraduate programme was designed.

**Findings** – The researchers outline a practical solution to the problem of designing academic programmes which satisfy the main expectations of potential employers (customers).

**Research limitations/implications** – The study is specifically concerned with the design of an SCM curriculum, but the researchers argue that the design methodology could be applied in other academic contexts.

**Practical implications** – The application of QFD and benchmarking as a joint analysis tool is an interesting approach in education because the information is analysed from different perspectives simultaneously. The new programme successfully meets customer/employer expectations and requirements.

**Originality/value** – This study demonstrates the effective application of quality design tools to enhance academic programmes. The approach can clearly be extended to other areas for the design of specific courses and programmes. The most important needs in programme design are those of identifying the programme's main customers and of clarifying their expectations.

**Keywords** Quality, Customers, Higher education, Quality function deployment, Benchmarking, Supply chain management

**Paper type** Research paper

## Introduction

Over the last 12 years, the concept of logistics management has been developed within a broader discipline of supply chain management. This new field involves all approaches used to efficiently integrate all participants of a supply chain so that products/services are delivered to the customer in the right quantities, to the right location, at the right time, and at optimal cost (Gonzalez *et al.*, 2004). Scholars, along with practitioners, are continuously developing philosophies and tools to overcome the risks inherent in the current changing environment. The evolution of this concept is driven by the competitive global market place, where providing very high levels of efficiency and customer service are prerequisites to success (Rutner and Fawcett, 2005).



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A few decades ago, total quality management arose as a philosophy that proposed the integration of functional areas in the organization for a common goal: customer satisfaction (Quesada, 1999). Firms started to think about their suppliers as strategic partners and began involving them in the strategic planning process (Ellram and Carr, 1994). Just a few years ago, both academic and practitioner communities were shifting paradigms regarding supply chain management. After years of viewing the organization as a single firm, they increasingly view them as one member of a network of suppliers and customers, comprising a supply chain (Leenders *et al.*, 1994; Harland, 1996; Choon *et al.*, 2002). However, this paradigm shift must be supported by the academic institutions that must prepare those future leaders who will eventually have the responsibility for achieving higher standards in supply chain issues in both the services and manufacturing areas. Therefore, it is the purpose of this research to determine the customer expectations and needs such that supply chain management academic programme can be developed to satisfy them.

In order to design an undergraduate academic programme in the area of supply chain management the authors consider the principles of total quality management (TQM). The major tool employed is Quality Function Deployment (QFD). QFD has found widespread acceptance in USA industry as an effective tool to translate customer expectations into product or service features. In this approach, several steps are followed to expose customer expectations into the service process and ensure that at each level of expectation the highest possible quality is provided. QFD is simply a planning tool; it begins with market research that identifies just what customers like, information hereafter referred to as “Voice of the Customer” (VOC). It is through the QFD process that the VOC is translated into system requirements (operational requirements). Since QFD is a relatively new process, almost all applications have been in industry or manufacturing. In this article, QFD principles will be applied to study undergraduate education. A discussion of the methodology and principles of QFD may be found in Hauser and Clausing (1988); Gonzalez *et al.* (2004); Akao and Mazur (2003); Gonzalez *et al.* (2005).

This paper contributes to the literature by showing the innovative use of total quality management tools such as Quality Function Deployment (QFD)/Benchmarking and Customer Windows Quadrant (CWQ). The authors show how these tools can be used to incorporate customer expectations into the development of an academic programme. Also they present an analysis of considerations to be used in the implementation of an undergraduate academic programme in supply chain management. The authors begin with a review of the theoretical framework of the paper and then identify customer expectations and the deployment of alternatives for satisfying these expectations. The data received from potential employers indicate they have unique requirements that are not being satisfied by existing undergraduate programmes in supply chain management. The research objectives are twofold, namely:

- (1) to develop a methodology for the design of a customer-focused undergraduate academic program in supply chain management using Quality Function Deployment (QFD); and
- (2) to define a customer-based improvement strategy based on the critical elements identified by quality analyses.

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### Literature review

Previous studies in academic or practitioner literature (Adkins and Radtke, 2004; Clayson and Haley, 2005; Lynne and Brennan, 2007; Hwang and Teo, 2001) and surveys with professionals, students (graduate and undergraduate) and potential employers have indicated that higher education programmes have several problems: First, these programmes tend to emphasize theoretical models that are hard for students to apply as real decision making tools. Next, schools fail to understand real-life problems and incorporate them into supply chain curricula. Finally, oral and written communication skills are not adequately covered; institutions of higher education can develop academic programmes that resolve these, as well as other customer expectations.

#### *Quality function deployment*

Quality function deployment (QFD) was developed in Japan during the 1960s by Akao (1972) as a method for incorporating consumers' demands into product development. Akao and Mazur (2003) defined QFD as a method for defining design qualities that are in keeping with customer expectations and then translating those customer expectations into design targets and critical quality assurance points that can be used throughout the production/service development phase. QFD is a widely used systematic process utilized by cross-functional teams to identify and resolve issues arising from the provision of products, processes, services, and strategies intended to enhance customer satisfaction Gonzalez *et al.* (2003). By employing QFD, manufacturers and service providers are able to translate customer expectations into measurable quality characteristics and create products and services which satisfy those requirements Hauser and Clausing (1988). Quality function deployment (QFD) is a methodology for the development or deployment of features, attributes, or functions that give a product or service high quality. QFD can be very helpful in answering the question "how to deliver quality products and services based on the needs of customers, or the voices of customers?" (Hwang and Teo, 2001). The two fundamental purposes of QFD are:

- (1) to improve the communication of customer expectations throughout the organization; and
- (2) to improve the completeness of specifications and to make them traceable directly to customer expectations and needs (González, 2001).

Several researchers have applied QFD to different service areas (Jeong and Oh, 1998; Trappey *et al.*, 1996; Stuart and Tax, 1996; Cadogan *et al.*, 1999; Pun *et al.*, 2000; Peters, 1988; Gonzalez *et al.*, 2003, 2005). Since the early 1990s, there have been a number of QFD applications in the education area, as can be seen in Table I. From these, the most related to this paper are: one case for an undergraduate statistics course (Duffuaa *et al.* 2003) and another one for the development of courses in higher education (Hwang and Teo, 2001). However, it was originally used in product development and design. Griffin *et al.* (1995) have considered that QFD provides a means of communication among product life cycle stages. Benefits which arise from these and other reported QFD applications include lower design and service costs, fewer and earlier design changes, reduced product development time, fewer start-up problems, better company performance, more reliable input for marketing strategies, improved service quality

