THE STRUCTURE AND PATHS OF MALCOLM BALDRIGE NATIONAL QUALITY AWARD (MBNQA) DIMENSIONS APPLIED IN GREEK TERTIARY EDUCATION SYSTEM

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Abstract

Introduction: Malcolm Baldrige National Quality Award (MBNQA) is a well known model as well as a quality vehicle related to self-assessment purposes.

Objective: This study analyses the structure, the relations and paths of Malcolm Baldrige National Quality Award (MBNQA) dimensions/subscales/criteria or conceptual constructs applied in Greek Tertiary Education System. These dimensions named Leadership, Strategic Planning, Customer Focus, Measurement, Analysis and knowledge management, Workforce focus and Process management may have a different impact on one another and the recognition of their role on a Tertiary Education Organization may suggests the best practices that must be taken and they may function as the appropriate predictors for best organization performance.

Design: A survey was carried out using a structured questionnaire related to MBNQA dimensions/subscales or conceptual constructs for a sample of 145 Pre-service teachers from ASPETE Thessaloniki in Greece. These subscales were measured items, rated on a seven-point Likert format, ranging from 1 (strongly disagree) to 7 (strongly agree).

Method: The study focuses on the presentation of the structure, the relations and paths by Implicative Statistical Analysis (ASI).

Results: Implicative Statistical Analysis (ASI) results released a model that presents the strengths of the paths and implicative relations between the dimensions/subscales or conceptual constructs MBNQA model. These paths made it evidence that the major player assessing quality in Tertiary Educational System are Leadership. Another asset that it must be taken into account is Strategic Planning, which its role is also extremely valuable in succeeded Quality.

Keywords: MBNQA, model, quality, tertiary, education, system.

1 INTRODUCTION

Anastasiadis et al. (2016) claimed that Quality Awards and Quality Models had their foundation on the philosophy of TQM and more especially on the principles of continuous improvement. According to Vokura et al. (2000) Malcolm Baldrige National Quality Award (MBNQA) was an output of efforts seeking for quality improvement and competitiveness in 1987. In addition Malcolm Baldrige National Quality Award (MBNQA) was produced to endorse and advance quality awareness, classify quality excellence’ necessities and requirements (Vokura et al., 2000). In fact Malcolm Baldrige National Quality Award (MBNQA) was established in 1987 by the US Congress in order the outstanding performance and excellence to be aware of in seven criteria: 1. Leadership, 2. Strategic Planning, 3. Customer Focus, 4. Measurement, Analysis and Knowledge Management, 5. Workforce Focus, 6. Process Management and 7. Results (Prybutok et al., 2011). The National Institute of Standards and Technology (NIST) presently run the award, with American Society for Quality (ASQ). NIST expanded a set of core principles for quality management, as well as customer driven quality, leadership, continues improvement and learning. In addition NIST included in this set of principles employee satisfaction, design quality and prevention, planning the future, organization responsibility and citizenship; and results (Vokura et al., 2000).

The criteria of Baldrige National Quality Award (MBNQA) are described below.

1 Leadership: This criterion refers to the extent to which the organization asks how Senior Leaders; personal actions quite and sustain your organization. Moreover, the current criterion asks with reference to organization's governance system and how your organization performs its legal, ethical and societal responsibilities (NIST 2015).
2 Strategic Planning: This criterion refers to the extent to which the organization develops objectives and action and achievement plans, implements them, changes them in case needed and measures progress (NIST 2015).

3 Customer Focus: This criterion refers to the extent to which the organization engages its students and other customers for long-term market success. In addition this criterion refers to the extent to which the organization takes into account customer voice, establishes relationships with students and other costumers, and uses their information seeking for improvement and innovation opportunities identification (NIST 2015).

4 Measurement, Analysis and Knowledge Management: This criterion refers to the ways that the organization selects, gathers, analyses, manages and improves its data, information and knowledge assets. Work Processes: How do you design, manage, and improve your key educational programs and services and your work processes how it manages information technology. In addition, this criterion refers to the ways that the organization uses review findings in order to succeed performance improvement (NIST 2015).

5 Workforce Focus: This criterion refers to the extent to which the organization assesses workforce capability and capacity needs and constructs a workforce environment conducive performance. Besides, this criterion asks about how the organization engages, manages and develops the workforce to utilize its full prospective in a line with the organization needs (NIST 2015).

6 Process Management: This criterion refers to the ways that the organization designs, manages and improves as well as innovate this programs and services and work processes. Above and beyond, this criterion asks how the organization improves operational efficacy to distribute value to students and other customers with a view to accomplish the desirable achievement (NIST 2015). In case of education this criterion represents a criterion named Operations (NIST).

