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Building Skills 4.0 through University and Enterprise Collaboration

SHYFTE 4.0

WP3: WP Quality Plan

D3.1: Strategic Quality Plan

vs:2.0

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This deliverable describes the quality plan to analyze the effectiveness of the teaching and learning model.
It also defines the formation quality plan and the quality indicators to analyze and evaluate the transfer of skills4.0

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Further Information

http://www.shyfte.eu/

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1. Executive Summary

This Strategic Quality Plan is aimed at establishing criteria, tools and procedures to analyse the effectiveness of the teaching and learning model developed in the Shyfte project.

Monitoring and Quality Assurance addresses three levels: 1) at the design level, 2) at the development level and 3) at the implementation level. It necessitates the coordinated efforts of many individuals, such as those who will generate information and those who will use the information or make decisions based on that information.

In addition this document describes the train the trainers in the Partners Countries to the basic of Quality Management Systems (QMS) according to ISO 9001, and to propose an operative formation plan of the Quality Managers (QM) for quality audits of the Learning Processes.

- Giving to the trainers the competencies needed to manage a QMS;
- Giving to the QM the skills for the Processed revision and re-engineering;
- Deepening of the structure of a QMS and its dynamics, the techniques used to measure Customer Satisfaction and set up an internal control system to monitor each process;

Capacity to develop internal auditing to evaluate the conformity of a QMS to ISO 9001:2015 regulations and its correct application inside the university

To carry out these assessments, a questionnaire was developed for students and trainers with the task of defining a strategic quality plan for the learning programs and the qualification of the trainers. The final objective is to offer a quality course to students, and let them express their opinion to evaluate the training offered.

The assessed indicators guarantee adequate and accurate monitoring of the preparation and development of the training, obtaining a high level of quality. They also allow to analyse and evaluate the transfer of Skills 4.0.

2. What is Strategic Planning?

Strategic planning is a means of establishing major directions for the university, college/school or department. Through strategic planning, resources are concentrated in a limited number of major directions in order to maximize benefits to stakeholders--those we exist to serve and who are affected by the choices we make. In higher education, those stakeholders include students, employers of graduates, funding agencies, and society, as well as internal stakeholders such as faculty and staff. Strategic planning is a structured approach to anticipating the future and "exploiting the inevitable."

The strategic plan should chart the broad course for the entire institution for the next five years. It is a process for ensuring that the budget dollars follow the plan rather than vice versa. Strategic planning is not just a plan for growth and expansion. A strategic plan can and often does guide retrenchment and reallocation. McConkey (1981) said that the essence of strategy is differentiation. What makes this university or college or department different from any other? Educational institutions, like other service organizations, can differentiate themselves based on types of programs, delivery systems, student clientele, location, and the like. Similarly, a department or administrative unit involved in strategic planning will identify its unique niche in the larger university community and focus its resources on a limited number of strategic efforts, abandoning activities that could be, should be, or are being done by others.

2.1 Why Is Strategic Planning Essential?

Formalized strategic planning grew out of budget exercises in the America of the 1950s and spread rapidly. By the mid-1960s and throughout the 70s, strategic planning (in many forms) was occurring in most large corporations Strategic Planning. The systematic analysis of strengths, weaknesses, opportunities and threats (SWOT) is a primary strength of the Harvard model and is a step in the strategic planning model used at UW-Madison (see Figure 1).

Given its thirty some years of practice in this country, why is strategic planning essential now? These are times of rapid change. Will Rogers said, *"Even if you're on the right track, you'll get run over if you just sit there."* No university can remain static for long. Neither can an institution survive for long with knee-jerk responses to change. Strategic planning should minimize crisis-mode decision-making.

