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**Assessing the Implementation of Quality Management System ISO 9001:2015
for the Tunisian Construction Companies**

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Abstract

The global construction market is currently worth \$9.5 trillion. With an estimated volume output growth of 85% by 2030, it is going to register an increase of a \$6 trillion in its value. The construction industry is a vital industry to achieve economic prosperity. Nonetheless, Tunisia, among other developing countries, is facing some barriers, affecting its construction companies' performance, specifically when it comes to quality and cultural practices.

In 2013, this dynamic industry is contributing by 7% to the Tunisian GDP (\$3.3 billion), employing 3,555 people in total, and is expected to grow by 1.54% in the next four years. Nevertheless, this industry is facing a competitiveness problem. With only 11.2% of ISO 9001 certified companies, this industry is lacking some quality practices.

The review of literature has demonstrated the relevance of the QMS and ISO 9001 certification in construction. They enhance companies' performance, by ensuring cost efficiency and customer satisfaction. However, implementing such a system does not necessarily validate its effectiveness. Previous studies have shown that the organizational culture is underrated in this field, while it is a critical component of ensuring the success of the implementation of QMS.

The objective of this thesis is to answer the following questions that arise from this context:

- *What is the construction companies' effectiveness in achieving the principles of ISO 9001 in Tunisia?*
- *What is the impact of the implementation of QMS by construction companies on its performance?*
- *What are the principal barriers to the implementation of the ISO 9001 in Tunisia?*

The methodology used, in this context, includes a primary research of the ISO 9001 practices in the global market, and a survey distributed to 15 ISO 9001 certified Tunisian companies working in construction. It identified the barriers related to this matter, examines the current status of the QMS implementation. A specific company was then selected to evaluate the contribution of ISO 9001 certification towards achieving its qualitative objectives in quality management and its financial performance. This assessment has been effectuated based on the most relevant tangible and intangible KPIs of the company. The outcomes from this research led to a set of recommendations that would help companies in the Tunisian construction industry improve the effectiveness of their QMS and enhance their customer satisfaction and their competitiveness.

Keywords: Quality Management System, Tunisia, Construction industry, ISO 9001.

Content

- 1. Introduction 5**
 - 1.1. Problem Statement..... 5**
 - 1.2. Research Aim and Objectives..... 7**
- 2. Literature Review 7**
 - 2.1. Quality Management Systems in Construction 7**
 - 2.1.1. Quality Definition in Construction Industry7
 - 2.1.2. The Effectiveness of Implementing a QMS 8
 - 2.2. ISO: International Standards Organization..... 9**
 - 2.2.1. ISO and ISO 9001 9
 - 2.2.2. ISO 9001 and its Benefits 10
 - 2.2.3. The New Version of ISO 9001: 2015 11
 - 2.3. Barriers in Implementing Quality Management Systems 11**
 - 2.4. The Existing Use of the ISO 9001 in Tunisia – Construction Companies 12**
 - 2.5. Research Gaps 13**
- 3. Methodology 14**
 - 3.1. Questionnaire Design 15**
 - 3.2. Assessment of EGMS: Impact of the ISO 9001 on the Performance of the Company 16**
- 4. Analysis of the Survey and the QMS Company’s Assessment..... 17**
 - 4.1. Analysis of the Survey..... 17**
 - 4.1.1. Respondents’ Profile 17
 - 4.1.2. Effectiveness of the QMS Implementation..... 18
 - 4.1.3. Barriers for ISO 9001 Implementation 18
 - 4.1.4. Companies Performance 19
 - 4.1.5. Organizational Culture 20
 - 4.2. EGMS Assessment: Impact of the ISO 9001 on the Company’s Performance 20**
- 5. Assessment of the Companies Behavior towards ISO 9001 21**
 - 5.1. Existing Barriers and Their Impact on the Effectiveness of the QMS and the Companies’ Performance 21**
 - 5.2. The Impact of the Tunisian Construction Companies’ Culture..... 23**
 - 5.3. Limitations and Recommendations..... 24**
 - 5.3.1. Limitations 24
 - 5.3.2. Recommendations 25
- 6. Conclusion 25**
- References 26**

1. Introduction

1.1. Problem Statement

The construction industry is considered as one of the few sectors that entirely reflect the economic growth, the gross fixed capital formation, the employment condition, and the quality life of a country. It is forecasted that the global growth of the volume of construction output will reach 85% in 2030 with projects valued at \$15.5 trillion (PWC, 2016).

Trends regarding this industry show that it is going to witness a drastic growth, in the forthcoming years. The emerging countries in Asia, Africa, Latin America, Middle East, and Eastern Europe will constitute the most contributors to this change, due to the economic and demographic growth that is accelerating the urbanization process. Construction companies, in these emerging countries, will achieve a total of \$6.7 trillion of profit, which constitutes 57% of the global contribution (Accenture, 2012).