Author	Research Findings
Clayton (1993)	Used QFD coupled with process analysis to provide cost-effective, high-quality lifelong learning for optometrists-to-be at Aston University
Jaraiedi and Ritz (1994)	Applied QFD to explore ways to improve advising and teaching processes at West Virginia University
Lam and Zhao (1998)	Use QFD matrix to evaluate the effectiveness of teaching at the Department of Management Science at the City University of Hong Kong
Motwani <i>et al.</i> (1996)	Use the three-house approach using American Assembly of Collegiate Schools of Business (AACSB) accreditation requirements as key considerations for designing the MBA programme at Grand Valley State University
Pitman <i>et al.</i> (1995)	Used QFD to evaluate their MBA programme by measuring customer satisfaction
Köksal and Alpay (1998)	Used QFD principles and software to prioritize their planning objectives for developing engineering laboratories at the University of Missouri-Rolla
Köksal and Alpay (1998)	Used QFD in conjunction with AHP to identify general design requirements for the Industrial Engineering programme at the Middle East Technical University
Krishnan and Houshmand (1993)	Used QFD to address customer expectations in the design of engineering curricula at the University of Cincinnati
Owlia and Aspinwall (1998)	Used QFD principles to identify broad categories of processes relevant to quality characteristics
Seow and Moody (1996)	Used the VOC to improve the curriculum development process at the University of Portsmouth
Chen and Bullington (1993)	Applied QFD in research strategic planning
Chang and Ku (1995)	Used QFD principles to highlight potential improvements to the engineering and technical education in Taiwan
Ermer (1995)	Analyzed the design requirements needed to satisfy each group of customers at the Department of Mechanical Engineering, University of Wisconsin-Madison
Rosenkrantz (1996)	Developed a curriculum in manufacturing using TQM tools
Murgatroyd (1993)	Application of QFD in Distance Learning Education
Ayşe and Veli (2005)	The curriculum of the Tyre Technology Department at the Kocaeli University Köseköy Vocational School of Higher Education (KU-KVSHE) has been reviewed by using the quality function deployment (QFD) technique
Akao <i>et al.</i> (1996)	QFD application in the improvement of higher education

**Table I.**  
Literature review in QFD applications for higher education

and, above all, increased customer satisfaction (Jae *et al.*, 1998; Franceschini and Rossetto, 1995).

The researchers, however, found a lack of quantitative tools that could add reliability and efficiency to the gathering of customer expectations and their subsequent translation into the critical elements of an academic institution, mainly in the higher education field. Furthermore, in 100 percent of the current higher education cases, the customers are students (graduate or undergraduate) yet all the academic programmes are based on the faculty experience. As stated before, in the current study the “customers” will be the potential employers, not the students. Using QFD

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methodology, the final processes/methods will produce the service that meets the original customer expectations (employers' expectations).

### *Benchmarking*

Benchmarking is a continuous quality improvement process by which an organization can assess its internal strengths and weaknesses, evaluate comparative advantages of leading competitors, identify best practices of industry functional leaders, and incorporate these findings into a strategic action plan geared to gain a position of superiority (Hokey *et al.*, 1997). Benchmarking can be defined as a process of comparison of some measure of actual performance against a reference or benchmark performance. There are three main aspects to the performance of a company: efficiency, productivity and quality. Benchmark results are used to identify, quantify and prioritize improvement opportunities offering the greatest potential return, while highlighting areas at risk due to under-spending. The end result is a factual basis and context for creating a business plan to drive change (Hokey *et al.*, 1997). Benchmarking may be a one-off event, but is often treated as a continuous process in which companies continually seek to challenge their practices

Benchmarking has two distinctive approaches: competitive benchmarking and process benchmarking. According to the American Productivity and Quality Centre, competitive benchmarking aims to measure organizational performance relative to the performance of competing organizations and consists of an ordered sequence of steps, (Hokey *et al.*, 1997) Benchmarking is not complicated but it does seem initially difficult for organizations to learn from others and complete exercises successfully in order to deliver measurable improvements. Based on the researcher's experience, often the difficulties seem to have less to do with the technique of benchmarking than the pressures the organization and individuals are experiencing and their lack of a coherent plan for integrating change management.

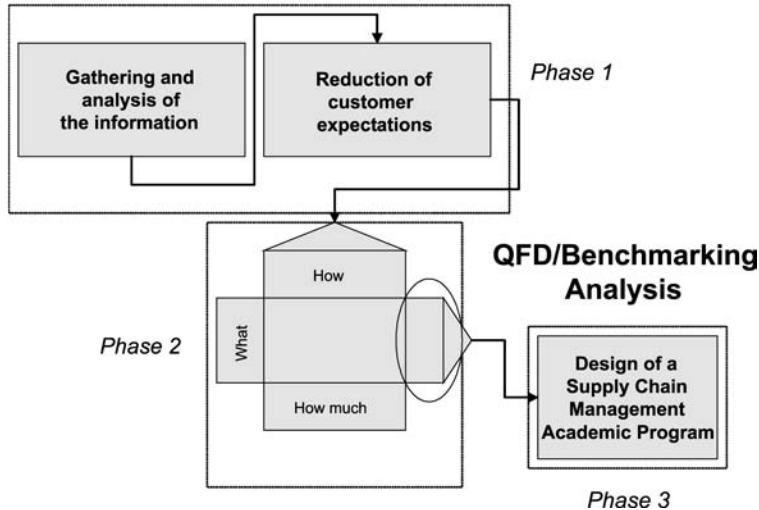
Additionally, benchmarking facilitates strategic planning, providing a clearer focus for setting strategic company goals. While competitor benchmarking encourages an external focus, many authors (Rogers, 1993; Andersen and Camp, 1995; Whymark, 1998; Woodburn, 1999) emphasize the particular benefits of generic benchmarking in focusing on strategic company goals and thus increasing competitiveness.

The shift in emphasis from comparison of direct competitor performance measures to one of learning about best practices and identifying what can be achieved (Rogers, 1993; Andersen and Camp, 1995; Whymark, 1998; Woodburn, 1999) has further enhanced the role of benchmarking in achieving sustainable competitive advantage and superior performance. Furthermore, Porter (1994) recognized the stimulus for change generated by benchmarking activities and the potential gains possible for all stakeholder groups, while Schmidt (1992) examined the link between benchmarking and an increase in shareholder value.

We used benchmarking in our paper to compare the new program obtained in the QFD process with the top programs in supply chain management according to Rutner and Fawcett (2005) and to analyze the competitiveness of in today's academic market.

### **Research methodology**

The general method proposed for the design of a supply chain management academic curriculum using QFD and Benchmarking is depicted in Figure 1. The road map for



**Figure 1.**  
Road map in the design of  
a supply chain  
management academic  
curriculum using QFD and  
benchmarking

developing the supply chain management academic curriculum (the authors call this process the development of academic strategy) is composed of three different phases. Phase 1 includes the procedure that the research group used to collect the initial information on customers expectations. Phase 2 includes the QFD and Benchmarking construction in the Voice of Customer matrix. In this phase the research group developed the planning matrix of QFD that was used as a base for the formulation of the academic program under study. Phase 3, is the development of the academic program at the College of Charleston and includes the critical parts and action plans matrices. Each of these phases is explained in detail below.

