# TOWARDS TOTAL QUALITY MANAGEMENT IN UNIVERSITIES: QUALITY FUNCTION DEPLOYMENT PARADIGM AND BEYOND

By

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***ABSTRACT***

*This paper is an endeavor to develop a customised and computerized matrix of Quality Function Deployment paradigm (QFD) that has been applied in industry, with the aim of probing quality assurance and enhancement in Universities. Results of testing the new matrix proved that, it is efficient and time-saving while compared with a detailed field study conducted at Philadelphia University, Jordan by the Jordan Accreditation Council. Challenges facing the application of the diverse relevant methodologies are mainly the scarcity of communication technologies and lack of physical and financial resources. This paper supports the adoption of the customized paradigm, to point out the following such as, Hybrid edutainment should be implemented; offices of quality management should be given a role in decision-making in Universities; awareness programs regarding the methods of quality assurance and enhancement should be organized, the culture of collaboration and interactivity among faculty members should be supported; and formation of regional networks of quality management should be advocated.*

*Keywords: Higher Education, Quality Assurance, Quality Enhancement, Accreditation, Evaluation; Lean Manufacturing and Enterprise, Material Requirements Planning, Six Sigma, Just-in-time, Theory of Constraints, Quality Function Deployment, House of Quality, Agile.*

## INTRODUCTION

The rationale for increased interest in quality management, which comprises of the quality assurance and enhancement is, the graduates are generally considered as products, and communities who consume large proportions of their gross national products to secure excellence in education processes and outputs. So, tools to probe the level of excellence of schooling are highly demanded.

All systems of quality management address the same standards and objectives of quality education, but with varied emphasis on inputs, throughputs, or outputs. Quality Function Deployment (QFD) is a form of management functional with objectives. Deployed in Universities, it probes the relationship between the cognitive, psychomotor and affective traits of graduates as products on one side, and the other variables of quality assurance which depend upon the needs of local, national and international labor market on the other side.

To be leading the process of quality management, it necessitates the adoption of four principles abbreviated as 4Es which are given as follows,

- Envisioning: It is the process of determining the vision, mission, and objectives.
- Enabling: It means strengthening the relation between newly acquired information and the cognitive stock.
- Empowering: It denotes the stressing cooperation and interdependency among co-workers.
- Energizing: It is interpreted as acquiring the energy needed to organize the learning process.

To probe the quality of certain facets of higher education, several relevant approaches are adopted as follows,

- "Quality for Learning" investigates the suitability of the inputs, otherwise what is called fitness of the purpose.
- "Quality in Learning" studies the efficacy of the throughputs and processes, or what is called fitness for the purpose.
- "Quality through Learning" checks the validity of the

outputs and the degree of conformity with specified objectives targeted.

- Quality Function Deployment, or Total Quality Management, probes the efficacy of the inputs, throughputs, and outputs.

### Scope and Importance of the Study

One of the main concerns of institutions in higher education is the dire need for personnel acquainted with the principles and practices of quality management. Researches and articles in this field positively reflect upon the culture of quality management.

In search of a total quality management paradigm, this paper advocates an updated form of QFD (Quality Function Deployment) that takes into consideration, the feedback from faculty, students, and employers. It also targets the diverse stakeholders in higher education to increase their awareness of quality management, by providing a short survey of previous literature on this discipline to form the theoretical background which is needed for all experimental efforts of improvement in the field.

### Research Questions

Generally, this paper attempts to tackle the following questions:

- How can Quality Function Deployment be a total quality management technique to encompassing quality assurance and enhancement, as a comprehensive mechanism in this field?
- What difference, if any, is there between the previously customized form of Quality Function Deployment Test and the newly updated form advocated in this paper?
- What are the other quality assurance models adopted both in the industry and in the institutions of higher education?
- Which model is considered the most comprehensive?
- How can the agile concepts be used in the information and communication technologies to positively reflect upon quality control?