The North African region is currently having 8 ongoing construction projects (Deloitte, 2014). Even if this number has declined compared to 2013 (22 projects), the value raised for these projects has increased by US \$2.4 billions, which represents a rise by 26.7%. And Tunisia is one of the countries where this industry will witness a higher growth in the four next years after a historical growth rate of 0.30% in the last four years. This forward growth is estimated to be at 1.54% for the next four years, with an amount of US \$2.275 billions but it is still low compared to the forecasted global growth of the construction industry (3.9%) due to investors' reluctance towards the political transition of the country. However, the approval of the new constitution, in 2014, is helping the country in regaining its political stability and economic growth. Historical valuations show that this industry was contributing by 7% to the GDP of Tunisia in 2013, and was ranked fourth in the national economy (Leaders, 2013).

New trends indicate that this dynamic industry will have a bigger economic impact, with the new Tunisian infrastructure agenda of building railways, roads, bridges, and buildings. The

government has a planned budget of 1.30 billion euros allocated for this agenda. In addition, the increasing demand for housing and the boom in renewable energy are fostering the growth of the construction industry. The government is also undertaking some financial measures to lower taxes for foreign investors, and thus improving construction facilities, as planned (Timetric, 2016), which increases the competition in this industry for local companies. Tunisia is lacking big-sized construction companies, with high competency, to match the forecasted demand in infrastructure and public projects.

Now, the major challenge Tunisian construction companies are facing is to capture the new market demand. And to conquer these new projects, these companies need to reinforce the quality of their workforce and activities. Nonetheless, there are some barriers that impede them to perform as expected, causing delays in finishing ongoing projects. Changing the existing prevailing culture is not that simple, and quality management is the key to cope with the expected growth, and increase in the number of new projects, for several reasons:

- 1- Getting the permit to work on some specific projects, where ISO 9001 is required
- 2- Improving company's reputation
- 3- Competing against international companies
- 4- Complying with international standards.
- 5- Enhancing the overall company's performance

Companies in this sector are generally motivated to be certified in quality just in order to secure a minimum number of clients. Nonetheless, having this part documented in head offices, does not necessarily mean that the system is well embedded and applied in the company. In case of an invalid QMS, customer satisfaction can't be achieved.

The International Federation of Consulting Engineers has conducted a survey, showing that this phenomenon of poor quality in construction is actually a global issue. Some studies have shown that quality performance is linked to the management culture adapted within the

organization (Corbett and Rastick, 2000). This might be one of the reasons the construction companies are witnessing low performance in quality management.

1.2. Research Aim and Objectives

This thesis is intended to bring guidance, in the Tunisian construction industry, for the implementation of quality management systems. To assess the current status of the companies in their implementation of the QMS, three questions were established:

- *What is the construction companies' effectiveness in achieving the principles of ISO 9001 in Tunisia?*
- *What is the impact of the implementation of QMS by construction companies on its performance?*
- *What are the principal barriers to the implementation of the ISO 9001 in Tunisia?*

2. Literature Review

Quality management started to become a concern to industries since the mid 20's when Walter A. Shewhart invented the control chart, a statistical process control tool. He made the process's quality matter as much as the quality of the final product. This was the first tool used to control processes and, consequently, risks related to quality in a company (Smith, 2009).

2.1. Quality Management Systems in Construction

2.1.1. Quality Definition in Construction Industry

Quality has different meanings, depending on the context. It can be regarded as a contractual requirement, an achievement of standards, or customer satisfaction (Chung, 1999). According to the International Organization of Standardization, quality is the "totality of characteristics of an entity that bears in its ability to satisfy stated or implied needs" (ISO 8402:1994). In construction, quality might be a more complex word. Chung (1999) states that "Quality of construction is even more difficult to define. First of all, the product is usually not a repetitive

unit but a unique piece of work with specific characteristics. Secondly, the needs to be satisfied include not only those of the client but also the expectations of the community into which the completed building will integrate. The construction cost and time of delivery are also important characteristics of quality”. When it comes to this industry, the set of activities is based on a learning curve. Every project that the company decides to undertake differs from the previous projects. It is different from manufacturing products or service industries, where quality depends heavily on the final product or service. Quality in construction is principally about construction control. It is defined as “that aspect of the overall management function that determines and implements the quality policy” (Lam, Low and Teng 1994). It is fundamental for construction companies to have an understanding of quality in order to implement a successful quality management system. A construction project can only be associated with high quality, if all the management processes have been relying on a QMS (Hoyle, 1997). This is considered as a strategic goal, when companies thrive to achieve customer satisfaction.

2.1.2. The Effectiveness of Implementing a QMS

Many studies have been conducted to measure the importance of implementing a quality management system. Thomas J. Douglas and William Q. Judge Jr. studied the impact of Total Quality Management (TQM) System, a quality management approach, on company’s competitive advantage. Their findings show a significant correlation between the two. The adaptation of TQM had an independent and interdependent impact on the financial performance of the company (Douglas & William Q. Judge Jr, 2001). Another empirical study by Thomas C. Powell shows that it is not the quality system itself that has a direct impact, but the “open culture, employee empowerment, and executive commitment” it conveys, constitute a sustainable competitive advantage for the company (Powell, 1995). According to the empirical investigation conducted by Kevin B. Hendricks and Vinod R.

