Lean Six Sigma Methodology to Improve Quality in Higher Education Sector using abduction Mathematic logic. period-01-11-2022/01-02-2023

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Abstract:

The new challenges that facing the higher education system. Due to the transformations conducted. As the adoption of the LMD, and the decision 1275 about the creation of the incubators. These changes can affect the quality of the services provided by the universities. To face the challenges Lean six sigma is considered as an approach used to improve quality throws five steps. its implementation needs changes in the university strector, by creating quality cellul.

The belts level of lean six sigma. The use of abduction is to validate the changes and transformations is needed, the abduction is considred as an alternative to the study case.The results are that the lean six sigma can improve the quality in higher education system.

Keywords: quality, higher education, lean six sigma, anduction, control.

Jel Classification Codes:E12.

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1. Introduction :

Higher education in Algeria has undergone many changes in the last decade, particularly with the introduction of the LMD system. That is the most important measures have been taken by the ministry through a series of regulatory endorsed, confronted and strengthened by the law that definitively established the LMD as a system teaching.

With these changes, the concept of quality takes its full scope in this new system, and its importance becomes paramount. Although it was originally intended for the production sector, quality has spread to all sectors, including higher education (W. Edwards Deming, 1993,p 39), which is one of the most affected sectors, through practices that evolve with the changes in society.

The term "quality" in higher education is more commonly known as "quality assurance": which is based on the principles and rules of quality management.

The Algerian university has put itself in the hour of quality assurance, by the adoption of many significant changes, by creating quality cells that take charge of the application of quality assurance based on the repository of quality assurance defined by the Ministry of Higher Education. However, the application of quality assurance is not a trivial operation, it requires specific methods to achieve it and a strong involvement of the administrative staff who must show the way and the actions to be undertaken to all the executors. In this perspective, one of the most used methods to improve quality is "Lean Six Sigma". This method was developed in industrial companies such as Motorolla. The principle of this method is to achieve a level of quality measured by the sigma variance, which evolves in relation to the improvement of quality from 1 to 6 sigma. Nevertheless, the improvement of quality in higher education in Algeria has experienced a delay, which can be made up for by applying the principles of "Lean six sigma" which can be considered as a solution. However, the adoption of Lean Six Sigma in higher education institutions can lead to organizational changes.

For it requires modifications, training and creation of cells. In the same way, quality assurance is a set of procedures to be applied, references to be reached. What makes the work more difficult is how to apply them, in what ways, from this observation we propose the following problems

2. Problematic :

In view of the permanent changes in the higher education sector and in the context of the obligation to apply quality assurance, the following problems arise: "Referring to the method "lean six sigma", which management model is best suited for an application of quality assurance within academic institutions in Algeria?".

3. Main assumption:

The application of quality assurance requires a model that supports the organizational needs and necessary changes at the organizational level. In order to achieve an acceptable level of quality according to the Lean Six Sigma method.   The management model based on the Lean Six Sigma method contributes to improving quality in higher education.

4.The objectives of the research

From a theoretical point of view, our work is based on two streams of research. One concerns the work on quality in higher education, particularly on quality assurance. The other current, much younger and less abundant, is closer to our research, and is oriented towards the application of the Lean six sigma methodology, i.e., tools that make it possible to obtain an acceptable level of sigma. Numerous studies have been supported about the first current concerning quality and quality assurance, however, less abundant are the investigations concerning the tools for the application of quality assurance. For this reason, our research question is not so much to explain the background and causes of quality assurance, but to understand the contribution of quality assurance in higher education, and how it perceives quality in a service organization with multiple actors "teachers, students, administration" who do not necessarily share the same needs; and the techniques used for its application, and to know what changes are necessary to optimize its application.