7 Results: The last criterion named results refers to the ways that the organization asks about its performance in relation to students learning and process rebuts, customers results, governance results and market results (NIST 2015)


From 2009, The Malcolm Baldrige National Quality Award (MBNQA) excellence criteria were established for educational institutions (NIST, 2009). The 2019-2020 Baldrige Excellence Framework booklet includes:

1 The educational criteria for Performance Excellence
2 Core values and concepts
3 Guidelines for responding to the Educational Criteria and evaluating and scoring processes and results
The Baldrige framework is based on core values and concepts related to beliefs and behaviors regarding organizations evaluated as high performing: These core values are: Systems perspective, Visionary leadership, Student-centered excellence, Valuing people, Organizational learning and agility, Focus on success, Managing for innovation, Management by fact, Societal contributions, Ethics and transparency and Delivering value and results.

Thus this study analyses the structure, the relations and paths of Malcolm Baldrige National Quality Award (MBNQA) criteria/dimensions/subscales or conceptual constructs applied in Greek Tertiary Education System. Many research has been done in Greece in terms of quality dimensions related to Malcolm Baldrige National Quality Award (MBNQA) or European Foundation for Quality Management (EFQM) dimensions (Anastasiadou, 2016, 2018a, 2018b). These dimensions may have a different impact on one another and the recognition of their role on a Tertiary Education Organization may suggests the best practices that must be taken and they may function as the appropriate predictors for best organization performance.

2 METHODOLOGY

This paragraph includes Sample description and Data Collection, the Instrument used and Data Analysis Methodology.

2.1 Sample and Data Collection

A survey was carried out using a part of the structured instrument/questionnaire MBNQA developed by Bardi et al. (2006) related to Leadership for a sample of 145 Pre-service teachers from ASPETE Thessaloniki in Greece. 79 (54.5%) were females and 66 (45.5%) were males. The instrument/questionnaire was originally developed in English by Bardi et al. (2006) and then translated to Greek using the translation and back translation procedure, while tutors of English who speak Greek fluently assumed to provide the appropriate translations.

2.2 Instrument

Leadership criterion is was measured using Bardi et al. (2006) multidimensional and hierarchical scale that consists of constituted by 6 dimensions/conceptual constructs named:

1. Leadership (e.g. Senior leaders show strong commitment to policies and strategies).
2. Strategic Planning (e.g. The organization ensures that its strategic planning addresses student learning and development).
3. Customer Focus (e.g. Organization’s programs emphasize “learning and communication skills”).
4. Measurement, Analysis and Knowledge Management (e.g. Information systems are used to link organization; programs and services with students outcomes).
5. Workforce Focus (e.g. Ethical behavior in all our students is ensured).
6. Process Management (e.g. Organization has effective way in determining and ensuring its Learning-Centered Processes-LCP).
7. Results (e.g. Educational services attributes as evidence of student and stakeholders satisfaction).

These 7 dimensions/conceptual constructs rated on a seven-point Likert format, ranging from (strongly disagree) to 7 (strongly agree).

2.3 Data Analysis Methodology- Implicative Statistical Analysis (ASI)

Implicative Statistical Analysis (ASI) was initiated and developed by Régis Gras to be applied in the Didactic of Mathematics (Gras, 1979). Since the doctoral dissertation of Régis Gras, a great deal of research has been published concerning different paths of theory development (Gras et al., 1997; Gras, & Couturier, 2013; Gras et al., 2004; Gras, et al., 2008; Gras, Regnier, & Guillet, 2009; Gras, Régnier, Marinica, & Guillet, 2013). According to Couturier (2008) the preliminary goal of this method
is to identify an approach that sufficiently deals with the question “if an object has a property, does it also have another one”. This is rarely correct though a tendency appears to emerge. ASI aims at highlighting such tendencies in a set of properties. According to Coutourier (2008), ASI can be regarded as a technique used to generate association rules. Furthermore, it is considered to be a wide theoretical framework, a theory connected with causality due to the fact that it responds to the weakness regarding other multivariate methods, as well as highlighting formal tools and practical methods of data representation, evaluation and interpretation.

It is of a major importance to note that compared to other association rule methods; ASI distinguishes itself by providing a non linear measure that satisfies some important criteria.

In order for the implicative association rules to be extracted, causal and predictive relations are influenced by the intensity of involvement.

Thus, the method is based on implication intensity that measures the degree of astonishment inherent in a rule. According to Coutourier (2008), the implication intensity maybe reinforced by the degree of validity that is based on Shannon’s entropy, in case that a researcher chooses this comparison approach.