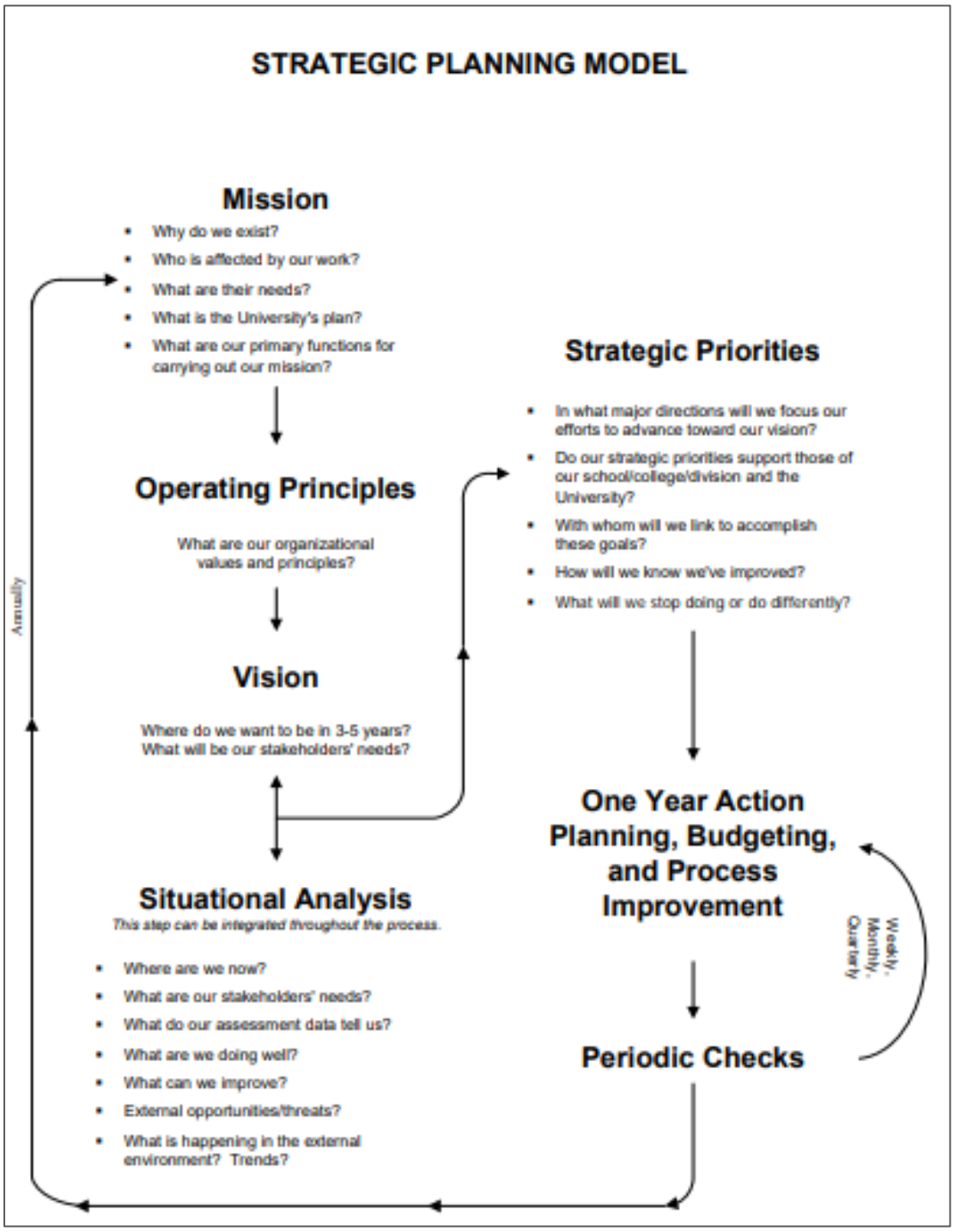

Fig. 1 Strategic plan model proposed by UW-Madison

3. What is a Quality Management System?

A quality management system (QMS) is a group of procedures and processes that help a business achieve high-quality results. Quality management can vary depending on the industry, but it involves creating strategies to ensure products and designs meet a certain standard. A QMS is a system that professionals can use in the quality management process. It may include documents, procedures or processes.

Implementing a quality management system affects every aspect of an organization's performance. Benefits of a documented quality management system include:

- Meeting the customer's requirements, which helps to instil confidence in the organization, in turn leading to more customers, more sales, and more repeat business
- Meeting the organization's requirements, which ensures compliance with regulations and provision of products and services in the most cost- and resource-efficient manner, creating room for expansion, growth, and profit.

These benefits offer additional advantages, including:

- Defining, improving, and controlling processes
- Reducing waste
- Preventing mistakes
- Lowering costs
- Facilitating and identifying training opportunities
- Engaging staff
- Setting organization-wide direction
- Communicating a readiness to produce consistent results

Each element of a quality management system helps achieve the overall goals of meeting the customers' and organization's requirements. Quality management systems should address an organization's unique needs; however, the elements all systems have in common include:

- The organization's quality policy and quality objectives
- Quality manual
- Procedures, instructions, and records
- Data management
- Internal processes
- Customer satisfaction from product quality
- Improvement opportunities
- Quality analysis

Fig. 2 Quality Management System Principles

Organizations depend on their customers and therefore should understand current and future customer needs, should meet customer requirements and strive to exceed customer expectations (see Figure 3). In addition it is necessary to carry out a:

- adequate and effective identification of your customers
- adequate and effective identification and understanding of what your customers want, expect and need (now and in the future)
- understanding of why your customers may need your products or service
- understanding of how your customers currently feel about your organisation

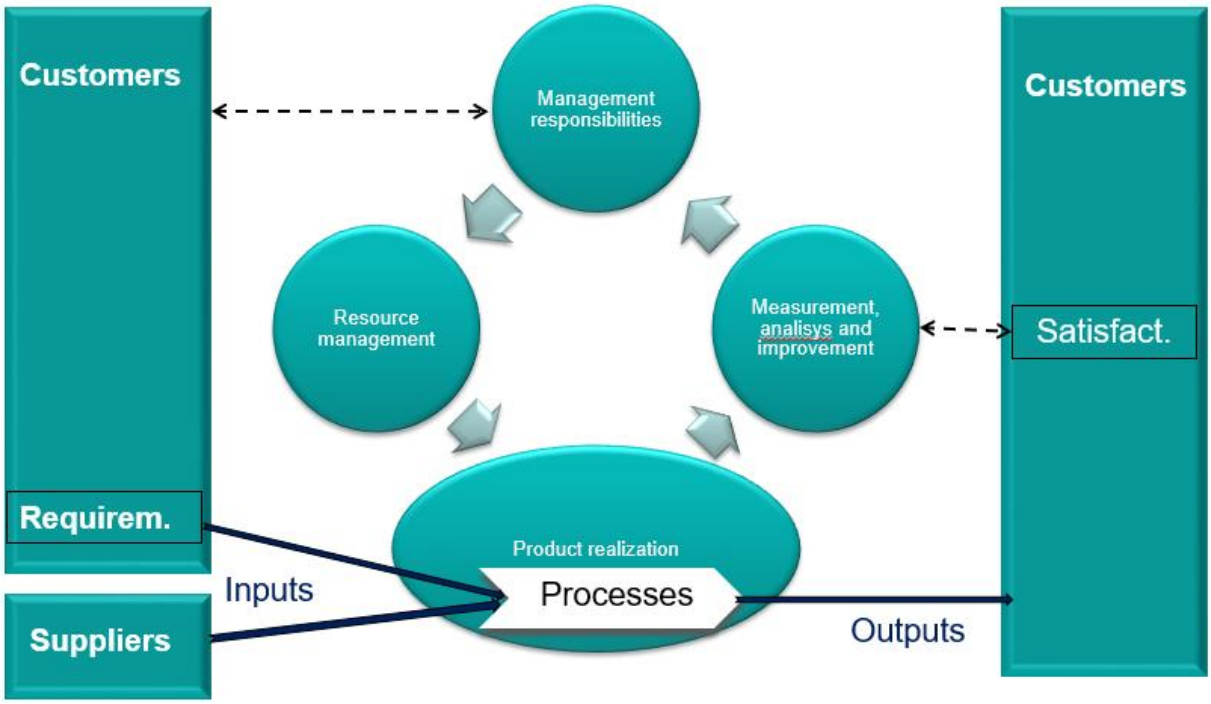

Fig. 3 QMS and customer satisfaction

ISO 9001 is defined as the international standard that specifies requirements for a quality management system (QMS). Organizations use the standard to demonstrate the ability to consistently provide products and services that meet customer and regulatory requirements. It is the most popular standard in the ISO 9000 series and the only standard in the series to which organizations can certify.