The problematic of our research is thus fully within the logic of the Methods of Quality Management, and revolves around the following objectives

a) the number of actors who form these institutions (administrative staff, students and teachers) have the same needs expressed or not.

b) whether the application of the quality assurance framework in these institutions meets the needs of the actors who form this structure.

c) Does the professional bureaucracy that characterizes university institutions and its technostructure favor the application of the quality assurance framework dictated by the Ministry of Higher Education?

 d) The last objective is to know if the proposed model - based on the lean six sigma method - will allow and facilitate the juxtaposition of the organization of the lean six sigma quality unit with the organization of the quality assurance unit. Based on the quality reference framework proposed by the CIAQES (Bouzid, Z. Berrouche, 2012, p08)

5. The methodology of research

According to GRAWITZ, (M.Grawitz, 1979,p 15) , "the research method is a set of operations by which a discipline seeks to reach the truths it pursues, demonstrates them, verifies them, and above all dictates the

concrete way of considering research, but this in a more or less imperative, more or less precise, complete and systematized way".

From a methodological point of view, our research requires the descriptive method to study the different definitions of quality and quality assurance. And the analytical method to be able to understand and analyze the different variables that constitute it. To make an overview of the most important theories that define the concept of quality in higher education. And to understand its dimensions. To be able to propose a model.

A third methodology is required in the practical part, which is the Lean six sigma method, which requires following a set of steps (D.M.A.C) (R. A. Broh, 2008, p65). In order to reach a quality level represented by sigma. A fourth methodology that is summarized in the last step of the case study which is the control. This last one is very difficult to be applied. Due to the fact that it requires changes in the organization of academic institutions. This led us to substitute the control step with the abduction method which consists in using logic to validate an idea that is difficult to apply in the field.

6. Case Study Methodology

Research must contribute to improving the effectiveness and efficiency of organizations through their actors. In this perspective, understanding the phenomenon is necessary, but not sufficient. Although the student is at the heart of our research priorities, our model is primarily aimed at those who accompany him or her, i.e. teachers, administrators, and managers. For the student is an important piece of the puzzle, except that this piece is dependent on an efficient and adequate organization and the unfailing commitment of those responsible.

In order to carry out our study, two working methods are necessary, which are the Lean six sigma with the D.M.A.A.C. steps and the abduction method. This last one is integrated in the last step of D.M.A.A.C (Womack & Jones. Lean Thinking,1996,p103)

. which is the control for the following reasons is that the step of control is impossible has executed in our case. And to validate the model, we chose the method of the abduction which consists in validating a hypothesis by a logic of the facts.

6.1 The epistemological status of the research

Our research objectives are to establish and validate a conceptual model, which contributes to improving quality assurance in academic institutions, by applying the quality framework by the technostructure, following the principles and steps of (D.M.A.C).

But to build the reality of a fact. Thus, by clearly answering our research questions, described above, we can contribute to the development of a new practical model, new processes that allow the members of the technostructure to better apply the referential as well as to implement their managerial knowledge.

The epistemological status of our research is thus abductive and seeks to identify from empirical studies on theories.

This epistemological choice was made because in this field of investigation, despite theories and empirical work on the definitions of quality and are effect in academic institutions, several explanations and studies show their effectiveness. That is why the priority of our research is first to understand the quality assurance and if the quality unit has the managerial means to apply them, and if so, propose a model that facilitates the application of the repository.

6.2. Lean six sigma methodology:

In this part we will not define the Lean six sigma what is already done in the first section. But to expose the steps to follow in this study to apply the Lean six sigma.

6.2 .1 The phases lean six sigma – DMAIC-

The Six Sigma methodology uses statistical tools to identify the key factors that improve the quality of processes, and generate net results .

It consists of five phases(N. Simons, 2013, p 97).:

- Define the projects, objectives and results expected by the customers (internal and external);

- Measure current process performance;

- Analyze and determine the cause and root cause of defects;

- Improve the process to eliminate defects;

- Controlling process performance.

Note that the Six Sigma methodology is not a rigid method. Approaches vary, sometimes significantly. One of the most important variations is in the phases. Some approaches use the five phases listed above, while others do not include all of these steps.

Six Sigma Professionals recognize that this approach is a kind of roadmap for improvement, and it doesn't matter if it's called DMAIC or MAIC, it depends on the need for the study, one may not use the of to define the problem if the problem is known. The point is that it is a set of tools to help managers and employees understand and improve critical processes.