Singhal, the market value increases for quality awarded companies. These certifications also convey a decrease in systematic financial risk and cause a decrease in equity (Kevin B. Hendricks & Vinod R. Singhal, 1998). This has also been validated in the construction industry. A study was conducted, on constructors, in Malaysia, by Zin, Chen and Ali (2009), emphasizing on the role of QMS on the rise of companies' competitiveness. According to their findings, this competitiveness has increased by 80% after implementing the ISO 9001. These studies noticeably prove the relevance of QMSs for the construction industry, and the companies who are thriving to compete in an international market and achieve customer satisfaction.

2.2. ISO: International Standards Organization

2.2.1. ISO and ISO 9001

ISO is a non-governmental institution, producing international standards. It started operating from Stockholm, in February 1947, after an international meeting conducted by represents of 25 countries, aiming to unify the industrial standards. In 1951, the organization published its first standard regarding the industrial length measurement. Since then, it has released over 19000 International Standards. These standards include specifications that help companies in achieving safety, reliability and good quality. Among these standards, there is ISO 9001, which sets requirements in the implementation of quality management systems. It was first released in 1987, and went through four updates since then. Developing a quality policy, according to the norms of ISO 9001, thrives to creating sustainability in answering the consistently changing customers' needs. According to a survey conducted by ISO in 2014, there are 1,138,155 companies worldwide certified ISO 9001. Table 1 and Figure 1 (Appendix) show the five industrial sectors that have the most ISO 9001 certificates in 2014: Basic metal and fabricated metal products, electrical and optical equipment, construction, wholesale and retail trade repairs of motor vehicles, and finally machinery and equipment

(ISO Survey, 2014). China is the first country in the top ten most certified countries, with 342,800 certifications. This represents 30.12% of the total number of certifications worldwide. This is probably due to the perceived quality image that products made in China have. Table 2 (Appendix) depicts the ten countries with the most certified organizations in 2014.

2.2.2. ISO 9001 and its Benefits

ISO 9001 is one of the most used regimes in quality management. Its implementation provides external benefits to the company: bringing new markets and business contracts by enhancing the company's reputation increasing the market share, and consequently increasing sales-when customer satisfaction is achieved. Some other benefits that are internal to the organization will only appear in the long run, if the company shows enough motivation in implementing the quality management system. Costs will decrease due to a better process control, a better quality of the product or the service, and finally an increase in productivity and efficiency. ISO 9001:2015 is based on seven quality management principles, which are: Customer focus, Leadership, Engagement of people, Process approach, Evidence-based decision making, and Relationship management. These principles constitute the pillars of a QMS, according to ISO. They are a set of beliefs and norms that, if they are well implemented, will enhance the companies' performance, regarding its construction project, project management, quality, organization performance, management system. Table 3 (Appendix) gathers these areas where ISO 9001 has the most of impact, when it comes to construction, and explains how the benefits are manifesting in each area (Willar, 2012).

Another study, from Harvard Business School, conducted in 2010 on 1000 companies in the United States shows the impact of ISO 9001 on employees and employers. These companies have demonstrated a lower organizational death rate compared to non ISO 9001 adopters. The main variables studied were sales, payroll, employment, and average annual earnings. All of

them were positively affected by the implementation of such a quality management system (David I. Levine & Michael W. Toffel, 2010).

2.2.3. The New Version of ISO 9001: 2015

The latest edition of ISO 9001 was released recently, in September 2015. The world has changed and brought new trends that are now relevant in terms of quality management: globalization, trade across borders, service-based economy and complex supply chains (ISO, 2015). The implementation of a quality management system that does not take into consideration risks, can't assure its validity. Defections can appear all along the way when risks are not treated. Thus, risk management process is the pillar to assure a valid quality management system. For this reason it has been included as a requirement in the new version of ISO 9001 for 2015. ISO 9001 is also linked to Business Continuity Management Systems (BCMS) and ISO 22313 regarding societal security. Both of ISO 9001 and ISO 22313 apply the PDCA plan cycle (Plan-Do-Check- Act) that fosters a risk-based thinking when looking at the interested parties of an organization. Figure 2 (Appendix) illustrates the mechanism of this cycle.

2.3. Barriers in Implementing Quality Management Systems

Implementing a quality management system does not automatically lead to an improvement in performance. This is specifically the case of the construction industry, where companies are dealing with long-term duration projects. Applying quality standards, in this context, to construction processes might constitutes an obstacle, due to the particularity of the industry (Oztas, Güzelsoy and Tekinkus, 2007). Besides that, construction companies have always been reluctant to changes, specifically in developing countries. According to Low and Hong (2005), this is demonstrated by the slowness of the getting the ISO 9001 certification.

The main identified barriers that led to this ineffectiveness in implementing a QMS are (Willar, 2012):

Using ISO 9001 as a commercial tool to win new clients, instead of looking at the long-term company's improvement and internal benefits.
Having recourse to a consultant who might be unfamiliar with the company's managerial and cultural practices
Giving the Quality Management Representative the simple task of developing the ISO 9001 documents and fulfilling the administrative requirements, instead of empowering him and giving him the opportunity to make decisions accordingly
Lacking financial resources when implementing an effective QMS
Considering the ISO 9001 certification an end in itself, when it is only a tool to achieve a larger objective, namely improving the company's performance and achieving sustainability
Feeling panelized and "exposed to an over bureaucratic system" while being audited, when it is supposedly to be a guidance to support and help you

All of these barriers are primarily caused by the company's culture of dealing with quality and performance. They present the root of the problem that this thesis is trying to build on towards achieving a better quality management.