ISO 9001 was first published in 1987 by the International Organization for Standardization (ISO), an international agency composed of the national standards bodies of more than 160 countries. The current version of ISO 9001 was released in September 2015.

3.1 The Importance of ISO 9001?

ISO 9001: 2015 is an internationally recognized standard for the creation, implementation and management of a Quality Management System for any company. It is intended for use by organizations of any size or industry, as well as by any business. As an international standard, it is recognized as the basis for creating a system that ensures customer satisfaction and improvement in any company and, therefore, many companies have it as a minimum requirement for their suppliers.

It is for this reason that ISO 9001 has become a necessity for many companies to be competitive in the market.

A Quality Management System is based on the Seven Quality Management Principles behind ISO9001 requirements.

3.2 The Structure of ISO 9001

The structure of ISO 9001 is divided into ten sections. The first three are introductory, while the last seven contain the requirements relating to the Quality Management System. Below is a summary of the seven main sections:

- Section 4: Context of the organization - This section discusses the requirements for understanding an organization in order to implement a QMS. It includes the requirements for identifying internal and external problems, identifying stakeholders and their expectations, defining the purpose of the QMS and identifying the processes and how they interact.

- Section 5: Leadership - The leadership requirements concern the need for top management to be instrumental in the implementation of the QMS. Top Management must demonstrate commitment to the QMS by ensuring customer attention, defining and communicating the quality policy and assigning roles and responsibilities within the organization.

- Section 6: Planning - Top Management must also plan the ongoing operation of the QMS. It is necessary to evaluate the risks and opportunities of the QMS within the organization and the objectives for quality improvement and plans to achieve these objectives must be identified.

- Section 7: Support - The support section concerns the management of all resources related to the QMS and illustrates the need to control all resources, including human resources, buildings and infrastructures, work environment, monitoring resources and measurement and organizational knowledge. The section also includes requirements relating to the competence, awareness, communication and control of documented information (the documents and records required for the processes).

- Section 8: Operation - Operational requirements cover all aspects of planning and creating the product or service. This section contains requirements related to planning, reviewing product requirements, designing, auditing external suppliers, creating and deploying the product or service, and auditing non-compliant process results.

- Section 9: Performance Evaluation - This section includes the requirements necessary to ensure that you can monitor the proper functioning of your QMS. These requirements include process monitoring and measurement, customer satisfaction assessment, internal audits and management review of the QMS.

- Section 10: Improvement - This last section includes the requirements needed to improve your QMS over time. This includes the need to assess process non-conformities and the adoption of process-related corrective actions.

3.3 Principles of Quality Management

The 8 Principles of Quality Management are the foundations that the ISO 9001 certification is built on, developed by ISO/TC 176, an international organisation responsible for maintaining ISO's quality management standards. For organisations looking to improve their performance, these principles will guide your quality management program in the right direction (see Figure 4).

- **Principle 1: customer focus**

As you'd expect, customer focus is the first principle, right where it should be. It covers both customer needs and customer service. This principle stresses that a business should understand its customers, what they need and when. While trying to meet, but preferably, exceed customers' expectations.

As the business's ability to spot new customer opportunities and satisfy them improves — customer loyalty increases, revenue rises and waste is then reduced. More effective processes result in improved customer satisfaction overall.

- **Principle 2: leadership**

Without clear and strong leadership, a business flounders. Principle 2, is concerned with the direction of the organisation. The business should have clear goals and objectives, and ensure its employees are actively involved in achieving those targets.

The benefits are higher levels of employee engagement and increased motivation to satisfy customer needs. Research shows, if employees are kept 'in the loop' and understand the business vision, they'll be more productive. This principle seeks to rectify employees complaints about 'lack of communication'.

- **Principle 3: people involvement**

The process approach is all about efficiency and effectiveness. Well-managed processes reduce costs, improve consistency, eliminate waste and promote continuous improvement.

By becoming a more efficient organisation, you will build confidence in your stakeholders by optimising performance. Manage processes by making responsibilities clear and ensuring your resources are used in the best way.

- **Principle 4: process approach**

The process approach is all about efficiency and effectiveness. It's also about consistency and understanding that good processes also speeds up activities.

Great processes reduce costs, improve consistency, eliminate waste and promotes continuous improvement.

- **Principle 5: systematic approach to management**

ISO defines this principle as:

"Identifying, understanding and managing interrelated processes as a system contributes to the organisation's effectiveness and efficiency in achieving its objectives."

A business focuses its efforts on the key processes as well as aligning complementary processes to get better efficiency. This means that multiple processes are managed together as a system which should lead to greater efficiency.

- **Principle 6: continual improvement**

This principle is very straightforward: continual improvement should be an active business objective.

The benefits of this are clear: increased ability to embrace new opportunities, organisational flexibility and improved performance. Especially in difficult economic times, the businesses that thrive are those that can adapt to new market situations.

- **Principle 7: factual approach to decision making**

A logical approach, based on data and analysis, is good business sense. Unfortunately, in a fast-paced workplace, decisions can often be made rashly, without proper thought. Implementing the Quality Management Principles we've discussed will allow decisions to be made with clarity.

Informed decisions lead to improved understanding of the marketplace as data is collated and analysed, and the ability to defend past decisions.

- **Principle 8: mutually beneficial supplier relations**

This principle deals with supply chains. It promotes the relationship between the company and its suppliers; recognising it is interdependent. A strong relationship enhances productivity and encourages seamless working practices.

The result is optimisation of costs and resources, improving and building long-term relationships and the 'flexibility of joint responses to changing markets or customer needs and expectations'.