### Tool of the Study

The researcher has developed and applied an Arabized customised and computerized form of QFD applicable in Educational settings. It heavily drew upon the QFD form applied in the field of industry. The technical qualities of the product were transformed into the traits of the graduate as a product of the education process (AlFuqaha, 2013 b). The pillars of quality assurance in the industry were transformed into Universally acknowledged standards of quality assurance in institutions of higher education. Instead of taking into consideration the evaluation of the customers, faculty members and students were requested to evaluate the inputs, throughputs and outputs. Appendix I shows the QFD form of the House of Quality as it appeared in the previous study in Arabic. The developed form is shown in Appendix II. This study tackled the operational steps followed to measure the quality assurance of Universities. It also defined the extent to which Philadelphia University/ Jordan succeeded in achieving its general aims from the view of faculty and students. Compared with the results of a field study conducted by a team of experts deployed by the Accreditation Council in Jordan, the results of applying the paradigm have high correlation coefficient, since performance criteria was (0.77039), criteria of numerical size was (0.442452), and criteria of technical details (-0.9987). This indicated that the "House of Quality" paradigm is adequately suitable for application in Universities, and assuredly proved to be efficient as a tool to compare the performance of Universities (AlFuqaha, 2013 b).

The questionnaire was developed to evaluate the efficacy of the objectives adopted by Universities from the point of view of employers of graduates as shown in Table 1.

### Theoretical Background of the Study

Evaluation of Educational environments and outputs can be conducted through several integrated techniques based upon other disciplines, especially information technology. They all have the following features in common as follows,

- All relevant techniques are complement to each other, and employ instruments from diverse disciplines (Stukalina, 2012).
- It is essential to make data mining to understand the work environment, and to "keep all lines of communication in the organization openly".

| | | Objectives | Degree of Importance for employers | Evaluation of Employers 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|
| Traits of Graduates | Cognitive Aspects | Deep understanding of knowledge in the field of specialization | | | | | | |
| | | Conglomeration of information data – base adequate for continuing higher education in the field of study | | | | | | |
| | Psychomotor Aspects | Verbal and written Communication skills | | | | | | |
| | | Work skills in the field of study practiced | | | | | | |
| | | Ability to perform collaborative work | | | | | | |
| | Social Affective Aspects | Comprehensive understanding of the social and ethical concerns in the field of study | | | | | | |

Table 1. Items of the Questionnaire Developed to Evaluate Efficacy of the Objectives from the Point of View of Employers of Graduates

(Stukalina, 2012).

- Obtaining knowledge is considered as a strategic and systematic organization-wide effort to plan, control and deploy resources (Gill, 2009).
- The establishment of a communication system based on new technologies is essential for the transfer of knowledge to all constituents of the Educational environment (Stukalina, 2012).

The array of conceptual models of quality management currently is used to encompasses the following methodologies such as Lean Manufacturing & Enterprise, Just-in-time (JIT), Theory of Constraints (TOC), Material Requirements Planning (MRP), Six Sigma, and Quality Function Deployment (QFD). Focus the interest in two of them, namely TOC and Six Sigma, the outputs is called as quality through learning. One (Lean) concentrates upon two others (MRP and JIT) focus on inputs and outputs, and still one (QFD) comprehensively focus on the three dimensions of the production process, with special attention given to throughputs. Cloud thinking is essential to decide the proper type to adopt, or the elements to be synthesized into a unique novel approach.

Among the integrated management practices used in educational environments, some of them can be explained as the following (Stukalina, 2012),

- Total Quality Management: Managing Educational environments using customer focus.
- Fact-based Management: Collecting data from customers/ students to perform fact-based analysis
- Human Capital Management: Utilizing the opinion of students in decision-making.
- Information Management: Creating efficient systems of internal communication based on ICT for collaborative knowledge.
- Knowledge Management: Regular evaluation of Educational environments is considered as a useful tool for developing collaborative knowledge.
- Customer Relationship Management: Creating a Learner-Centered Educational environment using diverse instruments (Hallinger, Snidvongs 2008).