#### *Phase 1: gathering and analysis of the information*

In this phase the researchers collected and analyzed the customer expectations from potential employers. In order to obtain these customer expectations, a questionnaire was distributed among a selected group of companies that hire professionals in the area of supply chain management and logistics. The researchers used the database of the Institute for Supply Management (ISM) for this initial sample. In addition, they used interviews with purchasing managers, plant managers and logistics managers (the research group named them as informants). Multiple informants at each plant reported their perceptions on the degree of knowledge and experience of future professionals in the area of supply chain management.

The questionnaire was structured in 3 sections (general information, customer expectations, and benchmarking questions). It is important to emphasize that potential customers are companies that hire professionals in the area under study. There is considerable debate in the literature regarding customers in higher education, the perspective of this research can be different from studies that consider students as customers (Lynne and Brennan, 2007; Clayson and Haley, 2005; Bennett, 2003; Adkins and Radtke, 2004). From the results, demographic analyses can be done in order to

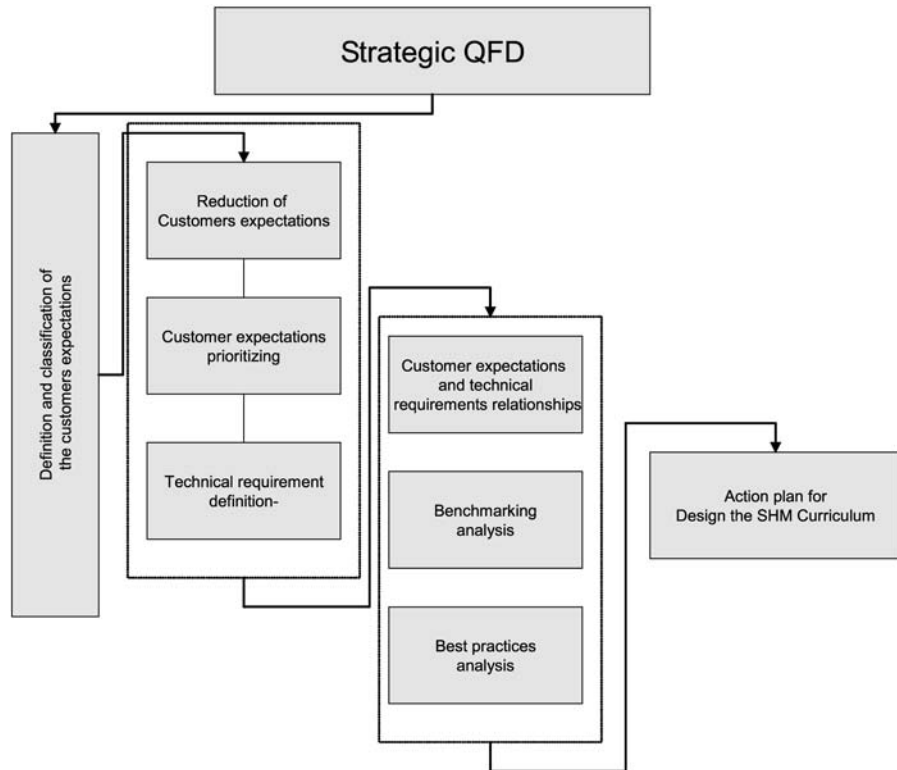
understand better the population under study and future trends and needs in the area of supply chain management.

The data collection resulted in 1596 customer expectations that were categorized and summarized in order to include the most influential and critical in the QFD matrix. Statistical analyses, such as dynamic analysis and factor analysis, were performed in order to classify, reduce and rank these customer expectations. The outcome of this process was the grouping of customer expectations into common customer requirement categories. Using the Customer Window Quadrant (CWQ), customer expectations were summarized and categorized in order of importance, with the final selection done using the results obtained in the CWQ.

*Phase 2: QFD and benchmarking analysis*

When all the customer expectations were defined and categorized, the final number of customer expectations analyzed in this study was 25, after the reduction process. QFD and benchmarking analyses were applied. As can be seen in Figure 2, the research group designed a method using the basic procedure of the QFD.

The conventional four-matrices of the QFD method designed for manufacturing companies (Hauser and Clausing, 1988) was modified slightly so that it could be applied to the academic program design. Specifically, the four-matrix method was



**Figure 2.**  
Strategic QFD

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transformed into a three-matrix action-based method (Gonzalez *et al.*, 2005). These three matrices included

- (1) house of quality (planning matrix);
- (2) critical parts matrix; and
- (3) action plans matrix.

Conventional terms also had to be modified to apply the methodology to the design.

*Matrix I: developing the planning matrix.* This step is known as the “House of Quality”. Activities in this step include the following:

- identifying the customers;
- identifying customer expectations and their importance;
- analyzing customer expectations (What);
- identifying current methods and processes (How or academic requirements);
- ranking academic requirements; and
- establishing correlations between customer and academic requirements to finally develop and analyze the House of Quality (HOQ) (Gonzalez *et al.*, 2004).

The other two matrixes are part of the problem solution and are explained in the next section.

### *Phase 3: design of an academic program in supply chain management*

This phase is divided in the two final steps of the QFD methodology: the development and analysis of the final academic program in supply chain management.

*Matrix II: developing of critical parts matrix.* This step corresponds to planning the design of a supply chain management academic curriculum using the links between the academic requirements identified in Step I to operational elements (this information came from the survey applied to faculty members of 18 supply chain academic programs in USA).

*Matrix III: action plans matrix.* In this step, an action plan is developed based on the information obtained in the previous two steps. The final action plan consists of the supply chain management academic curriculum. In this phase, multiple factors are considered based on the information collected in the previous phases. These factors include the academic program’s organizational structure, technology requirements, and marketing strategy for motivating the customers to support the academic program.

## **Results**

### *Designing an academic program in supply chain management; a study case*

To illustrate the methodology, results from the study of the proposed supply chain management undergraduate program at the College of Charleston (CofC) were used. The program is still under design, so all the findings obtained from this study will be used to shape the final undergraduate business major in supply chain management at the College of Charleston.



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The application of QFD and benchmarking enabled the researchers to translate research findings into actionable strategies. In the next section the authors explain each of those strategies in detail.

*Developing a planning matrix*

*Identifying the customers.* In a broad sense, the student is the product of any academic process that will serve the needs of the companies that will hire them. Therefore, there is no doubt that the customer of any academic institution is the companies that will hire their graduates, not the students; the latter are the products or outcomes of the academic processes at the institutions. With this in mind, the researchers will continue using the word “customer” for the companies and “products” for the students in academic institutions.

*Identifying customers’ requirements and importance.* The first step in applying QFD methodology is to generate the customer’s expectations. In order to generate this important information the research group consulted secondary data. Using the job descriptions and requirements for open positions in supply chain management and logistics, a set of 1,595 expectations were generated. More than 350 position requests were analyzed in this process.