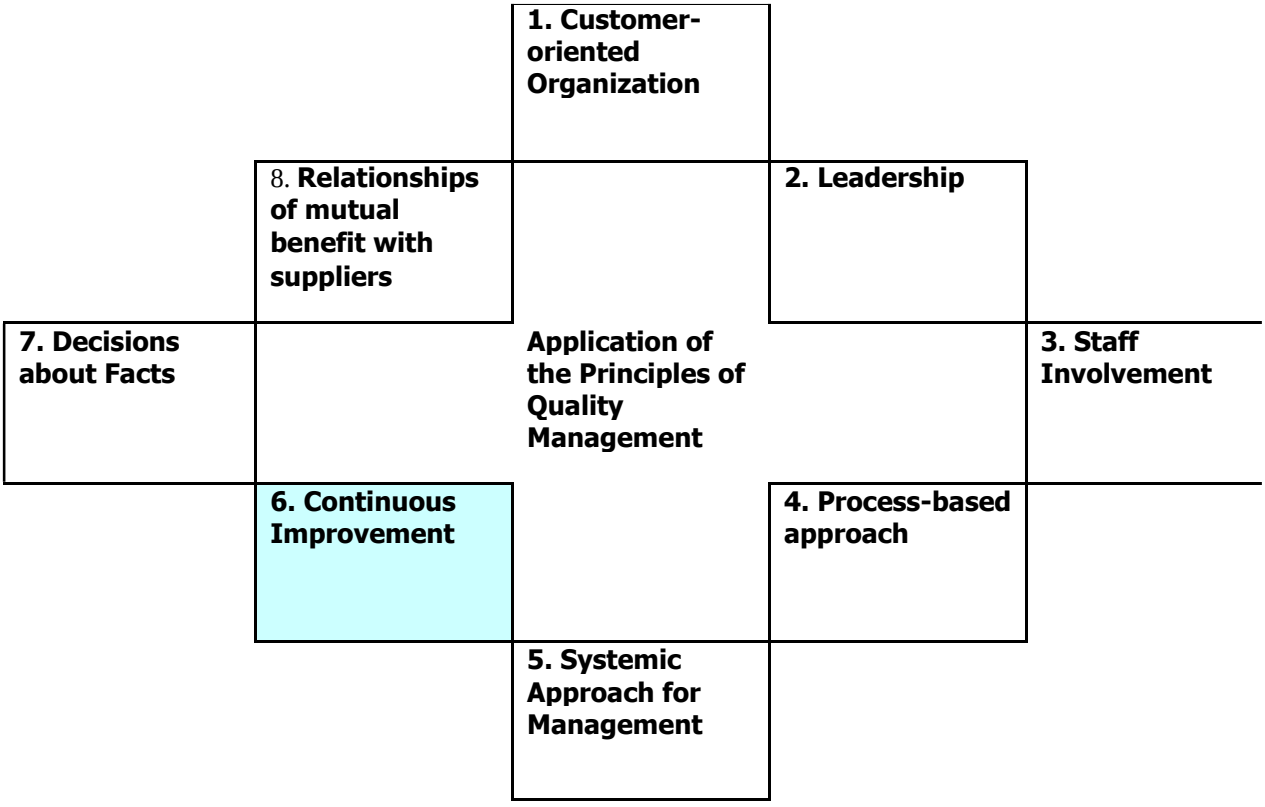

Fig. 4 Quality Management Principles

The Continuous Improvement is a kind of Super-principle that cross and influences all other principles. The Deming cycle is a continuous quality improvement model which consists of a logical sequence of four key stages: Plan, Do, Study, and Act.

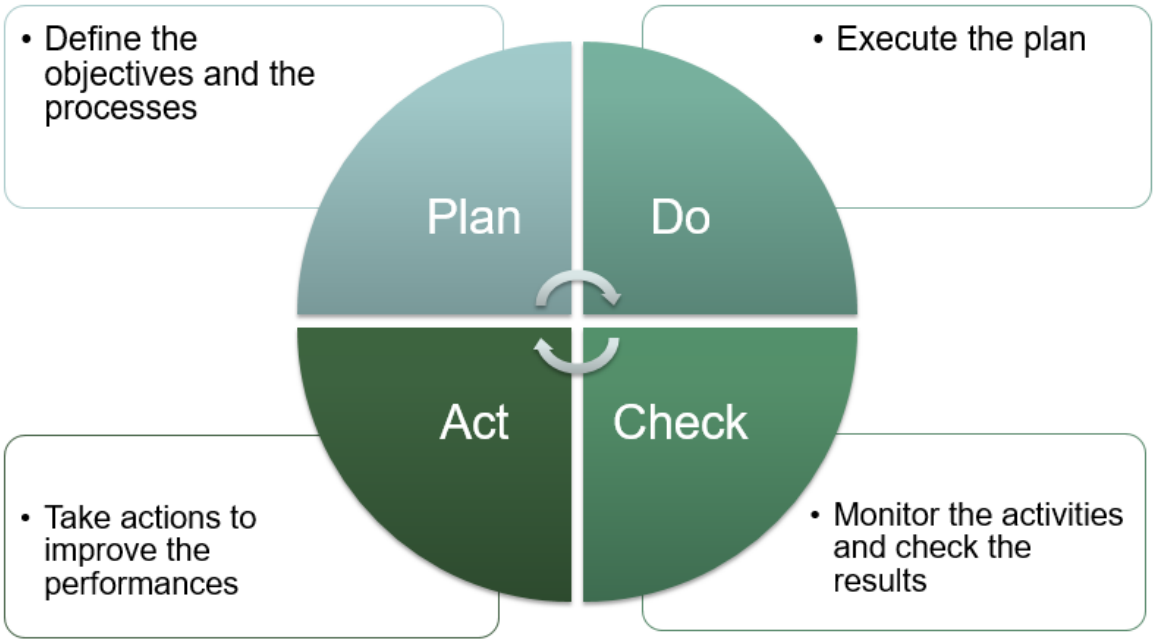

Fig. 5 The Deming Cycle PDCA continuous improvement

3.4 How to apply the Deming cycle

As we've established, the Deming cycle is a four-stage approach to continuous improvement. This section describes each of the four stages, and explains how you can implement each stage into your business to continuously improve quality and processes.