Total quality management means striving to achieve perfection in the realms of inputs, throughputs and outputs using cloud technologies, by developing comprehensive solutions in multiple areas, adopting a common approach of using a set of tools to manage complexity. The Agile "inspect-and-adapt" methodology is applied to assure quality, which greatly affects the production and marketing costs. It takes the ADRI form of "Approach Deployment Results Improvement" to be integrated into all quality management methodologies. Scrum stresses on the importance of empirical feedback, team self management, and making properly-tested product increments within short iterations. The sequential phase based production and service approach, depending on "waterfall" methodology, is criticized by the currently prevailing software systems. The Agile development and production approach makes it feasible to assess the direction of the production process. Since the work-cycle of the assessing team in the agile approach is two weeks, there are frequent chances for stakeholders to redirect actions to achieve the intended objectives. The Agile methodology positively reflects upon the proposed Total Quality Management Approach. Applied to quality

assurance and enhancement in institutions of higher education, the Agile approach is interpreted as using the accumulated statistical information available at offices of accreditation to conduct an internal evaluation of University work on semester basis. The Agile approach positively reflects upon the efficacy of the comprehensive total quality management.

A succinct discriminative description of each type gives an opportunity to highlight the basic elements that can be deployed as basic parts of a proposed model of Total Quality Management. So, a thematic overview of conceptual methods of quality management seems to be essential.

## Methodologies

### *Lean Manufacturing & Enterprise*

Lean, taking the prototype of the methods of Toyota Production System, tries to improve institutions by focusing on reducing waste. The foundation of Scientific Management is treating the actions of workers as totally planned and directed by the managers. Workers are like machines, and they just work as instructed. Lean implements a 5Ss methodology used to organize a work space for efficiency by identifying and storing the ingredients used. This methodology consists of the five activities listed below, with safety and security which are sometimes added to form 7Ss (Gidley, 2004):

- Seiri (Sort - organization): Defining the necessary things and discarding the unnecessary.
- Seiton (set in order – orderliness): Arranging and identifying things for easy access.
- Seiso (Shine – Cleanliness): Making a continuous thorough clean-up, and maintaining tidiness and cleanliness.
- Seiketsu (Standardize – Standard Cleanup): Constantly maintaining the 3Ss mentioned above (sort, set in order, and shine), and keeping a clean workplace.
- Shitsuke (Sustain – Discipline): Have workers accustomed to conforming to rules.

### *Six Sigma*

Six Sigma means, a search for excellence and perfection. It is a statistical method adopted to improve the quality through reducing the failure rates in industries. It is started at Motorola as a process improvement strategy designed to address concerns about low quality and face customer complaints. Six Sigma has evolved beyond a measure of quality into a globally-embraced methodology and business management system. Although it started simply as a manufacturing defect reduction methodology, Six Sigma has been widely adapted as a continuous improvement tool for many other business processes. The four commonly observed objectives of Six Sigma, as a process improvement method includes, understanding customer requirements, aligning processes to satisfy those requirements, minimizing variation in processes and driving improvement based on statistical findings.

Motorola continues to provide Six Sigma training and consulting services to businesses around the world. Sigma measures how far a product's quality varies from perfection; and builds on that measurement, establishing a goal of only (3 - 4) defects per one million outputs.

### *Theory of Constraints*

The Theory of Constraints (TOC) is a quality methodology derived from the field of business. Its philosophy rests on the assumption that, organizations can be improved through focusing on the constraints which affects the ongoing profitability. This necessitates going through definite steps, and breaking the beginning of the process. The steps comprises of the identification of the constraints, determining the way for exploiting them, giving priority to decisions, and elevating the system's constraints.

### *Just-in-Time (JIT)*

JIT aims to improve the profitability of an enterprise by minimizing costs of procurement and decreasing raw materials needed. It relies on signals among stakeholders involved in the process. JIT stresses on the continuous improvement of the return on investment, as well as of quality and efficiency. Key areas are focus on flow, employee involvement, quality, and other components of the inventory chain.

Contrary to traditional accounting, the JIT inventory defines inventory as cost and waste, instead of the cost of the processes of procuring and storing.

*Material Requirements Planning (MRP)*

In 1964, in response to the Lean 5Ss methodology of Toyota manufacturing program, Black & Decker introduced the Material Requirements Planning (MRP) control system. Other Companies and Universities took the example and implemented the same methodology.