6.3 The control phase:

The fifth step of the DMAIC process is a control and monitoring phase. It comes just after the "improvement" phase, which allowed the implementation of the new solutions selected by the Six Sigma team following the in-depth study of certain quality problems in the company. This stage is complex in that it must allow the teams to compare a new desired situation with an initially unsatisfactory one, and thus observe the current situation in order to confirm, then maintain, the success of the DMAIC project. In order to carry out this

step properly, and in view of the difficulty of implementing the model and validating it in the field. The choice of a validation method for the model was essential. Our choice was oriented towards the abduction method. Which can be an adequate method for this stage of the research. And here are the details of the abduction. we have choosen a nother alternative to test our methodology. We have applyed a nother methode called ABDUCTION.

6.3.1 The Abduction Method

The second method used is the abduction method, which fulfills the needs of the development of the model, and more specifically the control phase.The epistemology of management sciences is still the subject of much debate. Can management be considered as a science?

Management is considered as an art and a practice, which is only scientific in what it borrows from economics, sociology, psychology or cognitive sciences. And would there be science only in the methodical but passive observation of the action of managers, there are many works that question this vision of things. Piaget and the position of engineering in the spiral of sciences, Simon and the sciences of the artificial, Checkland and the Soft Systems Methodology, Argyris and Action Science, Hatchuel and Molet and the role of rational modeling in the understanding and transformation of organized systems, Le Moigne and constructivism in management sciences, Roy and the science of decision support, Koenig and diagnostic action research, to name   but a few, all contribute to a specific epistemological and methodological foundation for the management sciences

- **Etymological definition**

Generally speaking, abduction is a process of reasoning invoked to explain a puzzling observation From the Latin abductio, the action of removing, separating, derived from abducere to lead, to take away, to carry away, itself made up of the prefix ab - , indicating separation, to guide.

The term abduction designates :

- In anatomy, the movement of a limb or limb segment away from the midline of the body.

- In logic, epistemology and cognitive psychology, the action of choosing the most probable hypothesis or hypotheses and eliminating the most improbable ones to explain a given phenomenon, then arriving by deduction at a probable, but not certain, conclusion that is consistent with the observations.

7. Quality in higher education

Quality improvement requires a good understanding of the term. The latter has known several definitions through time. And to multiply the fields of use.(J. francois perellon, 2003, p11).

The academic institutions are not excluded and know a craze on the practices of quality management. Which requires a good knowledge of the customer. To whom the service is intended. For Kaoru Ishikawa best known for the development of the concept of the Fishbone diagram. He published two best-sellers which are.

Guide to Quality Control. Asian Productivity Organization1991. What is Total Quality Control? 1985. Where he defines quality as follows: (P.Crosby, 1996, p 71):

"Quality is the development, design and manufacture of the most economical, useful and satisfactory goods for the buyer. To manage quality is also to manage the cost price, the selling price and the profit". For Ishikawa, quality is synonymous with consumer satisfaction, economy and profit for the manufacturer. This approach is very close to the economic reality that companies are currently experiencing. A search for satisfaction with a minimum of costs, which sends the companies to conceive working methods more and more economic. Exempt the just in time or the Lean six sigma. For Genichi Taguchi who a Japanese engineer and statistician. Since the 1950s, he develops a method to use statistics as a tool to improve the quality of manufactured products he defines quality as follows (O. Taiichi, 1988, p23). :

"Quality is minimizing the losses inflicted by the product not only to the customer, but to the society in the long run. It is the ethics and social responsibility of the company that intervenes in the concept of quality, adding moral principles. This concept is now taken up in the most recent concepts of quality management developed in the ISO 9001 :

— the conformity of a product, a service, an organization with the implicit and explicit expectations of a customer;

— doing it right the first time, always looking for improvement, and always and desire. On the other hand, this expression of needs is a source of competitive advantage, if it is translated by a set of processes that allow their execution.

The term process takes a very important part in the definition of quality for the following reasons:

Quality is not a result that translates into a product or a service, but a sequence of operations to achieve a goal that is quality.