The four steps of the PDCA Cycle (or Deming Cycle, see Figure 5) are:

- **Plan**: Find and note down opportunities; Analyze problems that are present; Plan changes and steps to be made to your findings and problems
- **Do**: Implement the solution (ideally, on a smaller scale or a controlled testbed) & note down observations and findings
- **Check (Study)**: Study your findings and observations from your "testing" phase & make changes to the steps as necessary
- **Act**: Implement or improve the process

- ***Plan***

This stage involves planning the end goal and the process to be followed to reach it. In case you are looking to improve or solve a problem in an existing process, this is where you gather all the necessary information and steps that might help resolve the issue.

This stage involves a lot of analysis to find out the causes and fixes for the issues you are currently facing.

- ***Do***

This stage involves implementing the fixes and solutions that materialized during the planning stage. As a precautionary measure, it is recommended to implement the changes on a smaller scale, as a test, to find out whether the solution proves to be useful or not.

This is where you can benefit from setting up and implementing your changes in a small, controlled test environment. This not only helps give provide insight into the effectiveness of changes but also better understand “why” the outcome improved.

- ***Check (Study)***

This stage involves checking the results obtained from your trial runs for changes and improvements. If there are still issues or problems arising, then find out the causes and come up with a better solution.

  - It is advisable to ask the following questions –
  - “Will the proposed changes work on a larger scale?”
  - “Did the changes work?”
  - “Why did the changes work?”
  - “Is there more opportunities?”
  - “Can the plan be further refined?”

This might seem trivial at first but checking helps avoid further mistakes down the line and when the changes are implemented on a larger scale.

- ***Act***

This is the final phase were the recommended changes and tested processes are finally implemented in their entirety.

But, though this is the final process the cycle does not end here. In case there are further changes to be made, observations from this step are to be taken and the cycle is to be restarted once again.

This PDCA Cycle is to be followed until all the necessary expectations are met and there is no necessity of further changes down the line.

The PDCA Cycle (or Deming Cycle) helps reduce problems into smaller chunks, making it easier to tackle. It helps in the development of new products, services, process and solutions. It can be applied for most businesses and industries – however small or big it might be. It is a flexible model – you are free to use the methods and process for coming up with results in all of the four steps It helps promote the continuous development of the established systems and processes.

4. Quality Managers

The role of quality manager is common at many companies, and this individual has often been designated as the quality management representative that was required in the previous version of ISO 9001. This section describes what requirements are in the new Quality Management System (QMS) standard and how they could be implemented (see Figure 6.).

Quality Manager (QM) is a professional ever and ever requested both in private and in public sector.

The QM cooperates with the personnel at every levels and must have good relationship capacities, having also every techniques and instruments to monitor every times the internal processes and their performance. Due to the high dynamic of a university staff, both administrative and academic, must have the competencies of a QM, being able to be charged on this role in every moment.

Fig. 6 The ISO 9001 requirements for Quality Managers

Understanding the needs of interested parties: performing this task and keeping the information up to date is one task that is often within the job description of the quality manager.

Establishment and continual improvement of the QMS processes: Once the company processes and their interactions are determined and implemented, this process flow mapping needs to be maintained in order to track the continual improvement of the QMS. Maintaining an overall process integration flow is one activity that many quality managers perform.

- **Customer focus and product conformity:** When looking at customer focus, there is a need to determine the risks and opportunities that can affect product conformity. Managing the risks and opportunities for product quality could be one of the tasks of the quality manage.
- **Responsibility and authority for the QMS:** there is a need for top management to assign responsibility and authority for many activities of the QMS such as ensuring QMS conformance, promoting customer focus, and reporting on QMS performance. A quality manager has been the traditional employee to be given this responsibility.
- **Quality objectives:** Monitoring the quality objectives that have been established and reporting this to top management is another traditional role of the quality manager. Having one person focus on the management of this important activity is a good idea to provide focus and direction.
- **Internal and external communication:** Communicating with customers on quality matters is most easily done if you have one point of contact such as a quality manager. This way your customers know the best person to call to get answers when problems occur, rather than taking time to find the right person. Likewise, it is best if your employees receive QMS information from one source. A quality manager is ideal to fill these roles.
- **Release of products and services:** the requirements ask that you determine the planned arrangements to verify the products and services and indicate that the products and services have successfully met the requirements. The people who perform these inspections often report to a quality manager, so the quality manager would direct and control these operations within your company.
- **Internal audit planning & management:** Of all the requirements for performance evaluation, the requirements for managing the internal audit most easily fit into the traditional role of a quality manager. Having one overall person responsible for this activity can once again focus the resources to perform the auditing role within the company. The quality manager can provide this focus, direction, and control for QMS audits.
- **Nonconformity and corrective action:** Having a quality manager in charge of the nonconformity and corrective action processes is another traditional role of the quality manager. With one owner, these processes that are used throughout the organization can be better controlled so that one process is used everywhere and best practices are incorporated by everyone.

5. Shyfte 4.0 Formation Quality Plan

The objective of this training plan is to train the trainers to the basic of Quality Management System according to ISO 9001.

The training was conducted physically and remotely in two different didactic modules:

- The first module concerns the principles of the quality management system, reference standards and certification.
- The second module, the principles of the QMS were developed in detail, focusing on the ISO 9001: 2015 standard.

The course is aimed at company quality functions, consultants on company certifications, production managers, company managers, purchasing managers.

Number of Participants	30/40
Duration	2 modules of 2 hours
Frequency	Each participant is required to attend for the entire duration of the course.

Each participant is issued a certificate of acquired skills.

Fig. 7 Quality Management System Awareness Certificate

The course aims to:

- Give to the participants all the directives to realize a system of internal controls and process setting/reengineering
- Give the instruments to set up and improve a QMS
- Give a general knowledge on the instruments and techniques used in the customer satisfaction measurement
- Give all the instruments to evaluate, in economic terms the advantages deriving from the implementation of a QMS

The educational program includes:

1st Module

- "Introduction to Quality Management"
  - Quality concept and its evolution;
  - The main principles of the quality management;
  - The norms and the principle of certification.