The first reduction tool applied in this study was Dynamic Analysis Reduction Process (DARP) (Gonzalez *et al.*, 2003; Forrester, 1961) DARP is a tool used for reducing the number of variables; this technique considers the interrelationship among variables, and groups’ similar variables using the direct and indirect influence in the main variable. For this study, the main variable is customer supply chain management program. DARP determined that 1,202 indirect variables are related with only 29 variables or expectations that are related directly with the main variable. Using DARP allows a better understanding of the complexity in the relationships among variables; the application of DARP reduces the number of items by only 24 percent. The results of this analysis can be seen in Table II.

The original customers’ requirements (1,595) were grouped into 393 customer expectations (direct variables) using the DARP. After all the correlations were done, the research group separated the total number of customer expectations (1,595) into two groups. Group 1 contains the indirect variables (customer expectations) that are related indirectly with the main purpose of the project. Group 2 are the direct variables (393) and are those variables that affect directly the composition of the new academic program under study. Using the basic concepts of dynamic analysis, we selected the direct variables for next steps. According to dynamic analysis theory (Gonzalez *et al.*, 2003; Forrester, 1961) if we satisfy the direct problems, all the other indirect variables will be satisfied. Dynamic analysis examines the relationship among variables and reduces the number of variables that are related, obtaining only those that have a critical influence on the main problem. However, further data reduction will be needed for building the final house of quality. In order to further reduce the number of items, factor analysis (Varimax rotation) was used. Factor analysis was conducted to study in more detail expectations inter-relationships and to determine empirically their underlying structure. To conduct the factor analysis, given only 395 subjects (customer expectations), the researchers separated the quantitative from the qualitative expectations and analyzed each separately. Furthermore, 25 items with the lowest item-to-total correlations were deleted.

Customer expectation	Dynamic analysis results			Code
	Direct	Indirect	Total	
Production and operations knowledge	21	142	163	POMK
Technical aptitude	48	56	104	TA
Management skill	12	69	81	MSK
Business strategy skills	11	69	80	BSSK
Market knowledge	27	45	72	MK
Supply chain management knowledge	11	59	70	SCHMK
Leadership skills	14	55	69	LSK
Information systems skills	10	58	68	ISSK
Analysis skills	10	57	67	ASK
Logistics knowledge	15	49	64	LK
Quality engineering	26	35	61	QE
Financial knowledge	20	33	53	FK
Certification	22	31	53	CE
Forecasting skills	9	43	52	FSK
Supplier relations knowledge	13	38	51	SRK
Team work skills	17	31	48	TWSK
Knowledge of Asian supply	16	32	48	KAS
Purchasing knowledge	6	35	41	PK
Multi-bilingual	12	29	41	TO
Customer satisfaction knowledge	7	29	36	CSK
Customer relationship skills	11	23	34	CRSK
Inventory skills and knowledge	11	22	33	ISKK
Decision making skills	6	26	32	DSSK
Global knowledge	10	22	32	GK
Vendor relationship	6	26	32	VRK
Retailing skills	3	27	30	RSK
Negotiating skills	9	19	28	NESK
Procurement knowledge	4	24	28	PK
Communication skills	6	18	24	CSK
Total	393	1,202	1,595	

**Note:** Indirect customer expectations are the original ones (coming from the initial screen of expectations)

**Table II.**  
DARP results

Using this set of 370 items, and the criterion to retain factors with values greater than 1.0, six customer expectations factors were identified that explained 52 percent of the variance. Keeping in mind that one of the goals at this stage was to reduce the number of items further, we systematically deleted items that loaded ambiguously (factor loadings greater than 0.45 on more than one factor). Several iterations of analyses were conducted until a stable and interpretable set of results was obtained.

The output from the factor analysis shows 49 customer expectations remaining for further analyses. The process continues to cycle until the people involved in the project are satisfied with the results. Through these processes, individual customer expectations are grouped into common customer requirement categories. Before this can happen, however, further data reduction is normally needed. A new survey was released to ISM members in order to evaluate and prioritize for the final 49 expectations obtained from the previous analysis. After the evaluation of the new

results, the research group analyzed the results and used the Customer Window Quadrant technique designed by Intel, 2002 to categorize the final 48 expectations.

The CWQ is an analytical quality tool designed to cluster and classify customer expectations based both on the level of importance and the level of satisfaction of each expectation from the customer's perspective Gonzalez *et al.*, 2005. There are four quadrants whose characteristics and guidelines as can be seen in Figure 3 and are described as follows:

- (1) *Quadrant A.* The customer wants it but does not get it. Rated as High Importance/Low Satisfaction, this is the critical quadrant. All customer expectations placed here require immediate action. Universities must set up an action plan to move the critical ones to quadrant B as soon as possible.
- (2) *Quadrant B.* The customer wants it and gets it. Rated as High Importance/High Satisfaction, this is the most desired quadrant. All important and critical customer expectations should be here and stay here. Universities must improve and monitor all quality characteristics placed here.
- (3) *Quadrant C.* The customer does not want it and does not get it. Rated as Low Importance/Low Satisfaction, items in this quadrant are of the lowest importance and should not be the focus for now. Institutions should not take any action unless there are changes in the market, service strategy or customer expectations.
- (4) *Quadrant D.* The customer does not want it but gets it anyway. Rated as Low Importance/High Satisfaction items found here are not needed and possibly costly. Action should be taken to remove these items if the customer requirement being offered is expensive or represents any other type of risk to the university. If the quality characteristic placed here is eliminated or reduced, perhaps the customer will not notice it.

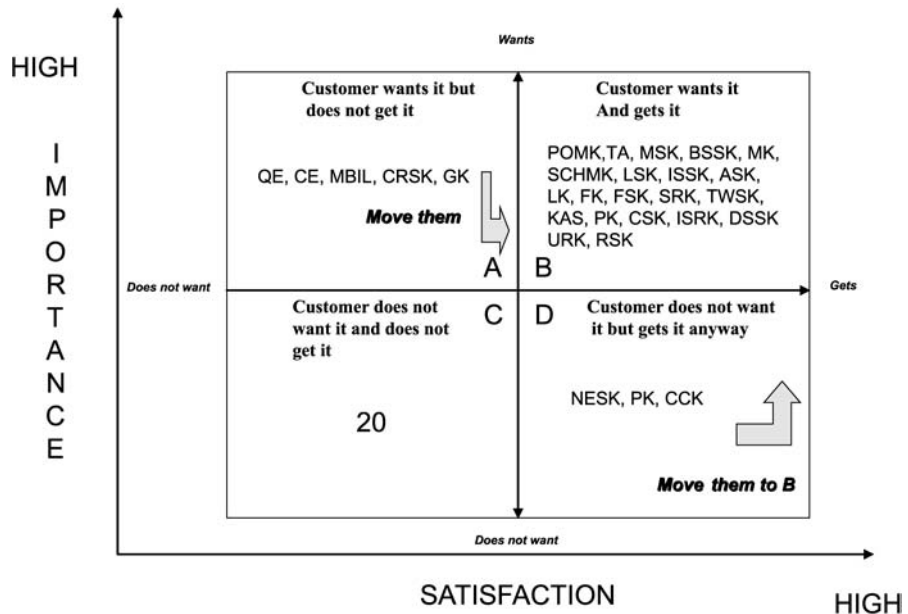


Figure 3.  
Customer windows  
quadrant

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The results of the application of the CWQ showed the following clustering based on customer weighting as described in the process-planning matrix mentioned above, namely:

- Quadrant A: five customer expectations were placed here. An action plan should be set up to describe how to move these customer expectations to quadrant B. According to the results, companies need people with knowledge of other cultures, especially Asian. In addition, the knowledge and practice of additional languages is also important. Clearly, a key finding of this research is that multicultural knowledge is essential for professionals in the area of supply chain management.
- Quadrant B: 21 customer expectations were placed here. A special plan should be formulated to maintain, improve and monitor these customer expectations.

In addition, three customer expectations were classified under quadrants C and 20 under quadrant D; however, only those considered as critical were shown on quadrants A and B. On the other hand, the expectations in quadrant D could be move to quadrant B in order to expand and satisfy the maximum amount of expectations.

The final number of customer expectations analyzed in this study was 29 (after all the process reduction).

*Analyzing the customer expectations (What's).* In this section of the curriculum planning stage, in order to setup the Voice of Customer matrix, information coming from different sources were used:

- potential employers prioritized customer expectations in a survey;
- research team rigorously evaluated the supply chain programs of the selected comparable competitors and assigned evaluations of each customer expectation, a degree of fulfilment; and finally
- research team set target goals for the School of Business and Economics at the College of Charleston (CofC) in all customer expectations.

Table III shows summary results of a survey applied to 65 practitioners and potential employers in the area under study. It is important to mention that the researchers sent the questionnaire using e-mail addresses to 75 potential customers (employers) and received in return, 65 usable questionnaires (90 percent response). From this Table, 14 customers' expectations are ranked as critical for future professionals in the area. An interesting finding was that the expectation about knowledge of both Asian and global markets were ranked as the most important skills that future professionals need to develop, factors that need to be considered seriously in the final academic program. From this survey, it was possible to establish that expectations for potential employers can be categorized in five defined areas: Management, Decisions Sciences, Supply Chain Management, Information Systems and Marketing.

In Table IV, there is a column that evaluates the level of importance of each customer expectation (obtained directly from customer surveys). Additionally, there is a column that evaluates the overall importance. Overall importance not only considers the customer's level of importance, but also the necessary degree of improvement for the CofC to fulfil the expectations (improvement ratio) and the qualification of the requirement as sales point (is this requirement prominent in the academic program to

QAE  
16,1

48

Customer expectations	Code	Average
Communication skills	CSK	4.46
Knowledge of Asian supply	KAS	4.42
Decision making skills	DSSK	4.39
Team work skills	TSWK	4.30
Logistics knowledge	LK	4.29
Market knowledge	MK	4.28
Multi-bilingual	TO	4.26
Customer relationship skills	CRSK	4.23
Analysis skills	ASK	4.20
Certification	CE	4.18
Business strategy skills	BSSK	4.13
Technical aptitude	TA	4.12
Supply chain management knowledge	SCHMK	4.11
Purchasing knowledge	PK	4.09
Customer satisfaction knowledge	CSK	3.96
Leadership skills	LSK	3.91
Supplier relations knowledge	SRK	3.89
Negotiation skills	NESK	3.86
Global knowledge	GK	3.84
Inventory skills and knowledge	ISKK	2.82
Information systems skills	ISSK	2.80
Production and open knowledge	POMK	3.73
Management skills	MSK	3.66
Financial knowledge	FK	3.63
Forecasting skills	FSK	3.63
Procurement knowledge	PK	3.54
Retailing skills	RSK	2.57
Quality engineering	QE	2.52

**Table III.**  
Customer priority results

be considered competent by employers?). At the same time, these importance levels will impact the decision on which courses are highly required to successful fulfilment of the most important customer requirements, considering not only the customer but also the benchmarking results that determine improvement ratios.

Using the importance of the potential employers and all the other evaluations the final results show that the expectations “knowledge of Asian Supply” (4.5), “communication skills” (4.3), “certification knowledge” (4.2), “decision-making skills” (4.1) and “teamwork skills” (4.1) are the most critical expectations and must be addressed in any academic program related to supply chain management. As can be seen from Table IV, potential employers consider important the expectations of “logistics knowledge” and “customer relationships skills” (4.2). Both results are very similar, thus confirming that the research team has listened to the customers’ needs or expectations in the right way.

*Identifying current methods and processes or critical elements (How’s).* Current methods and processes or critical elements (how’s) for the CofC case, refer to specific courses that contain topics that include the customer expectations. Unfortunately, customer expectations are not often stated in terms of the universities’ current courses. Therefore, the researchers translated customer expectations (called “What’s” in the

	Importance to customer	University of Tennessee	Southern University	North Texas University	Maryland University	College of Charleston	Goal	Improvement ratio	Sales points	Overall importance
Analysis skills	4.2	4.2	3.5	3.1	3.8	3.2	4.5	1.3	1	5.3
Business strategy skills	4.1	4.1	3	2.9	3.6	3	4.3	1.3	1	5.2
Communication skills	4.5	3.2	2.8	2.5	3	2.8	4.5	1.3	1	6
Customer satisfaction knowledge	4	4	3.7	3.1	3.8	3	4	1.2	1	4.8
Customer relationship skills	4.2	4	3.6	3.4	3.8	3	4.2	1.2	1	5.2
Decision making skills	4.4	3.9	3.5	3.3	3.6	2.8	4.5	1.3	1	5.9
Financial knowledge	3.6	4.1	3.5	3.3	3.8	3	4.4	1.3	1	4.6
Forecasting skills	3.6	4	3.6	3.2	3.8	2.5	4.1	1.3	1	4.8
Global knowledge	3.8	3.6	3.1	2.9	3.4	3	4	1.2	1	4.6
Inventory skills and knowledge	3.8	4.1	3	2.5	3.2	3	4.2	1.2	1	4.7
Leadership skills	3.9	3.8	3.2	2.6	3.5	3	4	1.2	1	4.7
Logistics knowledge	4.3	4.1	3.5	2.6	3.8	3	4.5	1.3	1	5.6
Management skills	3.7	4	3.2	3	3.5	2.5	4	1.3	1	4.8
Information systems skills	3.8	3.8	3.8	3	3.8	3	4	1.2	1	4.7
Negotiation skills	3.9	3.9	3.3	2.9	3.4	3	4	1.2	1	4.7
Production and operations knowledge	3.7	4.2	3.5	2.8	3.8	3	4.2	1.2	1	4.6

(continued)

Table IV. Comparing results

Table IV.