Material Requirements Planning (MRP) is a production management system intended to supervise inventory by maintaining low stock levels, and scheduling the process of the bill of material. The proper tool that provides answer for several issues regarding the items required, quantities demanded, and time needed is called as MRP.

*Quality Function Deployment (QFD)*

This approach involves management by objectives. It studies the relationship between the variable of learning outputs and quality management, that takes into consideration the needs of local, regional and international labor market. The model was developed in the form of the 'House of Quality' matrix that was first developed by Yoji Akao in 1966, and then used by Mitsubishi in 1972 (Sullivan,1966). Then it was adopted by several Companies and Universities, like University of Missouri-Columbia and University of Alabama.

They all utilized a computerized program to simplify the processes. The program is available on the web-site (http//:www.qfdcapture.com).

The matrix adopted is a consumer-centered approach which defines the needs of learners and stakeholders. It encompasses the performance requirements, product design, process design, and process control (Stan Aungst et al, 2001).

Comparison among lean, six sigma, and theory of constraints, material requirements planning, and just-in-time methodologies regarding the view of waste and value, application, tools, and focus is as shown in Table 2.

**The Present Study: QFD Paradigm Remodelled**

The Quality Function Deployment (QFD) paradigm has three aims such as, prioritizing the preferences and needs of students, transforming such preferences into measurable objectives, and developing new models of graduates which are accepted more by the labor market. The performance of institutions of higher education can be evaluated within four criteria focused on student-centered activities: reaction, learning, behavior, and results or

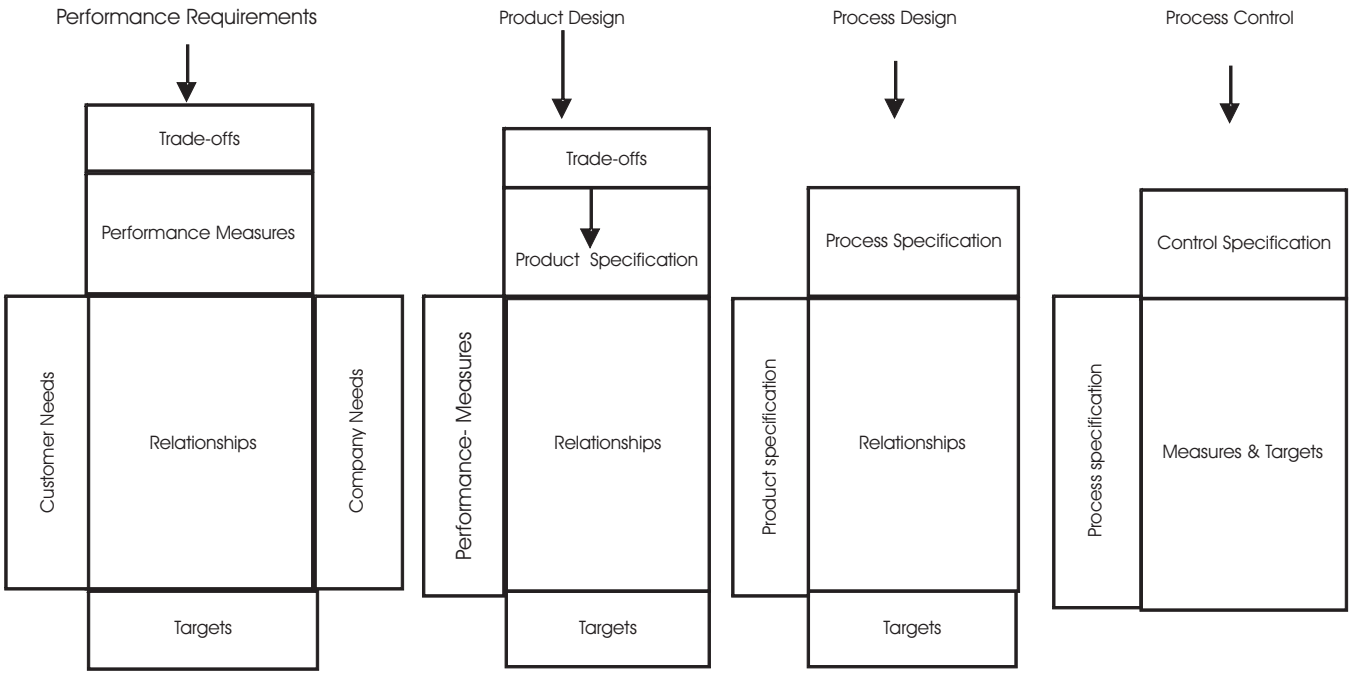


Figure 1. The Four Phases of Quality Function Deployment (QFD)