2nd Module

- "Quality Management Systems Principles"
  - The role of ISO 9001:2015 assessing the quality of process;
  - To specify the way of management a QMS and the related tasks;
  - The deming wheel and the indicators for continuous improvement.

- "The ISO 9001:2015 standard and the processes management"
  - To provide the main principles of the ISO 9001:2015 norm;
  - The principles of the process management approach;
  - The basics of the processes monitoring and improvement.

The course was held physically and online and the material was delivered to the selected trainers. Courses documentation (dispenses), slides, guidelines of the Audit Development.

Upon completion of the course, participants are able to:

- Explain the purpose and intent of the set of standards on Quality management systems
- Understand the application of quality management principles
- Explain the relationships between the clauses of ISO 9001: 2015

Possible Tips

- Capacity to manage a Quality Management System;
- Capacity to analyse processes in a Quality perspective;
- Capacity to manage and enhance the diffusion of Quality Culture;
- Capacity to manage and enhance the projects and actions related to Quality improvement.

6. Shyfte 4.0 Questionnaire for students and trainers involved in the program

The evaluation of the teaching is based on the continuous improvement of the quality of the training activities and related support services. The main purposes pursued are visible in increasing the attractiveness of the topic.

The evaluation is necessary to understand what are the shortcomings of the course to be filled and the characteristics to be improved.

Trainers evaluation is a process used to review trainers performance and effectiveness. The feedback from teacher evaluations can be used to improve instructional methods and strategies which, in turn, will improve the student experience. That last part is key, as feedback that comes directly from students helps teachers hone their teaching styles, identify learning gaps, address obstacles in their classrooms, and more.

6.1 Why is it important to evaluate trainers?

It can't improve the quality of teaching without first understanding what needs improvement. The goal of teacher evaluations, particularly a teaching survey for students, is to collect insights that can be used to take action. A solid system of teacher evaluation will:

- Assess the effectiveness of instruction, so you can repeat successful strategies and rework those that don't resonate with students.
- Clarify professional development needs, so you can seek out the training or resources that will fuel your teaching.
- Identify gaps in tools, support, and funding that may have prevented students from grasping a concept or fully engaging in the classroom.
- Provide evidence of growth and valuable data that you can use to inform your instruction or advance your career.

6.2 Evaluation Questionnaire

In order to evaluate the effectiveness of the learning program, a questionnaire for students and trainers was created.
The questionnaire asks various kinds of questions:

- concerning the congruence of the subjects, or if the workload is proportional to the lessons provided;
- on the quality of teaching: if a professor is not only prepared, he or she has qualities such as clarity, availability and ability to pass on the subject to students (fundamental characteristics for a professor);
- regarding the topic discussed: if there is interest and motivation in the specific topic.

The responses are organized according to a four-point Likert scale, with a score ranging from 1 ('strongly disagree') to 4 ('strongly agree') (Thirupathi and Vinodh, 2016).

6.3 Questions for training of the trainers (ToT)

Q1. Did the trainer(s) assigned a correct workload?	Score
	1. Strongly disagree;
	2. Somewhat disagree;
	3. Somewhat agree;
	4. Strongly agree.

Q2. Did the trainer(s) provide suitable learning material to teach the specific topic?	Score

Q3. Did the learning method of trainer(s) stimulate interest in the specific topic?	Score

Q4. The degree of explanation of the trainer(s) is adequate for this topic?	Score

Q5. Do you think that the trainer(s) owns complete experience to teach this topic?	Score

Q6. Do you think to understand the most part of explaination?	Score

Q7. Did the trainer(s) expose focus on practical cases?	Score

Q8. Did your trainer(s) respond to your queries in a timely manner?	Score

Q9. After attending this training, are you comfortable to be a trainer yourself?	Score

6.4 Questions for training of students (TOS)

Q1. Was the preliminary knowledge owned sufficient to understand the topics?	Score
	1. Strongly disagree;
	2. Somewhat disagree;
	3. Somewhat agree;
	4. Strongly agree.

Q.2. Is the teaching workload proportional to the work assigned?	Score

Q.3. Is the teaching material (indicated and available) suitable for the study of the topic?	Score

Q.4. Have the evaluation methods been clearly defined?	Score

Q.5. Are the lessons, exercises and other teaching activities carried out in accordance with the timetable?	Score

Q.6. The interest in the topic is correctly stimulated or motivated?	Score

Q.7. Are the topics clearly explain?	Score

Q.8. Are the other teaching activities (exercises, games, simulation, etc.) useful for learning the topic?	Score
Q.9. Clarification and explanation are always given by the trainers?	Score

Q.10. Are you interested in the topics covered?	Score

Q.11. Have you recently developed new skills or abilities?	**Score**
Q.12. What is the degree of achievement of the objectives?	**Score**
Q.13. Did you keep your class schedule?	**Score**
Q.14. Have you always been cooperative?	**Score**
Q.15. Have you shown proper communication?	**Score**
Q.16. Did you use specific and appropriate language?	**Score**
Q.17. Did you perform the assigned tasks, respecting times and methods?	**Score**
Q.18. Within the topics thought, do you think that has been of your interest "Approaches and methods for value chain management"?	**Score**
Q.19. Within the topics thought, do you think that has been of your interest "Quality Management System"?	**Score**
Q.20. Within the topics thought, do you think that has been of your interest "Environmental Impact Assessment"?	**Score**
Q.21. Within the topics thought, do you think that has been of your interest "Maintenance Management"?	**Score**
Q.22. Within the topics thought, do you think that has been of your interest "Production Scheduling"?	**Score**

6.4.1 Questions for trainers

Q.23. Did the students create a positive working atmosphere?	**Score**
Q.24. During the exercises and group work did the students work fairly?	**Score**
Q.25. Did the students interact with the trainers during the lessons?	**Score**
Q.26. Is the teacher satisfied with the students' learning?	**Score**