	Importance to customer	University of Tennessee	Southern University	North Texas University	Maryland University	College of Charleston	Goal	Improvement ratio	Sales points	Overall importance
Procurement knowledge	3.5	4.2	3.4	2.9	3.9	3	4.2	1.2	1	4.3
Retailing skills	2.6	4.1	3.6	3	3.9	3	4.1	1.2	1	3.2
Supply chain management knowledge	4.1	4.2	3.6	3	3.8	3.1	4.2	1.2	1	5
Supplier relations knowledge	3.9	4.1	3.5	3.1	3.8	3.1	4.2	1.2	1	4.8
Team work skills	4.3	3.8	3.4	2.9	3.6	3.1	4.3	1.2	1	5.3
Purchasing knowledge	4.1	4.1	3.6	2.8	3.9	3.1	4.2	1.2	1	5
Certification knowledge	4.2	1	1	1	1	3.1	4.2	1.2	1	5.1
Knowledge of Asian supply	4.5	1	1	1	1	3.1	4.5	1.3	1	5.8
Market knowledge	4.3	2.8	1	1	1.2	3	4.5	1.3	1	5.6
Multi-lingual	4.3	2	1	1	1.1	3.6	4.5	1.2	1	5.1
Quality control knowledge	2.6	3.1	1.9	1.5	2.9	3.8	4.3	1.1	1	2.9
Technical aptitude	4.1	3.6	2.9	1.9	3.2	2.8	4.1	1.3	1	5.2

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QFD language) into critical elements (called “How’s” in the QFD language). The critical elements are placed at the top of the HOQ and, in this application, represent the activities of the ideal academic program. In order to determine the relationship between “what’s” and “how’s”, researchers asked the question, “If this is what the customer requires, how can we cover and measure it in the academic program?”

In the critical matrix, these critical elements are divided into the five areas mentioned earlier: Accounting, Marketing, Management, Quantitative Analysis, Supply Chain Management and Information Systems.

*Ranking the critical elements.* The “roof” of the HOQ indicates the synergistic nature of the new proposed courses. They are used to identify courses that are highly correlated, but also, courses that may detrimental to other courses. In the design of the supply chain management academic program, there were no such courses limiting the success of other courses

*Establishing correlations between customer and critical elements.* An analysis of customer expectations in each university selected for the benchmark analysis was developed in order to assess the relationship among customer expectations (potential employer’s requirements) and critical elements (Academic Program requirements). Table IV shows evidence of a strong relationship among Communications skills (6.0), Decision-making skills (5.9) and Knowledge of Asian Supply (5.8).

Notice that the value in parentheses represents the overall importance that defines the strength of the relationship between all the variables and relations in the matrix. This means that if the customers (potential employers) are looking for special skills in Asian market knowledge, communication abilities and decision making thinking when they hire professionals in the area of supply chain management, then satisfying the critical elements mentioned above will satisfy part of the customer skills requirement.

*Developing and analyzing the house of quality.* The HOQ matrix (the planning matrix) fully depicts all the customer expectations (What’s) and critical elements (How’s) and provides information useful in determining which courses or areas are important in meeting the demands of the customers. It creates a set of priorities for the customer expectations based on their importance to the customer and their importance to the development team’s organization. This set of priorities will have a major impact on all future planning and development activities. As can be shown in Figure 4, universities need to enhance all academic requirements because, in all cases, the customer evaluations are under the average and behind of the Goal (performance gap). The HOQ provides important information about what areas need to be improved. Using the improvement factor it is easy to understand that currently the CofC has a slight advantage if we compare it to other universities in the area of bilingual skills of students. The CofC is a Public Art and Sciences University with a strong liberal arts tradition. One of the strengths of the College is the availability of courses in different languages. In fact, students must complete two years of a foreign language as part of their academic curriculum. For this reason, this area or customer requirement requires less improvement than the remaining customer expectations. The matrix also shows that CofC’s proposed program does not yet has any sales points (sales point is the ability to sell product or service, based on how well each customer need or expectation is met). Moreover, the HOQ shows that improvements are needed in all the customer expectations. These customer expectations received the lowest evaluations in the competitive analysis and should be addressed in order to satisfy customer