2.4. The Existing Use of the ISO 9001 in Tunisia – Construction Companies

Tunisia has a total of 455 companies working in construction and building materials, 20 of these companies are totally exporting companies and the rest are working locally. They represent 8% of total companies in Tunisia and employ 3,555 people in total (API, 2016). The total percentage of these companies who have been certified ISO 9001 is only 11.2%. This is the most used certification type, in this industry, due to the fact that it constitutes a customer requirement. Customers with big constructions project always do a background check to approve the quality management of their suppliers. This constitutes an external motivation for companies to get the ISO certification. The second most used certification type is ISO 14001, which is related to environment management. Companies working in construction have a huge impact on environment, as they necessitate a lot of energy, which might explain why there is a need for ISO 14001 certification.

The certification intensity in Tunisia for ISO 9001 is considered to be high compared to other African countries. The CI (Certification Intensity) is a ratio that is calculated by dividing the percentage of contribution to the total certification in a country over the percentage of participation to the world GDP. The Tunisian CI ratio for ISO 9001 was estimated at 1.94 in

2012 (Allur, Aran-Landin, & Heras-Saizarbitoria, 2014). Figure 4 (Appendix) shows the Certification Intensity in Tunisia compared to other African countries. There has also been an empirical study on Tunisian construction companies that shows the significance ISO practices have on the companies' performance, compared to noncertified construction companies (Chaher & Raissi, 2014). This study also confirmed that the use of ISO certifications was more for marketing and commercial purposes, rather than for internal benefits.

2.5. Research Gaps

Although ISO 9001 has been the focus of many studies recently, none of them was conducted on the case of the construction companies in Tunisia. The significant correlation between the ISO 9001 principles, and the construction companies' performance has already been confirmed in several countries, such as the US, Turkey, Indonesia, etc. However culture differs from one country to another and from one industry to another. And Tunisian companies working in construction are a special case that has not been studied before. This country was suffering from a recession period after the Jasmine Revolution that took place in 2011, and now is looking to grow its economy. Construction is one of the industries that are going to witness a growth, after obtaining the agreement on some important infrastructural projects for railroads, bridges, highways, and buildings. This growth was estimated at 1.54%. The rise in the number of projects will consequently impact the competition in this industry. And implementing the ISO 9001 could be one of the strategies companies will adopt to enhance their brand image and achieve customer satisfaction. The issue lies in the internal environment Tunisian companies are endorsing. Studies have shown that "the internal barriers related to the poor communication between the partners, the lack of managers' training, the resistance to change and the lack of leaders' commitment have the most significant role in impeding the progress"(Aouni & Kammoun, 2012). With this context, this thesis assesses the effectiveness of the implementation of ISO 9001 in Tunisia to bring new recommendations,

for construction companies when implementing a quality management system, at the time they need it the most.

3. Methodology

Regarding the research design, both primary and secondary data were collected. To answer the thesis problematic, three research methods were adapted combining quantitative and qualitative approaches. A survey was conducted on 15 Tunisian construction companies to assess their effectiveness in achieving the principles of ISO 9001, to identify the principal barriers to its implementation, and to look at the impact of this certification on the companies' performance. Then, a company was selected for a better assessment of the impact of the implementation of QMS on its performance, through the track of a set of KPIs before and after the certification. A qualitative method was also used, which consists of an interview to understand the relevance of organizational culture in the process of implementation of quality management systems. The interviewee is, an external auditor for ISO 9001, and the represent of DQS Group in the region of Maghreb (Morocco, Algeria, Tunisia, and Libya). DQS is a certification body in management systems headquartered in Germany, and present in over 60 countries. He was selected for his knowledge and expertise in the area of quality management practices in Tunisia.

Three variables can be identified in the methodology used to design the survey:

1. Companies' effectiveness in the implementation of the QMS,
2. Barriers in the Tunisian construction industry,
3. Companies' performance.

To understand the interaction between these variables, a quantitative survey was designed. Its content is better developed in the survey design section.

Assessing the KPIs related to quality management before and after the implementation of the quality management system is essential to evaluate the overall process of certification. For the

sake of this assessment, EGMS (Entreprise Gloulou) was selected among this industry, as it has recently obtained the ISO 9001 certification in December 2015. Tripling its revenues in the last two years, it is now considered among the best construction companies in Tunisia with projects related to the public infrastructure.

3.1. Questionnaire Design

The survey has two main parts. The table below lists the questionnaire's objectives for the first part and the questions answering to those objectives. As for the second part, it studies the organizational culture profiles of the same companies, based on the Organizational Culture Assessment Instrument (OCAI) (Figure 4 in the Appendix).