Questions specific to each of the Shyfte four domains

Software Engineering and Bigdata Analysis domain	
-	
Q.27. How do you think the students practically acquired the "BigData Technology" methods and approaches?	**Score**
Q.28. How do you think the students acquired "Approaches and methods for Artificial Intelligence" to put that in practice?	**Score**
Q.29. How do you think the students practically acquired "Critical Thinking Oriented BigData" to be able to conduct critical thinking?	**Score**
Q.30. Was "Smart Decision Making with BigData" practically put enough in practice?	**Score**
Q.31. Was "Data Mining Ideology and Technology" practically put enough in practice?	**Score**

Industrial Engineering and Management	
-	
Q.32. Was "Human Resource Management" practically put enough in practice ?	**Score**
Q.33. Was "Communication" practically put enough in practice ?	**Score**
Q.34. Was"Project Management" practically put enough in practice?	**Score**
Q.35. How do you think the students practically acquired "Role of Data for Future Organization" to be able to use design databases and basic functions of SQL?	**Score**
Q.36. How do you think the students practically acquired "Business Inteligence" to be able to use Power BI for business analysis?	**Score**
Q.37. How do you think the students practically acquired "New Product Development" for new product management in practice?	**Score**
Wireless Networks and Analytics	
-	
Q.38. How do you think the students practically acquired the "Introduction to Cybersecurity" methods and approaches?	**Score**
Q.39. How do you think the students acquired "Data Acquisition and Analysis" to put that in practice?	**Score**
Q.40. How do you think the students practically acquired "Data Governance and Management" to be able to practice Quality Management?	**Score**

Q.41. Was "Introduction to Energy Management" practically put enough in practice?	**Score**
Q.42. Was "Renewable Energy for Wireless Networks" practically put enough in practice?	**Score**
Q.43. Was "Green Energy Wireless Networks" practically put enough in practice?	**Score**
Artificial Intelligence domain	
-	
Q.44. How do you think the students practically acquired the "Fundamental of AI" methods and approaches?	**Score**
Q.45. How do you think the students acquired "Supervised and unsupervised learning" to put that in practice?	**Score**
Q.46. How do you think the students practically acquired "Neural Network computing" to be able to practice?	**Score**
Q.47. Was "Convolutional Neural Network" practically put enough in practice?	**Score**
Q.48. Was "Advanced Machine Learning for Big Data" practically put enough in practice?	**Score**
Q.49. Was "AI for industry" practically put enough in practice?	**Score**

7. Key Performance Indicators for Quality Assurance

The key quality indicators or Key Performance Indicators (KPIs), are measurable values with the aim of demonstrating how effectively an organization is pursuing the objectives it has set itself and, consequently, to evaluate its overall success.

They should be identified when developing the quality policy and the choice of the right ones should depend on the sector in which you operate and which part of the business you want to actively monitor. Their main utility is to monitor the level of implementation of the organization's objectives, in order to correct their progress, if needed.

It is important that the main indicators are specific to the organization and directly connected with the strategic objectives, with the vision and mission of an organization and that they take into account the requirements of internal and external customers.

The aim of being able to count on a constantly updated collection of KPIs is to provide management with important information so that it can make the right decisions and guide the course of action if, for example, there is a risk that a goal will not be achieved.

Indicators can be of different types depending on the area they need to monitor. Here are some examples that certainly do not claim to be exhaustive.

7.1 Key performance indicators for Shyfte 4.0 quality assurance (Training of trainers)

1) **Effectiveness Indicator (EI) - Planned teaching and Teaching provided**
   This indicator will help us evaluate the training commitment undertaken by the organization towards students, with respect to the teaching actually provided.

   How is calculated this quality KPI?

$$EI = \frac{Level\ of\ programmed\ teaching}{Level\ of\ teaching\ provided}$$

   Consider the following questions for the planned teaching:

   - Did the trainer(s) assigned a correct workload?
   - Did the trainer(s) provide suitable learning material to teach the specific topic?

   Consider the following questions for the teaching provided:

   - Did the learning method of trainer(s) stimulate interest in the specific topic?
   - The degree of explanation of the trainer(s) is adequate for this topic?
   - Do you think that the trainer(s) owns complete experience to teach this topic?

2) **Customer Service Indicator (CSI)– Students Complaints**
If the students are complaining a lot, it's a sign that things are not going well at all.

This indicator is based on the following question:

- Did the trainer(s) provide suitable learning material to teach the specific topic?
- Did you understand the content of the module?
- Did your trainer(s) respond to your queries in a timely manner?

This indicator can also be assessed considering the workload of the teaching and the teaching material provided to the student:

$$CSI = \frac{teaching\ workload}{teaching\ material}$$

3) **Productivity Index (PI)**
Refers to the teacher's responsibility for student learning.

It is based on the following questions:

- Did the learning method of trainer(s) stimulate interest in the specific topic?
- The degree of explanation of the trainer(s) is adequate for this topic?
- Did you understand the content of the module?

$$PI_m = \frac{Teacher\ Motivation}{Student\ learning}$$

$$PI_e = \frac{Ability\ to\ explain}{Student\ learning}$$

4) **Efficiency Indicator (E_fI)**
It refers to the teacher's ability to arouse interest in students for the different module titles.

This indicator is based on the following questions:

- Did you understand the content of the module?
- Did the learning method of trainer(s) stimulate interest in the specific topic?

$$E_f I_{SM} = \frac{Teacher\ Motivation}{Interest\ in\ a\ specific\ Module}$$

5) Impact Indicator (II)

This indicator allows us to make a correlation between the module in order to evaluate what is most interesting, attractive to trainers.