| Program | Lean Thinking | Six Sigma | Theory of Constraints | Material Requirements Planning | Just-in-Time |
|---|---|---|---|---|---|
| View of Waste & Value | Non-value addition is waste | Variation is waste | Constraints drive waste | High level of availability of items required compared to quantities demanded. | Reducing inventory and associated costs |
| Application | -Identifying Value<br>-Defining Value Stream<br>-Determining Flow<br>-Improving Process | -Defining<br>-Measuring<br>-Analyzing<br>-Improving<br>-Controlling | -Identifying Constraints<br>-Exploiting Constraints<br>-Subordinating minor ones<br>-Elevating Constraints<br>- Repeating Cycle | -Control of inventory,<br>-Processing of bill of material<br>-scheduling | Continuous increase of profits and improvement of quality |
| Tools | Visualization | Math-Statistics | Systems thinking | Planning production control system | minimizing costs of procurement and decreasing raw materials needed |
| Focus | Process flow focused | improving quality through reducing failure rates | Constraint focused | Maintaining low inventory levels | Flow, employee involvement, and quality. |

Table 2. Comparison Among Some Methodologies of Quality Management

function. Figure 1 shows the 4 phases of QFT.

This paper advocates a contribution to the previous customised matrix. That is, the evaluation of the employers of the graduates as important constituents of the stakeholders. The questionnaire developed to probe the opinions of employers has taken the form shown in Appendix II.

The QFD paradigm helped for collating and analyzing the descriptive data in order to comprehend the competitiveness of Universities, the expectations of students and faculty, the requirements and impediments of work, and the priorities in education services and strategies that are adopted in this study.

The main concern with QFD was that, it didn't take into consideration, the opinion of employers as stakeholders in addition to faculty and students. Such a concern is tackled in this paper, and is hopefully rectified with the proposed three-dimensional matrix.

The traits of graduates which have been evaluated by employers are shown in Table 3.

In the case of Philadelphia University, applying the new developed matrix of the House of Quality, by surveying the opinions of a sample of (25) employers of University graduates, the result of employers' assessment, as well as the cumulative result of assessment of the three stakeholders (students, faculty, and employers), is shown in Appendix II.

But that gave rise to a new concern, which is giving the same weight of importance to the estimations made by the three stakeholders (faculty- members, students, and employers of graduates).

## Conclusions

A study conducted at Philadelphia University, Jordan revealed that the addition of the dimension of the feedback of employers rectified the drawback of QFD as not comprehensive in taking into consideration the views of all stakeholders. It complemented a previous study conducted in 2013, and took the feedback of students and faculty, by adding the views of employers of graduates. As for the challenges facing the implementation of Total Quality Management, the studies outlined in Appendixes I & II revealed that, faculty members estimated the challenges facing the implementation of transformative education, as well as the application of a total quality management policy, which are categorized as below.

### *Scarcity of Communication Technologies Needed for Transformative Education:*

Estimation of the degree of prevalence of communication technologies in education institutions up to 2020 has the following as (AlFuqaha, 2013a): Adoption of Online Courses (82 %), Social Networks (76%), Text Messaging Notifications (74%), Wikis (70%), Software Collaboration (70%), Video Podcasts (64%), Blogs (60%), Document Management 60%, Mashups (58%), RFID (Radio Frequency Identification) / Sensor Networks (52%). This implies a drastic move from

| Objectives | | Traits of Graduates | Ranking (Out of 5) | Ranking (%) |
|---|---|---|---|---|
| Traits of Graduates | Cognitive Aspects | Deep understanding of knowledge in the field of specialization | 3.4 | 68 |
| | | Conglomeration of information data – base adequate for continuing higher education in the field of study | 3.2 | 64 |
| | | Comprehension of strategies of thinking | 2.3 | 46 |
| | Psychomotor Aspects | Verbal and written Communication skills | 2.1 | 42 |
| | | Work skills in the field of study practiced | 3.3 | 66 |
| | Social Affective Aspects | Ability to perform collaborative work | 3.6 | 72 |
| | | Comprehensive understanding of the social and ethical concerns in the field of study | 2.5 | 50 |