Objectives	Questions
Understanding the context	<ol style="list-style-type: none"> 1. What's the major customer segment your company is working with? 2. Did your company hire a consultant to assist in the implementation of the ISO 9001? 3. From a scale of 1 to 4 (1 being not helpful and 4 very helpful), how helpful was the consultant you hired? 4. Who participated in the QMS documentation process? 5. What was the main motive for the company to get the ISO 9001 certification?
Effectiveness of the implementation of the ISO 9001	<p>What is the level of implementation of each of these seven principles of ISO 9001? (4 = Fully implemented, 3 = Not so fully implemented, 2 = Minimally implemented, 1 = Yet to be implemented)</p> <ol style="list-style-type: none"> 1. Customer Satisfaction 2. Leadership 3. Engagement of People 4. Process Approach 5. Improvement 6. Evidence-Based Decision Making 7. Relationship Management
Impact of the barriers in the implementation of the ISO 9001	<p>According to your experience, did you company face any of these barriers? (4 = Often experienced, 3 = Sometimes experienced, 2 = Rarely experienced, 1 = Not experienced)</p> <ol style="list-style-type: none"> 1. Using ISO 9001 as a commercial tool to win new clients, instead of looking at the long-term company's improvement and internal benefits. 2. Having recourse to a consultant who might be unfamiliar with the company's managerial and cultural practices 3. Giving the Quality Management Representative the simple task of developing the ISO 9001 documents and fulfilling the administrative requirements, instead of empowering him and giving him the opportunity to make decisions accordingly 4. Lacking financial resources when implementing an effective QMS 5. Considering the ISO 9001 certification an end in itself, when it is only a tool to achieve a larger objective, namely improving the company's performance and achieving sustainability 6. Feeling panelized and "exposed to an over bureaucratic system" while being audited, when it is supposedly to be a guidance to support and help you
Impact of the ISO 9001 certification on the companies' performance	<p>How would you describe the performance of your company during and after the certification ISO 9001? (4 = Very high performance, 3 = High performance, 2 = Low performance, 1 = Very low performance)</p> <ol style="list-style-type: none"> 1. Profitability 2. Sales' Growth 3. Market Share 4. Quality of Service and Products 5. Employees' Satisfaction 6. Customer Satisfaction

Survey Sampling

The construction companies in Tunisia are categorized from 1 to 5, depending on the materials, the financial assets, and the human capital the companies are benefitting from. According to the ministry decree, only the fourth and fifth categories, answering to special government specifications are authorized to undertake public projects. There are 90 Tunisian companies in total having this approval. As the present study takes into consideration the companies who are contributing to the infrastructure's development, categories 4 and 5 were selected as a criterion in the sampling method. In addition, the purpose of this survey is to assess the ISO 9001 practices, in this industry. Thus, among the categorized 4 and 5 companies, only those who have already went through an implementation of a QMS according to ISO 9001 were selected. Even if this study is developed to give an insight about how any construction company should be implementing the QMS, the previous experience of the certified companies is relevant to understand what should be done differently. This narrows down the sample to 15 companies. This sample might not be the most appropriate, in terms of size, to optimize the accuracy of the research, however it is representative of the Tunisian construction industry, and it confirms the research gap on which this study has been developed. As it has been mentioned above, there is a poor quality culture in this sector, and companies' awareness towards this issue is extremely low.

3.2. Assessment of EGMS: Impact of the ISO 9001 on the Performance of the Company

The assessment of the company was made after obtaining the certification ISO 9001, in comparison to its performance before the certification. The KPIs selected are related to the objectives of the QMS, but also to the company's performance in general. The company's revenues and the number of newly acquired clients were evaluated after the certification was released. The company also started tracking other KPIs during the implementation process.

The following table gives a general presentation of the metrics used and the objectives they are associated with.

Objectives	Indicators	Method	Frequency
Increasing profitability	Profitability	Percentage of increase in profitability after the ISO 9001 certification	-
Growing the customer base	Number of newly acquired customers/projects	Count of the number of customers acquired after the ISO 9001 certification	-
Improving customer satisfaction	Customer satisfaction rate for public projects	The average of customer satisfaction according to whether or not the government has validated the public projects after six months of their start of operation.	Annual
	Customer satisfaction rate for private projects	The average calculated from the evaluation sheet distributed to customers	Annual
Developing the reputation of the projects quality	Number of nonconformities in the internal organization	Count of the number of nonconformities detected in the worksite	Monthly
Developing a partnership with the main suppliers	Number of nonconformities in the purchases	Count of the number of nonconformities in the purchases	Monthly
	Number of ruptures in stock	Count of the number of ruptures in stock	Monthly
Involving and motivating the staff members through communication and trainings	Respect rate for the trainings planning	$(\text{Number of conducted trainings} / \text{Number of planned trainings}) * 100$	Biannual
	Effectiveness rate of the trainings	$(\text{Number of successful trainings} / \text{Number of conducted trainings}) * 100$	Biannual
Optimizing the usage of the material resources	Availability rate of the engines	$((\text{Normal running time} - \text{Stop time}) / \text{Normal running time}) * 100$	Monthly
	Availability rate of the trucks	$((\text{Normal running time} - \text{Stop time}) / \text{Normal running time}) * 100$	Monthly

4. Analysis of the Survey and the QMS Company's Assessment

4.1. Analysis of the Survey

4.1.1. Respondents' Profile

The fifteen companies contacted to participate in this survey were selected according to two criteria, namely, the government approval and the ISO 9001 certification. Among this sample, fourteen companies answered, which makes a total response rate of 93.3%. Even if all the respondents have answered to the government specifications to participate in calls for tenders, six of these companies (43%) are considering private projects are their main customer segment. Independently of the company's type, all of the respondents answered "yes" when they were asked if they had recourse to a consultant when implementing the quality management system. The following table shows how helpful the contribution of the hired consultants was.