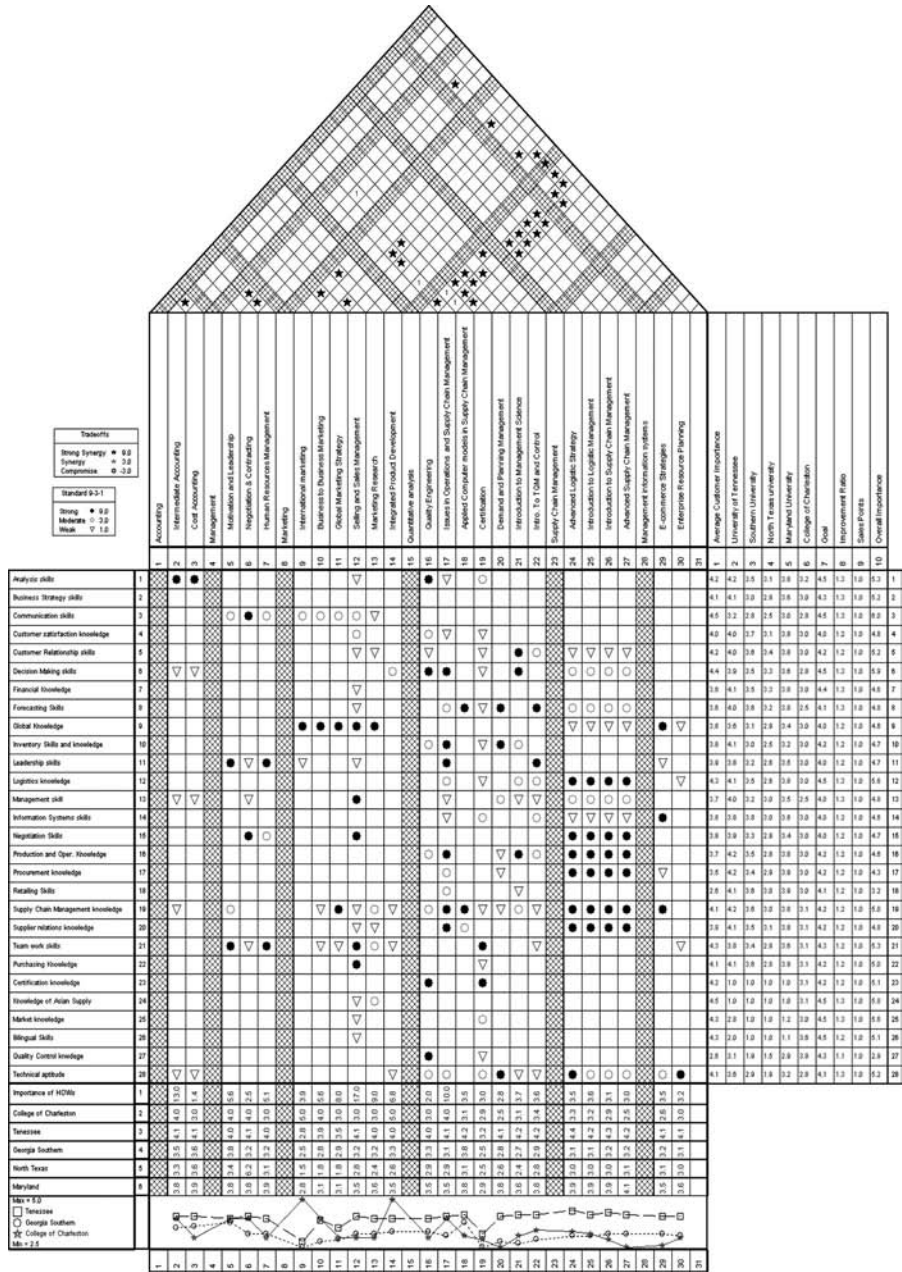


Figure 4.  
Planning matrix

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expectations. The latter is an expected result because COFC does not yet have the official program in supply chain management.

The HOQ also provides information about the evaluation of the critical elements. The following “How’s” were found to be the most important and need to be considered on the final action plans: courses in the areas of Supply Chain Management (Advanced Logistics strategy (294.4), Introduction to Logistics Management (269.8), Introduction to Supply Chain management (269.8), Issues in Operations and Supply Chain Management (269.8)).

*Analysis of the house of quality from the benchmarking perspective.* This section provides a summary of the benchmarking results by area. The benchmarking was done with comparable universities for the COFC, including: University of Tennessee, Southern University, University of North Texas and Maryland University (ranked in Rutner and Fawcett, 2005). The best academic program in SCM from the four universities is the University of Tennessee. The research team divided the skills into four areas in order to evaluate each area in each university. According to this distribution, University of Tennessee obtained a global average in analytical skills of 3.96, in management skills of 3.725, in supply chain management of 4.1 and in other specific areas of 2.08. All benchmarked universities had low values in other specific areas. This is because they involve some of the unique customer expectations that have not been fulfilled yet in the market of supply chain management programs. These unique customer expectations include knowledge of Asian supply, global knowledge and certification. Therefore, these are areas for creating competitive advantage

According to Table V, the performance of University of North Texas Program is lagging the other programs and needs an improvement in all of the activities and all areas in order to compete with the other universities close to its campus in Denton, TX.

It is important to mention that the “others specific skills area” in all the cases is the area with lower evaluation by the practitioners and potential employers. As mentioned before, the requirements are new due to new market trends generally, and new opportunities specifically within Asia. In summary, the academic program with the overall highest performance is University of Tennessee (3.61), followed by Maryland University Academic Program (3.25), Southern University (2.99), and University of North Texas (2.60). This information can be graphically observed for all academic programs in Figure 5.

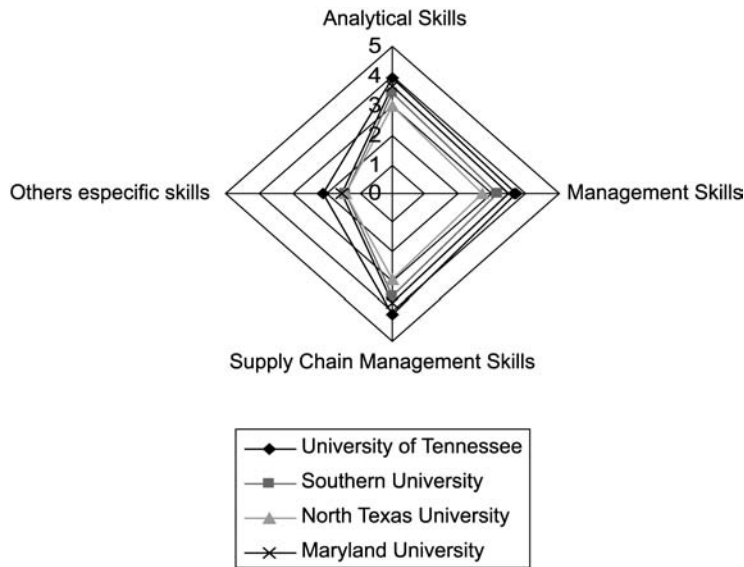
#### *Developing action plans*

The present study indicates that five major action plans should be implemented in order to satisfy customer expectations:

- (1) focus on a program that involves more analytical skills;
- (2) increase the number of courses related to global issues (Asian Markets, Asian supply, international certification, etc.);
- (3) promote bilingual classes and study abroad programs to students in the Supply Chain Management major;
- (4) have a balance among the five areas selected by the customers (accounting, management, quantitative, supply chain management and management information systems); and,
- (5) create continuous improvement teams that evaluate customer expectations and the competitions performance (benchmarking) periodically.

**Table V.**  
Benchmarking analysis

	Benchmarking analysis	Average customer importance	University of Tennessee	Southern University	North Texas University	Maryland University	
Analytical skills	Analysis skills	4.2	4.2	3.5	3.1	3.8	
	Decision making skills	4.4	3.9	3.5	3.3	3.6	
	Financial knowledge	3.6	4.1	3.5	3.3	3.8	
	Forecasting skills	3.6	4	3.6	3.2	3.8	
	Technical aptitude	4.1	3.6	2.9	1.9	3.2	
	Average	3.98	3.96	3.4	2.96	3.64	
	Management skills	3.7	4	3.2	3	3.5	
	Business strategy skills	4.1	4.1	3	2.9	3.6	
	Leadership skills	3.9	3.8	3.2	2.6	3.5	
	Information systems skills	3.8	3.8	3.8	3	3.8	
Management skills	Team work skills	4.3	3.8	3.4	2.9	3.6	
	Communication skills	4.5	3.2	2.8	2.5	3	
	Customer satisfaction knowledge	4	4	3.7	3.1	3.8	
	Quality control knowledge	2.6	3.1	1.9	1.5	2.9	
	Average	3.863	3.725	3.125	2.688	3.463	
	Supply chain management skills	Logistics knowledge	4.3	4.1	3.5	2.6	3.8
		Purchasing knowledge	4.1	4.1	3.6	2.8	3.9
		Procurement knowledge	3.5	4.2	3.4	2.9	3.9
		Retailing skills	2.6	4.1	3.6	3	3.9
		Negotiation skills	3.9	3.9	3.3	2.9	3.4
Inventory skills and knowledge		3.8	4.1	3	2.5	3.2	
Customer relationship skills		4.2	4	3.6	3.4	3.8	
Production and operations knowledge		3.7	4.2	3.5	2.8	3.8	
Supply chain management knowledge		4.1	4.2	3.6	3	3.8	
Supplier relations knowledge		3.9	4.1	3.5	3.1	3.8	
Other specific skills	Supplier relations knowledge	3.81	4.1	3.46	2.9	3.73	
	Average	4.3	2	1	1	1.1	
	Bilingual skills	4.5	1	1	1	1	
	Knowledge of Asian supply	4.2	1	1	1	1	
	Certification knowledge	3.8	3.6	3.1	2.9	3.4	
	Global knowledge	4.3	2.8	1	1	1.2	
	Market knowledge	4.22	2.08	1.42	1.38	1.54	
	Average						



**Figure 5.**  
Performance by skills requirement and by university

In order to achieve the previous action plans, a new academic program is depicted in Figure 6. As shown, the major in supply chain management requires 54 hrs, and all the expectations are satisfied with the new program.