The implicative representation of the associations is presented in figure 2 by a weighted graph without cycle where each edge corresponds to a rule, and in figure 3 by an ascending hierarchy oriented by meta-rules.

![Figure 2](Image)

![Figure 3](Image)


Similarity tree is based on the similarity indexes, defined by Lerman (1981). Similarity indices are used in data analysis to study objects described by binary variables. According to Blanchard (2009), they allow one to assess the likeness between two objects and two variables.

The likelihood index is based on Likelihood Linkage Analysis (LLA) (Lerman, 1981) and it is given by Lerman (1993) in Blanchard (2009) as:

\[ \text{Likelihood Linkage Index of Lerman } P(N_{ab}<n_{ab}) \]

while the Implication Intensity of Gras (Gras, 1996; Gras & Kuntz, 2008) is given in Blanchard (2009) as:

\[ \text{Likelihood Linkage Index of Gras } P(N_{ab} > n_{ab}') \]

where the hypothesis tested is \( H_0: \) there is independence between \( a \) and \( b \), and \( N_{ab} \) and \( N_{ab}' \) are random variables for the numbers of examples and counterexamples \( n_{ab} \) the number of examples and \( n_{ab}' \) the number of counterexamples.

It can now be expected that the cohesive hierarchy, always obtained by CHIC Software, which structures successes in groups guided by implication, respects, within them, the presumed taxonomic order.

For the analysis of the data Implicative Statistical Analysis is used. Specifically the Cohesion tree (Gras et al., 1997) as well as the Similarity tree (widely known as dendrogram (Lerman, 1981) resulted by CHIC Software (Couturier, 2008).

### 2.4 Research hypotheses

This study evaluates the following research hypothesis.

- Ho2: Results have a relation with Operations criterion.
- Ho3: Results have a relation with Workforce criterion.
- Ho4: Workforce has a relation with Measurement criterion.
- Ho5: Operations have a relation with Customers criterion.
- Ho6: Measurement has a relation with Customers criterion.
- Ho7: Customers have a relation with Strategy criterion.
- Ho8: Strategy has a relation with Leadership criterion.

3 RESULTS
This paragraph includes the results related to the similarity diagram/tree, the hierarchical diagram and implicative diagram.

3.1 The similarity diagram/tree
The similarity diagram/tree: The similarity diagram/tree (Figure 4) presents groupings of statements based on customer behavior when completing the questionnaire. Similarities in emphasized black are significant, at a significance level of 99%. The similarity diagram (Figure 1) presents one distinct similarity group with two similarity subgroups (Subgroup A, Subgroup). The first similarity group (Subgroup A) refers to similarity relations between the criteria Workforce- Measurement-Operation- Results (similarity: 0.842114) that regard criteria Workforce, Measurement, Operation and Results and show the similar tactic employed by the interviewees to treat and perceive concrete MBNQA dimensions.

Specifically, similarity Workforce-Measurement (similarity : 0.989817) shows the similar tactic of adopted by interviewees to deal with and perceive the extent to which the organization assesses workforce capability and capacity needs and constructs a workforce environment conducive performance and the ways that the organization selects, gathers, analyses, manages and improves its data, information and knowledge assets, while its value is almost 1, exhibiting, that is almost perfect similarity.

![Figure 4. Similarity diagram/tree](image)

Not only is this similarity, Workforce-Measurement, the most forceful in the first group, it is the most forceful compared to all other similarity groups. The second most forceful similarity is that between variables Workforce-Measurement-Operation (similarity: 0.954663 ) that refer to Operation regarding the manner pre-service teachers think the organization designs, manages and improves as well as innovate this programs and services and work processes and improves operational efficacy to
distribute value to students and other customers with a view to accomplish the desirable achievement. The Similarity between conceptual constructs Workforce- Measurement-Operation-Results shows that those criteria between customers are very powerful constituents. Although, the Similarity between conceptual constructs Workforce-Measurement shows that those criteria between pre-service teachers is the par excellence most powerful constituents.

The similarity Customers-Strategy (similarity: 0.948062) is equally important and refers to the Customers Focus related to customer voice, students and other costumers relationships’ establishment and information seeking for improvement and innovation opportunities utility as well as Strategy related to the extent to which the organization develops objectives, actions and achievement plans. This group, Customers-Strategy, is connected to a third variable, FDB7, which belongs to the conceptual construct Leadership and relates to the informing of the extent to which the organization asks how Senior Leaders; personal actions quite and sustain your organization. Thus the similarity of the Subgroup B appears to be of above medium significance (Customers-Strategy-Leadership) (similarity: 0.701611).