Level of contribution	Not helpful	Fairly helpful	Helpful	Very helpful
Number of companies	-	-	8	6
Percentage	-	-	57,14%	42,86%

When it comes to the documentation of the quality policies and other related quality documents required in ISO 9001, the companies didn't make the internal divisions to the organization participate in drafting the documents. The table below sums-up the survey's results for this part.

Level of employees' participation	Every division prepared its own draft of the documents	Quality management team developed the documents	The consultant developed the documents	The quality management team developed the documents with the support of the consultant
Number of companies	-	-	11	3
Percentage	-	-	78.57	21.43%

Finally, as to the main driver for those participants to get the ISO 9001 certification, 71.4% said it was to fulfil the clients' requests, and 28.6% said it was for reputational purposes. None of them has selected "to improve business performance", "to minimize poor quality in the projects", or "to effectively and efficiently control the activities on the worksite".

4.1.2. Effectiveness of the QMS Implementation

The effectiveness of the QMS implementation was assessed according to the principles of ISO 9001. Most of the principles were minimally or not fully implemented, except for customer satisfaction. All of the respondents reported that they have fully implemented this principle. The following table shows the average mean of the 1-to-4 scale regarding the implementation level of these seven principles.

Principles	Customer Satisfaction	Leadership	Engagement of people	Process approach	Improvement	Evidence-based Decision Making	Relationship Management
Mean	4,00	3,21	2,14	3,29	3,07	2,00	2,36
Implementation level	Fully	Not fully	Minimally	Not fully	Not fully	Minimally	Minimally

4.1.3. Barriers for ISO 9001 Implementation

In the survey, six barriers were proposed to the respondents. These barriers were identified from previous literature on the practices of ISO 9001 in general construction companies. This section discussed the relevance of each barrier to the Tunisian market. According to the respondents, the most experienced barriers are "Giving the Quality Management

Representative the simple task of developing the ISO 9001 documents and fulfilling the administrative requirements” and “Considering the ISO 9001 certification an end in itself, when it is only a tool to achieve a larger objective”. The least experienced barrier was “Lacking financial resources when implementing an effective QMS”. As for “Having recourse to a consultant who might be unfamiliar with the company’s managerial and cultural practices”, it was rarely experienced. Finally, using the ISO 9001, as a commercial tool and feeling exposed to over bureaucratic system are two barriers, which were sometimes experienced. The following table ranks the barriers from the most experienced to the less experienced ones.

Rank	Barriers	Mean
1	Using ISO 9001 as a commercial tool to win new clients	3,71
2	Considering the ISO 9001 certification an end in itself	3,57
3	Giving the Quality Management Representative the simple task of developing the ISO 9001 documents and fulfilling the administrative requirements	3.36
4	Feeling panelized and “exposed to an over bureaucratic system” while being audited	3.36
5	Having recourse to a consultant who might be unfamiliar with the company’s managerial and cultural practices	2,93
6	Lacking financial resources when implementing an effective QMS	1,29

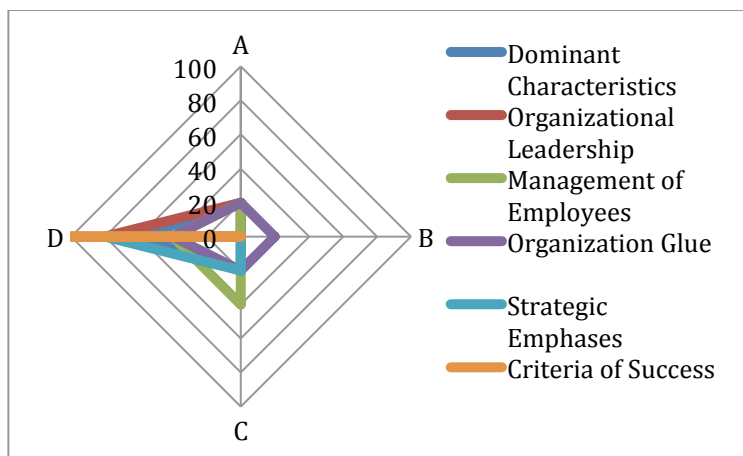
4.1.4. Companies Performance

Companies’ performance was measured through six KPIs, namely profitability, sales growth, market share, quality, employee’s satisfaction, and customer satisfaction. Respondents were asked to score these KPIs after the implementation of the QMS from very low to very high performance. Results show that companies found that profitability, sales growth, market share, and customer satisfaction have been performing higher after getting the certification. However, the quality of the projects and employees’ satisfaction have not been affected. They are still performing low. The table below ranks the KPIs performance and presents the mean of each one.