### Conclusions and recommendations

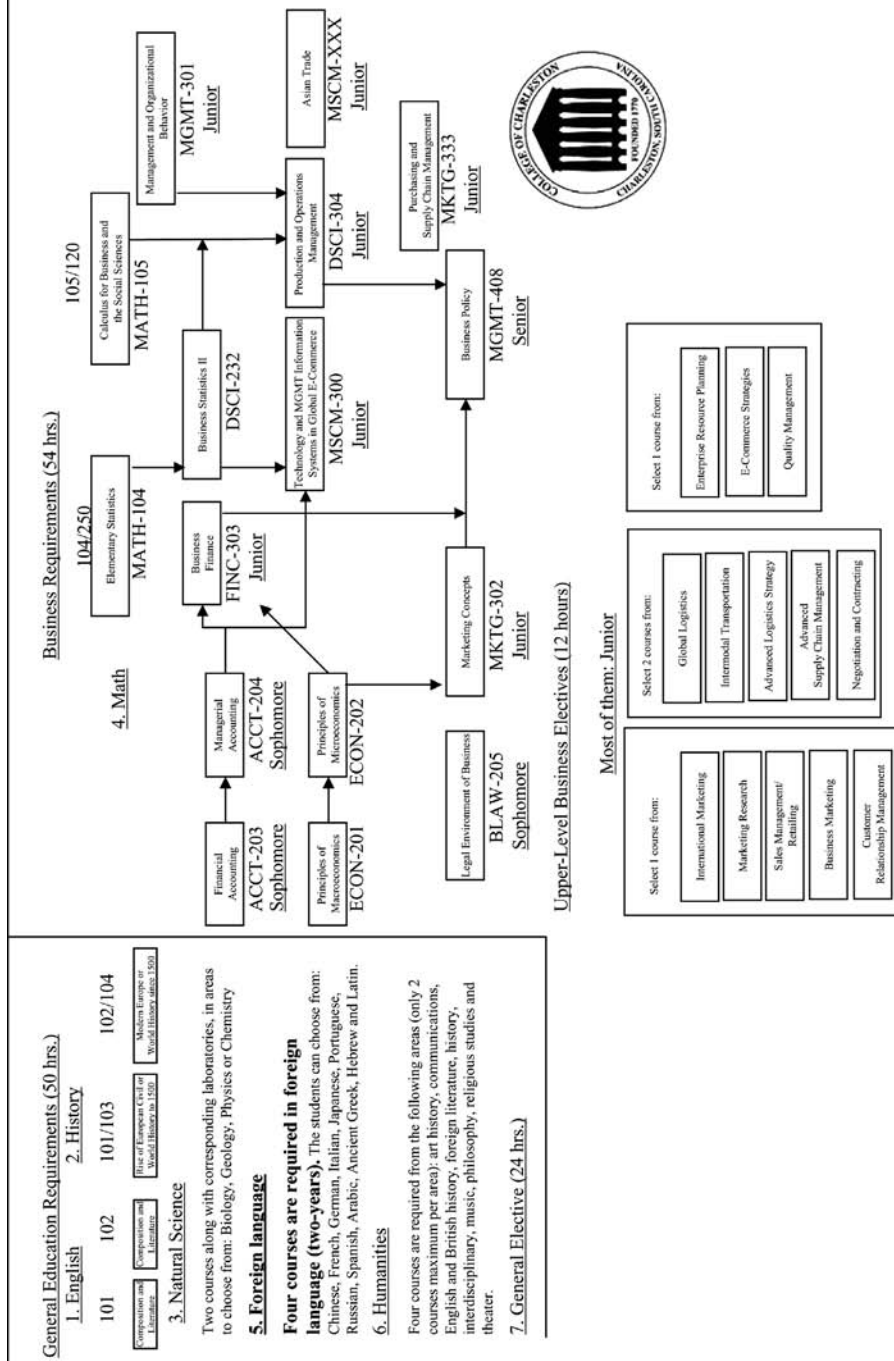
This research has several important contributions. First, it suggests a useful solution to the design of academic programs, where all the expectations of potential employers can be satisfied. Second, it presents a methodology for analyzing customer expectations. Finally, it opens the window for future research in the area to include the uses of innovative tools to solve real problems.

The application of QFD and benchmarking as a joint analysis tool is a very interesting approach because the information is analyzed from different perspectives simultaneously. In addition, the resulting outcome from the QFD/benchmarking analysis is an academic programme which embraces customer expectations and the requirements that potential employers are looking for. Determining detailed skills for future professionals in the area of supply chain management reduces the potential training costs for companies and reduces the gap between academia and business.

With the outcomes produced by this methodology, academic institutions' decision makers can now have specific suggestions on which to base decisions regarding the most appropriate courses and potential student profiles. Areas designated as highly important for performance standards improvements can easily be pinpointed and addressed.

In today's competitive world, customer satisfaction is a vital goal to be accomplished at an affordable cost. One important factor in customer satisfaction is the effective identification of customer expectations. This paper illustrates the use of an approach that takes advantage of benchmarking/QFD analysis in order to design an

**Figure 6.**  
Supply chain management  
academic program



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academic programme that satisfies the real needs of the market in the area of supply chain management.

While this study demonstrates the effectiveness of the applications of these techniques to applied academic areas, the use of this approach can clearly be extended to other areas for the design of specific courses. The most important of these is to clarify who the customers are and what their expectations are. Future research can benefit from this research by: expanding the scope from academic programmes to industrial applications in order to comparatively analyze the applicability of the proposed tools; and applying the same methodology to other areas of academia such as research, for developing a model for the identification of customers, (student) needs and potential solutions.

### Glossary of terms

QFD	Quality Function Deployment
VOC	Voice of the Customer
CWQ	Customer Windows Quadrant
SCM	Supply Chain Management
TQM	Total Quality Management
HOQ	House of Quality
CofC	College of Charleston
DARP	Dynamic Analysis Reduction Process
ISM	Institute of Supply Chain Management

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