8.1 Definition of quality in higher education

Some people, including academics, believe that it would be almost impossible and useless to reach a definition of the concept of quality in higher education because, for example, "the actors involved cannot agree on a common definition". For others, the definition of quality is not neutral and is instead based on particular interests, values and beliefs about what is perceived as the common good to be developed, at a given time, in a given society. For the European Agency for Quality Assurance in Higher Education, the challenge of defining quality is not to impose a definition, but to open the debate and encourage all institutions and universities to ask themselves the question of quality within their institutions and how they conceive of it and implement it. One of the reflections on quality is the one proposed by BURLA from the University of Lausanne "the perception of what is quality teaching or research varies according to the groups concerned. The needs of the students may be

partially in contradiction with the priorities of the teachers, which themselves do not necessarily correspond to the needs of the institution or of the professional community.

We conclude that quality is subject to three parts:

- the needs of the student ;

- the priorities of the teachers;

- Administration;

- The tutel department which is the client, it is the one who pays.

- the needs of the professional community.

For Chauvigné, quality can only be a "negotiated quality" between several parties. Who can have non concordant opinions. Several authors have defined the term quality in management, and their definitions vary according to their points of view. There are those who conceive it from the point of view of the consumer "satisfaction", there are those from the point of view of conformity "the product is in conformity with the standards". Among the writers who have defined quality in higher education by approaches is David Garvin who distinguishes five ways of defining quality:

a. The transcendent approach

"Quality is neither mind nor matter, but a third entity independent of both...even if quality cannot be defined, you know what it is." Quality is seen as an innate character of excellence, absolute and universal. One cannot define precisely what quality is, but one who has been exposed to it "knows it when he sees it. According to Garvin, everyone who is exposed to quality will recognize it.

In this definition Garvin does not specify the characteristics to recognize the quality, but it is more a subjective observation of the one who receives it. In this case, quality remains a feeling. That each individual feels it in his own way, and that brings us back to the definition where quality is the difference between perceived and actual.

b. The approach based on the product:

"Quality refers to the amounts of unquantified attributes contained in each unit of the price attribute." satisfying the customer;

— an essential asset to perpetuate contracts and a competitive advantage to obtain new markets;

— satisfying customers while seeking to improve.

These definitions are all taken from the ISO 9001 version 2010. A synthesis of these definitions can be formulated as follows:

"Quality is compliance with implicit and explicit customer expectations, and in accordance with standards. And can be sources of a competitive advantage, the latter is implemented by a process well studied

and executed, to achieve customer satisfaction. What we mean by implicit and explicit expectations is that not all customers have the same needs and desires. And it is not all the needs that can be expressed, there are those that are difficult to disclose, by their complexity or by a bad expression of the need

Quality is seen as a specific, measurable variable, which is related to the presence of certain characteristics or the amount of an ingredient or attribute that the product possesses (e.g., the quality of a car engine versus the mileage driven). A "better quality" product has a greater quantity of that ingredient or attribute (which, of course, must be considered desirable by the majority of buyers) than a "poor quality" product. This definition of quality has two results, according to Garvin:

- better quality leads to higher costs;

- quality is presented as an objective characteristic of the product "as a result of standards", not as a characteristic attributed to the product by the consumer.

c. The user-based approach:

"Quality is the degree to which a specific product meets the needs of a specific consumption"
In this case, quality is precisely a question of attribution by the consumers or users of the product. Garvin places in this approach the definition given by JURAN in the first editions of the Quality Control Handbook which states that quality is fitness for use*, but he also includes all the definitions which say that quality is the satisfaction of the customers' needs. According to him, these definitions are highly subjective and therefore pose practical difficulties in identifying market preferences.

There are as many definitions of quality as there are authors. Although there are similarities between the different typologies.