Rank	KPIs	Mean
1	Profitability	3.60
2	Sales	3.36
3	Customer Satisfaction	3.36
4	Market Share	3.07
5	Quality of the Project	2.14
6	Employee Satisfaction	1.86

4.1.5. Organizational Culture

The last part of the survey had for purpose to identify which of the four cultural profiles, clan, adhocracy, market or hierarchy are the companies adapting. The results show that companies are all hierarchical. This means that there is an internal focus and integration combined with stability and control. Cameron and Quinn (2006), who set the Organizational Cultural Assessment Instrument (Figure 4 & Table 6, Appendix), define hierarchy as a culture “characterized by a formalized and structured place to work. Procedures govern what people do. Effective leaders are good coordinators and organizers. Maintaining a smooth running organization is important. The long-term concerns of the organization are stability, predictability, and efficiency. Formal rules and policies hold the organization together.” Even with having profiles very focused on hierarchy, there is a small tendency towards the market culture, which is also about stability and control but has an external focus and differentiation. The least witnessed characteristics are the ones belonging to clan and adhocracy. The results are consistent with the performance of the companies. The following radar chart shows how one example of a company is scoring its profile’s culture.



4.2. EGMS Assessment: Impact of the ISO 9001 on the Company’s Performance

EGMS, one of the respondents, was selected to have a better assessment of the performance. The company obtained the ISO 9001 certification in December 2015, and started to track its

KPIs in January 2016. It has registered an increase of 9% in its revenues. This was due to the acquirement of a public project with a very high turnover, that the company could only undertake if it had the ISO 9001 certification. Therefore, acquiring a new client was the main motive for the company to get certified. The following table presents the percentage of achievement for each KPI and the target objective for the month of January 2016.

Objectives	Indicators	Target	Current Status
Increasing profitability	Profitability	-	9%
Growing the customer base	Number of newly acquired customers/projects	-	1
Improving Customer Satisfaction	Customer satisfaction rate for public projects	≥ 80%	96%
	Customer satisfaction rate for private projects	≥ 80%	81,5%
Develop the reputation of the projects quality	Number of nonconformities in the internal organization	≤ 4	0
Develop a partnership with the main suppliers	Number of nonconformities in the purchases	≤ 5	0
	Number of ruptures in stock	≤ 5	0
Involve and motivate the staff members through communication and trainings	Respect rate for the trainings planning	≥ 80%	75%
	Effectiveness rate of the trainings	≥ 80%	100%
Optimize the usage of the material resources	Availability rate of the engines	≥ 80%	80%
	Availability rate of the trucks	≥ 80%	97%

The company was successful in achieving all target objectives, except for the respect rate for the training planning, which is related to employees' satisfaction.

5. Assessment of the Companies Behavior towards ISO 9001

5.1. Existing Barriers and Their Impact on the Effectiveness of the QMS and the Companies' Performance

The analysis of the fourteen companies has shown a similar pattern in their behavior towards ISO 9001. All of the barriers were very relevant to the Tunisian construction industry, except for allocating the financial resources towards the completion of the ISO 9001. This shows the financial impact of such a certification. All the companies hired consultants to assist them in the procedures and the documentation of the quality policies, which reflects how much they are willing to allocate money and confirms the cost efficiency of the QMS. The other existing barriers are affecting the effectiveness of the ISO 9001 principles.

The first principle “Customer satisfaction” is the driver in this process and it’s ranked very high. This is consistent with the motive of these companies in getting the certification: The research has found that these motives are mainly to fulfill the clients’ request and improve the companies’ reputation. This confirms previous studies conducted in Turkey, United States, and Indonesia on how the ISO 9001 certification is used as a marketing tool (Chini and Valdez 2003; Turk 2006; Willar 2012).

The other principles were either partially or nominally implemented. This is linked to the secondly ranked barrier, which states that companies only look at ISO 9001 as an end in itself, rather than a system to improve the internal organization and the quality of its processes. Once the companies have the customer approval to work on a solicited project, they tend to neglect the other principles and just focus on the external benefits.

Nonetheless, these barriers, even if they were often experienced at work, they are not affecting the performance of the companies. All of the respondents have reported an increase in the following KPIs after the certification: profitability, customer satisfaction, market share and sales. Surprisingly, the quality of the undertaken projects, and the employees’ satisfaction have not witnessed any change after the certification. These two indicators are the only ones tightly related to the experienced barriers and thus, are affected by them. They are also representative of the failed implementation of some principles of ISO 9001, such as relationship management, engagement of people, and evidence based decision-making.

Another issue detected when studying the behavior of the companies, is how they don’t perceive quality in itself as a driver for customer satisfaction. Previous literature has shown the relevance of quality when it comes to the customer. However, those two KPIs had different ranking pattern, among the respondents. Such misapprehension led the companies to focus its efforts on short-term benefits and to underestimate the internal improvement. Thus,

how do companies succeed in achieving high financial and market performance, with the presence of these barriers and a poor implementation of QMS?