Table 3. Traits of Graduates from the Point of View of Employers

transmission and generative pedagogy to a transformative type of education. The internet currently covers almost one third of the population in the Middle East, yet that doesn't positively reflect on the full use of that facility in education processes. Such a cognitive foundation forms an integral basis of discussion of quality management and enhancement issues.

*Lack of Physical and Financial Resources:*

Faculty members in Universities are not adequately qualified to cope up with the new technological setting. It assuredly seems unacceptable to adopt traditional pedagogical methods for interactive students with e-genes in the twenty-first century. The teacher-centered pedagogy has been transformed into a web-3 student-centered paragogy type of education that is a new thing to the majority of faculty members. The same study revealed that faculty members estimated the degree of this challenge at (65%). Besides, objection to change was estimated at (63.3%), while lack of incentives to professional development among faculty members was estimated at (61.7%), lack of resources at (56.7%), lack of sufficient space at (61.7%), scarcity of information resources at (55%), and scarcity of financial resources at (51.7%) (AlFuqaha, 2013 a).

*Management Challenges and Limitations:*

Lines of authority in institutions of higher education should be clearly delineated, and everybody should be subjected to evaluation through well-designed previously-known assessment forms. The challenges facing management processes encompass the following aspects weak governance (55%), lack of planning (65%), negligence of implementation of quality management measures in higher education institutions (65%), centralization of decision making (60%), nepotism (56.7%), low employment salary scale (56.7%), and external intervention in academic work (45%) (AlFuqaha, 2013a):.

*Human Communication Challenges and Limitations:*

The environment at institutions of higher education is characterized as having poor communication among faculty members and staff which is at (60%), lack of communication among faculty members and students which is at (58.3%), and unrevised curricula which is at (46.7%) (AlFuqaha,2013 a).

*Quality Management Challenges and Limitations:*

Every single item mentioned above indicates a well-defined measure that should be implemented in a way to enhance quality in institutions of higher education. A Total Quality Assurance and Enhancement Approach should be synthesized from elements chosen from all approaches to fulfill the desired aims. Offices of quality management should be considered as academic internal auditors, accountable before boards of trustees, and not Presidents of Universities. All recommendations should be followed-up by Boards of Trustees.

## Recommendation

The developed form of the Quality Function Deployment Test (QFD) should be adopted for periodical application in Universities, which facilitates the comparison among Universities in the field of quality assurance. Following are the recommendations of the study.

- While information technology facilitated Web 1, 2, and 3 learning, in institutions of higher education, Hybrid

edutainment should be advocated with traditional Education.

- Offices of quality management in Universities suffer from the limitation of their tasks to the role of reflective perceivers instead of being proactive leaders. They just keep the records of practices instead of conducting studies to probe the efficacy of practices regarding the inputs, throughputs and outputs. They don't have any role in decision-making. So pro-activity is the trait that matters most regarding the job undertaken. Awareness programs regarding pillars of excellence and methods of quality assurance and enhancement should be organized for faculty members, students and other stakeholders. The rationale of changing the locus of focus in quality assurance from waste to value, and then to a comprehensive total quality assurance should be elucidated and advocated. The Agile Approach of 'inspect and adapt', taking the ADRI form of 'Approach Deployment Results Improvement' should be integrated into all quality management methodologies.
- External peer auditing forms a corner-stone measure in search of excellence in higher education institutions. One should make use of the good practices and evaluative experiences of others, not simply regarding exams, but of all facets of institutional practices.
- The culture of collaboration and interactivity should prevail among faculty members through organizing conferences and workshops.
- Periodical review of practices and assessing the degree of accomplishing objectives should be undertaken, and extensively studied by all.
- Academicians are expected to call for the formation of regional networks of quality management. Such networks shouldn't be limited to national bases.