The authors cited highlight various functions associated with quality assurance in university education. Or Harvey distinguishes four functions:

- accountability, which ensures that institutions are accountable for the service they provide and the public funds they spend, reassures students about the quality of the education promised, and produces public information that fund providers can use to guide their decisions about funding allocation;

- oversight, which ensures the integrity of the higher education sector, protecting its status, position and legitimacy

- compliance, which is about ensuring that institutions adopt procedures, practices and policies that are considered desirable by funding providers, governments and other stakeholders such as professional bodies and regulators

- improvement, which is more about encouraging adaptation than compelling it.

9. Control:

In the impossility of applying the stage of control in the field given the difficulty of applying the model itself. We opted to follow a separate methodology in this stage to validate our work and at the same time the model.

The elaboration of the model followed two different but complementary methodologies:

- Lean six sigma with its DMAIC steps;

- the abduction and the mathematical logic for the validation.

The first method has already been explained. Let's give in to the second method.

a The abduction:

Consists in elaborating an empirical observation that connects a general rule to a consequence, i.e. that allows us to find the consequence if the general rule is true. It is therefore a kind of backward reasoning and an inferential process (a hypothesis) which is opposed to deduction. Abduction gives the discovery an explanatory or comprehensive status which, in order to tend towards the rule, needs to be tested afterwards.

The abduction concerns the reasons for adopting a hypothesis, it is constituted by an explanatory process. From an observed fact (a result) and a particular rule, one is led to assume the rule's data (the case). Finally, abduction is an inference whose logical form is the following.

a.1 The Mathematical Formula:

$$[If (P \Rightarrow Q) And P, Then Q] And [If (P \Rightarrow Q) And Q, Then \sim P]$$

The degree of acceptability of the conclusions of an abductive reasoning can be illustrated on the following reasoning: from an example taken from Boudon:

- if it rains, the street is wet (p Þ q)

- the street is wet (q)

- conjecture : it rains (p) this conclusion is not valid in the sense that the conjecture represents only a possibility. It does not have, as with deduction, a certain value. The street can, in fact, be wet for other reasons: let us suppose that it can also be wet because the street sweeper has passed by, but that we also know that the street sweeper only passes by in the afternoon. The formulation of the problem then becomes:

- if it rains, the street is wet (p Þ q)

- if the sweeper passes, the street is wet (p " Þ q)

 - the sweeper passes only in the afternoon (r)

- It is morning, so the water does not come from the sweeper ($\sim$ r, so $\sim$ p ").

- therefore it is raining (p).

This conclusion is always conjectural, but if rain and the sweeper are the only two sources of rain and the sweeper never comes by in the morning, then this conclusion is acceptable as true with a very low risk of error. But if we expand the interpretive framework, and start a reasoning loop that includes deduction and induction, several conclusions are possible:

1.It is raining: but this is easy to verify (if it is not raining, or if several witnesses confirm that it did not rain, then this solution must be discarded).

2. The street sweeper is exceptionally passed in the morning (or the municipal services have changed the schedule).

3. If this is not the case, look for other theories that could explain why the street is wet: dew phenomenon, pavement marking work requiring the surface to be wet beforehand, student prank, etc.

4. Or, the street is not wet: it is an optical effect (mirage caused by heat), you are badly awake, etc.

a.2 Purpose of using the method

The objective of the use of the method is to contribute to the improvement of the effectiveness and efficiency of organizations through their actors. In this perspective, the understanding of the phenomenon is essential, but not sufficient, although the parties constituting the university, be it students, teachers, and administrative bodies, are at the heart of our research priorities.

The model is primarily addressed to the decision-makers who accompany these parties, and who may also be the same actors targeted, teachers, administration and managers. To do a management dedicated to the improvement of the quality is essential. It is based on a work organization and coordination that follows a method and/or approach that ensures an appreciable quality.

After many reflections on how to start the research. We have in fact, in a first step, constructed hypotheses, testable in the field and/or in the literature by collecting data, from our own reflections on this or that aspect of our research object and from an analysis of the literature. We are here in a deductive reasoning.

We then formulated hypotheses to be tested either in the literature or in multiple professional contexts in order to draw regularities. This is both induction and abduction.

b Implementation of the steps on the model :

b.1 Formulation of hypotheses:

- First hypothesis:

 Quality improvement methods in industry can be applied in academic institutions.