This indicator is based on the following questions:

- Did you understand the content of the module?
- After attending this training, are you comfortable to be a trainer yourself?

$$\mathrm{II}_{SMP} = \frac{Interest\ in\ a\ specific\ Module}{interest\ in\ the\ topics\ covered}$$

6) Load indicator (I_{lo})

These indicators evaluate the training commitment undertaken by the trainers and their skills.

$$I_{lo} = \frac{workload\ value}{Max\ Score}$$

7) Compliance indicator (I_c)

Through this indicator, the proportionality of the teaching material with respect to the study topic is assessed.

$$I_c = \frac{suitable\ teaching\ material}{Max\ Score}$$

8) Level indicators (LI_{pk}, LI_{st})

to evaluate the explanation of trainer and supplementary activities.

$$LI_{pk} = \frac{Importance\ of\ preliminary\ knowledge}{Max\ Score}$$

$$LI_{st} = \frac{Importance\ of\ supplementary\ teaching\ activitiese}{Max\ Score}$$

9) **Level indicators (LI_e, LI_a)**
to evaluate the learning of the topics.

$$LI_e = \frac{teacher\ skills}{Max\ Score}$$

$$LI_a = \frac{teacher\ available}{Max\ Score}$$

7.2 Key performance indicators for Shyfte 4.0 quality assurance (Training of sudents)

1) Effectiveness Indicator (EI) - Planned teaching and Teaching provided

This indicator will help us evaluate the training commitment undertaken by the organization towards students, with respect to the teaching actually provided.

How is calculated this quality KPI?

$$EI = \frac{Level\ of\ programmed\ teaching}{Level\ of\ teaching\ provided}$$

Consider the following questions for the planned teaching:

- Was the preliminary knowledge owned sufficient to understand the topics?
- Is the teaching workload proportional to the work assigned?
- Is the teaching material (indicated and available) suitable for the study of the topic?
- Have the evaluation methods been clearly defined?

Consider the following questions for the teaching provided:

- Are the lessons, exercises and other teaching activities carried out in accordance with the timetable?
- Does the trainer stimulate / motivate interest in the topic?
- Does the teacher explain the topics clearly?
- Are the other teaching activities (exercises, games, simulation, etc.) useful for learning the topic?

2) **Customer Service Indicator (CSI)– Students Complaints**
If the students are complaining a lot, it's a sign that things are not going well at all.

This indicator is based on the following question:

- Is the teacher available for clarifications and explanations?

This indicator can also be assessed considering the workload of the teaching and the teaching material provided to the student:

$$CSI = \frac{teaching\ workload}{teaching\ material}$$

3) **Productivity Index (PI)**
Refers to the teacher's responsibility for student learning.

It is based on the following questions:

- Does the teacher stimulate / motivate interest in the topic?
- Does the teacher explain the topics clearly?
- Are the other teaching activities (exercises, games, simulation, etc.) useful for learning the topic?

$$PI_m = \frac{Teacher\ Motivation}{Student\ learning}$$

$$PI_e = \frac{Ability\ to\ explain}{Student\ learning}$$

4) **Efficiency Indicator (E_fI)**
It refers to the teacher's ability to arouse interest in students for the different domains examined.

This indicator is based on the following questions:

- Did you understand the content of the module?
- Did the learning method of trainer(s) stimulate interest in the specific topic?

$$E_f I_{SM} = \frac{Teacher\ Motivation}{Interest\ in\ a\ specific\ Module}$$

5) Impact Indicator (II)

This indicator allows us to make a correlation between the domains in order to evaluate what is most interesting, attractive to students.

This indicator is based on the following questions:

- Did you understand the content of the module?
- After attending this training, are you comfortable to be a trainer yourself?

$$\mathrm{II}_{SMP} = \frac{Interest\ in\ a\ specific\ Module}{interest\ in\ the\ topics\ covered}$$

6) Load indicator (I_{lo})

These indicators evaluate the training commitment undertaken by the trainers and their skills.

$$I_{lo} = \frac{workload\ value}{Max\ Score}$$

7) Compliance indicator (I_c)

Through this indicator, the proportionality of the teaching material with respect to the study topic is assessed.

$$I_c = \frac{suitable\ teaching\ material}{Max\ Score}$$

8) Level indicators (LI_{pk}, LI_{st})
to evaluate the learning of the topics.

$$LI_{pk} = \frac{Importance\ of\ preliminary\ knowledge}{Max\ Score}$$

$$LI_{st} = \frac{Importance\ of\ supplementary\ teaching\ activitiese}{Max\ Score}$$

9) Level indicators (LI_e, LI_a)
to evaluate the learning of the topics.

$$LI_e = \frac{teacher\ skills}{Max\ Score}$$

$$LI_a = \frac{teacher\ available}{Max\ Score}$$

7.3 Possible Tips

- Lighten the overall workload;
- Increase the didactic support activity;
- Provide more basic knowledge;
- Improving the quality of the teaching material;
- Provide teaching materials in advance;
- Insert intermediate evaluation tests;
- Activate evening or weekend lessons.

8. Conclusion

Making quality, in the context of training, allows us to establish learning objectives and to implement what is needed so that trainees have the opportunities to actually reach them.

Ensure the quality consists in measuring, evaluating and estimating the closeness between pre-established objectives and results obtained. Quality Assurance is the set of activities put in place to produce adequate confidence that the Quality objectives will be met. An essential component is the production of evidence suitable to demonstrate the degree of correspondence between the expected results and those obtained.

ISO 9001 quality certification is certainly an important goal for universities that aspire to continue their growth path, gaining market share and retaining existing customers by guaranteeing excellent product or service quality constantly over time, reducing their costs of production.

The implementation of the UNI EN ISO 9001: 2015 Quality Management System involves first of all an analysis of the University, of its organization, of the production processes, and then a work of designing and fine-tuning the system.

Subsequently it will be essential to involve all the staff, explaining the fundamentals of a Quality System, the quality policy of the organization in general, and finally the procedures and work instructions must be illustrated, the ways in which the university in all its individual components (administrative, researchers, teachers) guarantees constant quality over time for its customers (students, companies…), in compliance with established standards.

Within the framework of the Shyfte project, we have developed processes and KPI's, based on ISO 9001 standard, to cover all stages of the training of students and companies.

These processes, procedures and KPI's have been integrated into the Learning Centers to allow for continuous process evaluation and improvement.

Annexes A : References

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