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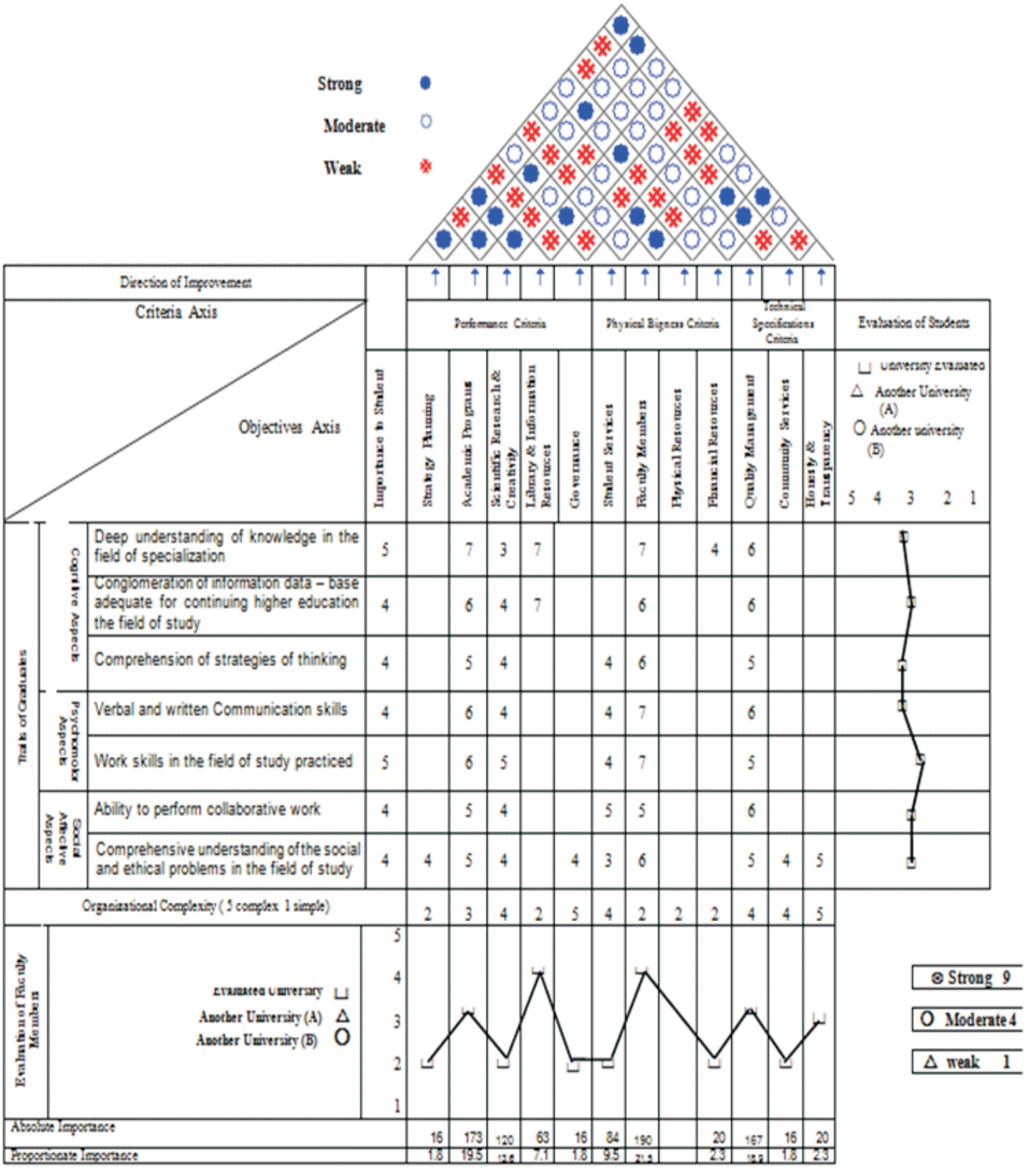
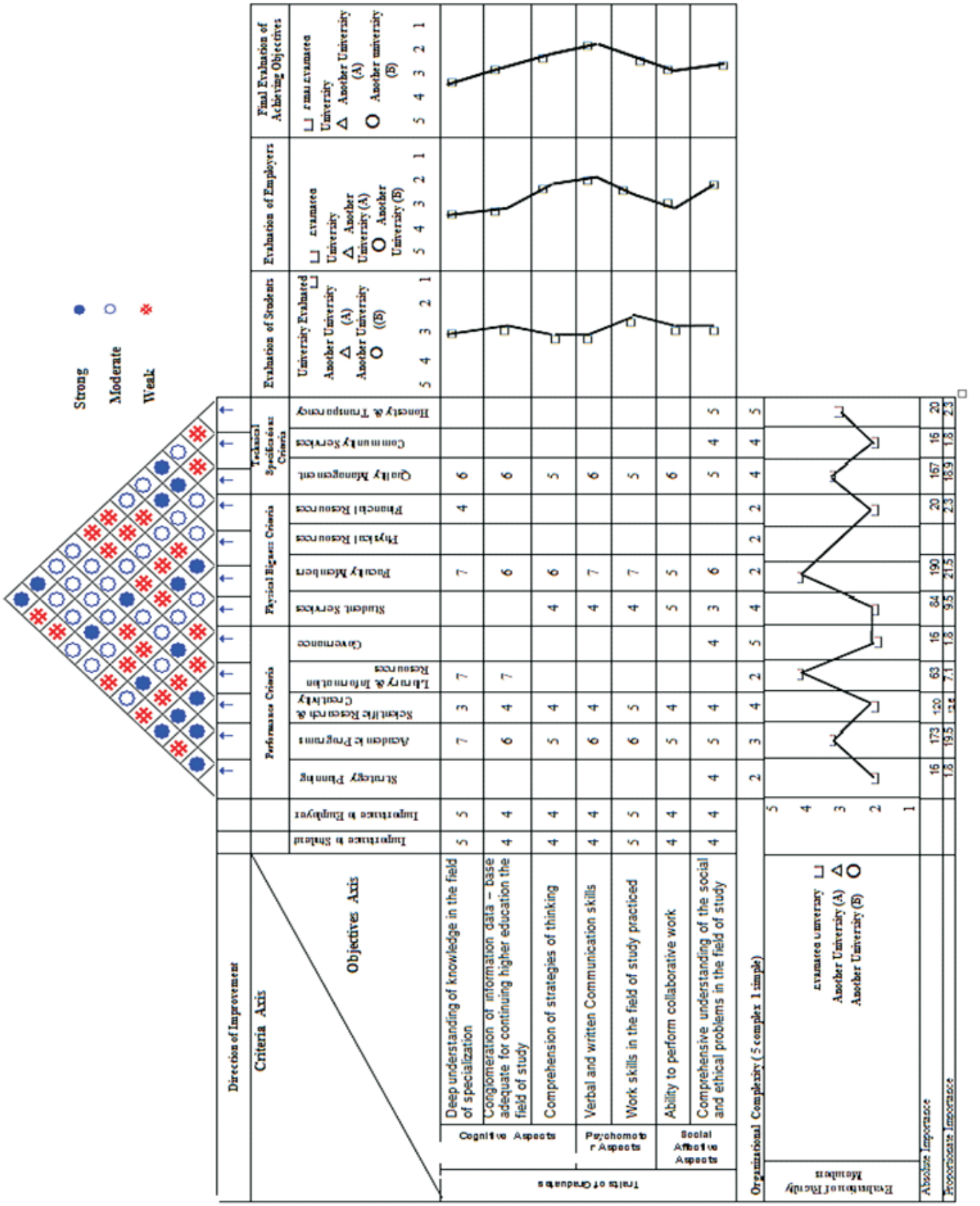
Appendix I: The Customised Form of the House of Quality and Results of Application (AlFuqaha, 2013 b)



Appendix II: The Updated Form of Quality Function Deployment Matrix and Results of Application Added



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