- Second assumption:

The Lean Six Sigma method is one of the most recent methods and is based on approaches that facilitate the understanding and application of quality in higher education institutions.

- Third assumption:

 The repository of quality assurance is a repository where all the needs of the customers of the university (teacher, student, administration) can converge.

b.2 Testing the hypothesis in the literature :

- First hypothesis: is evoked by W.Edwrd Deming.

According to Deming: "academic institutions can be improved by following the same principles that are used in other industries".

So the improvement methods that apply in industry can be applied in higher education institutions.

- Second assumption:

    Norma Simons did a study on cost and quality in American universities using Lean six sigma. Where she trained university members on the principles of Lean six sigma. Where she achieved the results. This study proves that the Lean Six Sigma method can be applied on universities.

Sandra Furterer in a set of case studies illustrated in her book "lean six sigma in services applications and case studies" where she experimented with the lean six sigma method in several institutions of higher education. This study also proves the possibility of using lean six sigma in institutions.

- Third hypothesis:

Since quality in higher education is difficult to define because of differences in requirements, the quality framework is a means of reconciliation, this assumption is confirmed by the definition given by Phil Crosby, (P.Crosby, 1996, p57), on quality "Requirement of compliance". A quality product is one that meets the defined requirements. In our study the defined requirements is the quality repository.

b.3 Validation of the model by abduction logic:

The main hypothesis to be validated is the following:

The model contributes to improving quality - which is translated by the quality assurance framework - in higher education using the lean six sigm method.

b.4 The logic by abduction follows the following steps:

-b.4.1. **Deductive reasoning: Abductive reasoning**:   -

- Rules Rules

- Result Cases

- Cases Results

b.4.2 **The rule:**

Rules show how the logic of deduction is done. This rule helps us to define the rule for abduction.

- The rule of deduction

- abduction rule:

This rule follows the logic already presented in the shema above, where the abduction starts with the result (hypothesis), which leads us to a "mathematical" rule, this rule can validate the hypothesis thanks to the "case". In our study the "case" cannot be applied in the field. Therefore, a mathematical validation is invited. Hence the rule:

$\Psi\,(\,\Gamma \Rightarrow \Phi\,)$.

Identification

Ψ: the case

Γ : the rule

Φ : the result

The rule is the formula that allows us to apply the model mathematically.

The components of the rule are the following:

P = Quality Assurance.

Q = Model.

R= higher education institutions can apply the methods of continuous improvement 'LSS'.

S= if the quality cell follows the lean six sigma method will result by quality

$\overline{S} \Rightarrow$q= the quality cell 'without the application of the Lean six sigma method' can achieve quality.

$\overline{R}$= higher education institutions cannot apply 'LSS' continuous improvement methods.

(R∧S) $\Rightarrow$q= if the quality cell follows the lean six sigma method and applies the quality framework then it will achieve quality The complete rule :

▢▢P▢Q▢▢▢S▢Q▢▢▢R▢▢▢R▢▢S▢▢Q▢▢▢P

Alors

$\Psi \vdash (\Gamma \Longrightarrow \Phi)$

$\Psi \vdash$▢▢P▢Q▢▢▢S▢Q▢▢▢R▢▢▢R▢▢S▢▢Q▢▢▢P

b.5 Interpretation of the rule is as follows:

The Model Allows the application of the quality framework to achieve quality assurance, and the quality cell can achieve quality assurance without the application of the Lean six sigma method.

Knowing that the quality cell in academic institutions in Algeria do not have a precise method to apply the quality repository. But it does not prevent them from applying the quality standard. If the quality cell follows the lean six sigma method and applies the quality framework then it will achieve quality.

To check the validity of the rule, we test with mathematical logic (semantics).

b.6 Semantics:

To be interested in the semantics of propositional logic is to determine the truth value of a statement, i.e. of a formula, within the framework of one of its possible worlds. We speak of the interpretation of a formula:

it is more concretely to assign a true or false value to each of the propositional variables that compose it. For a formula with n variables, there are possible worlds.