Finally, the similarity group of the whole group is Workforce-Measurement-Operation-Results-Customers-Strategy (similarity: 0.163575), is insignificant.

3.2 The hierarchical diagram

The hierarchical diagram (Figure 5) presents the implicative relations between the variable in order of significance. Additionally, the hierarchical diagram also shows the direction of such relations.

With respect to the first hierarchical group, this refers to conceptual constructs Workforce-Operation (cohesion: 1) where the response to Workforce entails the response to Operation. Responses to conceptual construct Measurement entail the response to Workforce and Operation criteria [Measurement-(Workforce-Operation)) cohesion: 0.975]. In addition the response to Results criterion entails the response to Measurement, Workforce and Operation criteria. The hierarchical group Results-(Measurement-(Workforce-Operation)) exhibits an externally significant cohesion (cohesion: 0.921).

There are three hierarchical structures in the second hierarchical subgroup. More specifically, the first refers to the conceptual construct Customers and Strategy and their cohesion is almost equal to 1, namely an almost perfect cohesion [(Customers-Strategy) cohesion: 0.987].

Criteria Customers, Strategy, Leadership [(Customers Strategy) Leadership] cohesion: 0.938] form another hierarchical group whose cohesion is also almost perfect. With respect to hierarchical relation Customers-Strategy (cohesion: 0.987) whose cohesion is, again, almost perfect, it shows the opinions on Customers it implicatively constitutes opinions on Strategy. This implication in turn also implies opinions on Leadership.
The hierarchical relation Customers-Strategy-Leadership accentuates the hierarchical relations between the three first criteria related to Malcolm Baldrige National Quality Award (MBNQA) (((Customers Strategy) Leadership) cohesion: 0.938).

The hierarchy between these two groups cited above, (Results-(Measurement-(Workforce - Operation))) and ((Customers-Strategy)-Leadership)) is significant (cohesion : 0.747) demonstrates the existence of a hierarchy between seventh criteria or conceptual constructs of the same latent variable, named Baldrige National Quality Award (MBNQA).

### 3.3 The implicative diagram

The implicative diagram shows the implicative relations between the seven criteria (Figure 6). In more detail, the leg of the implicative chain Results->Operations, Workforce->Measurement, Operations, Measurement->Customers->Strategy->Leadership.

In more detail, the first part of the implicative chain Results->Operations, Workforce->Measurement shows that the construct Results is that which lead to constructs Operations and Workforce. The conceptual construct/ criteria Workforce) leads to construct Measurement.

![Implicative diagram](Graphe im plicatif : C:\Users\User\Docum ents\Effrosyni.csv)

The part leg of the implicative chain Operations, Measurement->Customers->Strategy->Leadership accentuates that the criteria Operations and Measurement shows the implicative relations between them and the conceptual construct Customers implies the criteria Strategy which then and in turn implies criteria Leadership.

The implicative chain Results->Operations, Workforce->Measurement, Operations, Measurement- >Customers->Strategy->Leadership shows the implicative relations between the seven criteria (Figure 6). In more detail, the leg of the implicative chain revels the Results existence due to Operations and Workforce existence, the Workforce existence is based on Measurement criteria. Operations and Measurement criteria both based on Customers criterion. Customers’ criterion existence is based on Strategy winch is leaded by Leadership.
It is worth noting that one and only one implicative chain begins from the Results and then to Leadership. More specifically, when results have a weight, meaning that when results are accomplished effectively Leadership constituting a key principle of quality assurance.

All the above results reveal that all the research hypotheses $H_0$-$H_8$ are accepted.

4 CONCLUSIONS

Implicative Statistical Analysis (ASI) results released a model that presents the strengths of the paths and implicative relations between the dimensions/ subscales or conceptual constructs MBNQA model. Leadership, Strategic Planning, Customer Focus, Measurement, Analysis and Knowledge Management, Workforce Focus, Process Management/Operations and Results constitute the unique model named Malcolm Baldrige National Quality Award (MBNQA) according to 145 Pre-service teachers from ASPETE Thessaloniki in Greece perceptions. Implicative Statistical Analysis (ASI) released one and unique implicative chain that represented the implicative relation and paths between them. These paths made it evidence that the major player assessing quality in Tertiary Educational System are Leadership. Another asset that it must be taken into account is Strategic Planning, which its role is also extremely valuable in succeeded Quality.

Still further research qualitative as well as quantitative has to be made evaluate assessment in relation to quality in tertiary education in Greece based both on MBNQA and EFQM criteria.

REFERENCES