A clause in Boolean logic is a conjunction or a disjunction of literals. We speak respectively of a conjunctive clause and a disjunctive clause. Without precision it is most often the disjunctive clause that is implied.

In propositional calculus, a conjunctive clause is of the form.

While a disjunctive clause is of the form :

In mathematical logic, a literal is an atom (also called a positive literal) or the negation of an atom (also called a negative literal).

In propositional logic, a variable P is a literal, as well as its negation ¬P ; the disjunctive normal forms are disjunctions of conjunctions of literals, as well as literals alone, disjunctions and conjunctions of literals, and disjunctions of conjunctions and literals

How to obtain from a well-formed formula a set of clauses?

First, we have to transform the formula into its normal conjunctive form and then eliminate the connectors .

We thus obtain a set S of clauses.

If C1 and C2 are 2 clauses and if L1 is in C1 and L2 is in C2

This is the disjunction of the remaining clauses after deleting the literals L1 and L2.

It is called resolving clause and or resolver of C1 and C2.

L1 and L2 are the resolved literals.

The False clause is noted it is the empty clause

The resolvent C of two clauses C1 and C2 is a logical consequence of C1 and C2

- p $\vee$ ¬p is a tautology.

- p $\wedge$ ¬p is a contradiction.

- The negation of a tautology is a contradiction: ¬V = F

- If p = q, then p $\Longleftrightarrow$ q is a tautology.

- Modus ponens or detachment

Theorem

The proposition (p $\wedge$ (p $\Longrightarrow$ q)) $\Longrightarrow$ q is a tautology. The associated deduction rule is:

If p is true and p $\Rightarrow$ q is true, then q is true

- Modus tollens Theorem

The proposition ($\neg$q $\wedge$ (p $\Rightarrow$ q)) $\Rightarrow$ $\neg$p is a tautology. The associated deduction rule is :

Morgan's Laws

- Law of excluded third party Is a tautology

Mathematical demonstration of the model by mathematical logic (semantics):

- The abduction rule

$\Psi\,(\Gamma \Rightarrow \Phi)$.

- Proof:-

Ψ　　　　$(\Gamma \Rightarrow \Phi)$.

$$\Gamma = \left[(P \Rightarrow Q) \wedge (\bar{S} \Rightarrow Q) \wedge \bar{R} \wedge \{(R \wedge S) \Rightarrow Q\}\right]$$

$$\Phi = P$$

Preuve :　　　　　　　　　　　　　　　　　　　　　　　　-

$$\overline{\Psi} \vee \left[\left(\overline{\overline{P} \vee Q}\right) \vee \left(\overline{S \vee Q}\right) \vee R \vee \{(R \wedge S) \wedge \overline{Q}\}\right] \vee P$$

$$\underbrace{\overline{\Psi}}_{\underbrace{C_7}_{L_3}} \vee \left[\left(\underbrace{P \wedge \overline{Q}}_{C_1}\right) \vee \left(\underbrace{\overline{S} \wedge \overline{Q}}_{C_2}\right) \vee \underbrace{R}_{C_3} \vee \left\{\left(\underbrace{R \wedge S}_{C_4}\right) \wedge \underbrace{\overline{Q}}_{C_5}\right\}\right]_{L_1} \vee \underbrace{P}_{\underbrace{C_6}_{L_2}}$$

$$\left.\begin{array}{l} C_1 = P \wedge \overline{Q} \\ C_2 = \overline{S} \wedge \overline{Q} \\ C_3 = R \\ C_4 = R \wedge S \\ C_5 = \overline{Q} \end{array}\right\} L_1$$

$$C_6 = P \,\} L_2$$

$$C_7 = \overline{\Psi} \,\} L_3$$

$$\underbrace{\left(P \wedge \overline{Q}\right)}_{C_1} \vee \underbrace{\left(\overline{S} \wedge \overline{Q}\right)}_{C_2} =$$

$$\left[\left(\left(P \wedge \overline{Q}\right) \vee \overline{S}\right) \wedge \left(\left(P \wedge \overline{Q}\right) \vee \overline{Q}\right)\right]$$

$$\therefore \left(\left(P \vee \overline{S}\right) \wedge \left(\overline{Q} \vee \overline{S}\right)\right) \wedge \overline{Q}$$

$$\therefore \left[\left(\left(P \vee \overline{S}\right) \wedge \overline{Q}\right) \vee \left(\left(P \vee \overline{S}\right) \vee \overline{S}\right)\right] \wedge \overline{Q}$$

$$\therefore \left[\left(\left(P \wedge \overline{Q}\right) \vee \left(P \wedge \overline{Q}\right) \vee \left(P \vee \overline{S}\right)\right) \wedge \overline{Q}\right]$$

$$\therefore \left[\overline{Q} \vee \left(P \vee \overline{S}\right) \wedge \overline{Q}\right]$$

$$\therefore \left[\overline{Q} \vee \left(P \wedge \overline{Q} \right) \vee \left(\overline{Q} \wedge \overline{S} \right) \right]$$

$$\therefore \left[\overline{Q} \vee \left(\overline{Q} \wedge \overline{S} \right) \right] = \overline{Q}$$

$$\therefore \underbrace{\left(P \wedge \overline{Q} \right)}_{C_1} \vee \underbrace{\left(\overline{S} \wedge \overline{Q} \right)}_{C_2} = \overline{Q}$$

$$C_3 \vee \left(C_4 \wedge C_5 \right) = \left(C_3 \vee C_4 \right) \wedge \left(C_3 \vee C_5 \right)$$

$$\therefore \left(R \vee \left(R \wedge S \right) \right) \wedge \left(R \vee \overline{Q} \right)$$

$$\therefore \left(R \wedge \left(R \vee \overline{Q} \right) \right)$$

$$\therefore \left(\left(R \wedge R \right) \vee \left(R \wedge \overline{Q} \right) \right)$$

$$\therefore R \vee \left(R \wedge \overline{Q} \right) = R$$

$$\underbrace{\left(C_1 \vee C_2 \right)}_{\overline{Q}} \vee \underbrace{\left(C_3 \vee \left(C_4 \wedge C_5 \right) \right)}_{R}$$

$$L_1 = C_1 \vee C_2 \vee C_3 \vee \left(C_4 \wedge C_5 \right) = \overline{Q} \vee R$$

$$L_2 = C_6 = P \quad , \quad L_3 = C_7 = \overline{\Psi}$$

$$L_3 \vee L_1 \vee L_2 = \overline{\Psi} \vee \overline{Q} \vee R \vee P$$

$$\Psi \vdash \overline{Q} \vee \left(R \vee P \right)$$

$$\Psi \vdash \left[Q \Rightarrow \left(R \vee P \right) \right]$$

10 - The interpretation

Ψ represents the case sought, which included that Q and the model that depends on R which is quality assurance or P the application of the lean six sigma method in organizations in institutions of higher education.

This relationship shows that we can take one of the two R or P, or take both.

In our study we take the second option - taking P and R- Which means that Q model involves the use of lean six sigma and the application of quality assurance.

Our model is mathematically validated.

11. conclusion:

- Institutions of higher education are characterized by the heterogeneity of clients—from our perspective—"Students, teachers, administration, labour market and the Ministry of Higher Education", making the definition of quality very difficult. Each party conceives of quality in its own way. And has different needs and objectives from others.

- The creation of a specialized unit is dedicated to the application of quality. That is headed by the rector or another responsible person who has the decision-making power. This cell must apply the principles of lean six sigma.

- Training of cell members on quality principles and six sigma lean tools.

- Establish a quality culture through the involvement of all people who want to join the cell.

- Use of lean and six sigma tools in problem detection and resolution.

- The incorporation of the quality assurance framework as a goal to be achieved.

- Change in the organizational system, where in each faculty the incorporation of a quality cell, which includes the heads of department since they are the holders of power. And who have a clear vision of their departments. Through their positions and access to information."

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