5.2. The Impact of the Tunisian Construction Companies' Culture

To further elaborate on the matter stated above, an interview was conducted with an external auditor of ISO 9001 in Tunisia. The interviewee has confirmed the existence of the poor implementation of the QMS, and how this concern is not affecting the tangible KPIs of the Tunisian construction companies, such as profitability. He highlighted how Tunisian companies in general, and the ones operating in construction specifically, perceive the certification in quality management as a commercial tool. He reported that there is no problem with that, as this certification has proven to be a very effective marketing tool. Thus, the increase in profitability and market share is only due to a marketing investment. It is not directly influenced by the improvement of the quality management. The interviewee has also reported that, even though there is nothing wrong with using the ISO 9001 as a commercial tool, the companies' performance would increase even more, if the focus would be on the internal development instead of external factors. Therefore, the utility of this certification is not maximized. The barriers that were mentioned above and assessed in the survey, should be treated, instead of accepted as unpreventable facts the companies chose to live with. One might wonder how to overcome this lack of awareness regarding the maximization of the ISO 9001 utility. Increasing the companies' awareness can only be effectuated by a change in the internal culture. One of the main issues, when implementing a quality management system, is that the top management team is underrating the organizational commitment of employees (Reavill, 1999). Instead, they are overemphasizing the QMS techniques and tools (Page and Curry, 2000). Since construction industry is changing rapidly, and competition is increasing, rethinking the companies culture becomes a need. A preliminary culture check should be effectuated prior to the implementation of such systems. All the companies participating in

the survey have a hierarchy structure. Cameron and Quinn (2011), the developers of the Organizational Culture Assessment Instrument, state that there is no good or bad organizational profile. Each company should adapt its profile to its business activities and operations. The problem with the hierarchical structure is the lack of communication and standardization in the priorities. Each employee's main task is to first fulfill the responsibilities his manager gave him, and then work on other assignments. The company's structure should be more dynamic, in a way that would allow the employees to prioritize other tasks coming from other departments, without feeling the pressure of their manager. Applying the process approach could be done, to achieve this shift in culture and increase the quality awareness of the construction companies. This would consist of dividing the company's structure into processes, and set of activities for each process. It is different from a departmental structure, but it doesn't mean that the company would have to dismantle its existing hierarchical profile. The culture shift should be adjusted to that current status, and, clearly, it will take time to become embedded in the organization. However, it is essential and represents the starting point for any improvement in ISO 9001, especially with the dynamic changes in the Tunisian construction companies. A successful change in culture will not only improve the tangible KPIs such as market growth, and profitability, but also the intangible ones like employees satisfaction and quality improvement. This could be developed as part of the company's strategy in achieving a sustainable competitive advantage.

5.3. Limitations and Recommendations

5.3.1. Limitations

- Intangible KPIs measures need to be more complex and better developed, in order to have a more accurate assessment of the performance. Construction companies, and specifically the one that we tracked its objectives, are using simple measurement tools when assessing the quality improvement, and the customers and employees' satisfaction. They are only

documenting these objectives for the sake of obtaining the certification, which again brings the issue of the motives behind an implementation of a quality management system.

- For a better accuracy of the performance assessment, the company selected was asked to provide the exact numerical results for tangible KPIs. Due to data confidentiality, the company could only provide us with the increase in percentage of these KPIs after obtaining the ISO 9001 certification.

- This study is also limited by the small sample used in the survey. There are only fifteen large construction companies in Tunisia, which are certified ISO 9001. Their behavioral pattern is similar and doesn't give the possibility to profoundly study the regression between the effectiveness of the implementation of the quality management system, its effectiveness, and the companies' performance. Nonetheless, this limitation reflects the lack of awareness in quality management in the Tunisian construction companies.

5.3.2. Recommendations

- This study could be used as a basis for the development of a culture-based framework for Tunisian construction companies. A further analysis of the legal context and business culture should be conducted, to develop this framework that would assist companies in improving their current practices in ISO 9001. This framework would be then specifically tailored to the Tunisian construction environment

- Internal sources to the organization tend to be more subjective in their own assessment. Thus, a further study, in this field, could be conducted by including the point of views of the consultants hired by the companies. They have a different perception on the quality management practices of the companies and are able to better assess their improvement.

6. Conclusion

This study shows how big-size construction companies in Tunisia have similar pattern in their behavior towards the ISO 9001. The usage of this certification is only for commercial purposes, helping the companies in attracting more construction projects, which explains the

poor implementation of the quality management system. Nonetheless, even with an ineffective implementation of the ISO 9001 principles, this certification is actually proven to increase the companies' tangible performance indicators. The fact that this is a successful commercial tool impedes them from taking measures to deeply improve the quality of their construction projects. This concern should not be neglected, since the benefits of the certification are actually more than just a commercial investment, and its utility should be maximized. Changing the culture by introducing a process-based approach and increasing the quality awareness are the key towards a successful and valid implementation of ISO 9011 principles. Once these principles are well embedded in the company's organizational culture, with the leadership commitment, it will bring an added value and increase even more the performance of the company. It could be a valuable and sustainable competitive advantage, enhancing the productivity and performance of the staff, making the company ready to face and adapt to the dynamic changes the construction industry is witnessing in Tunisia.

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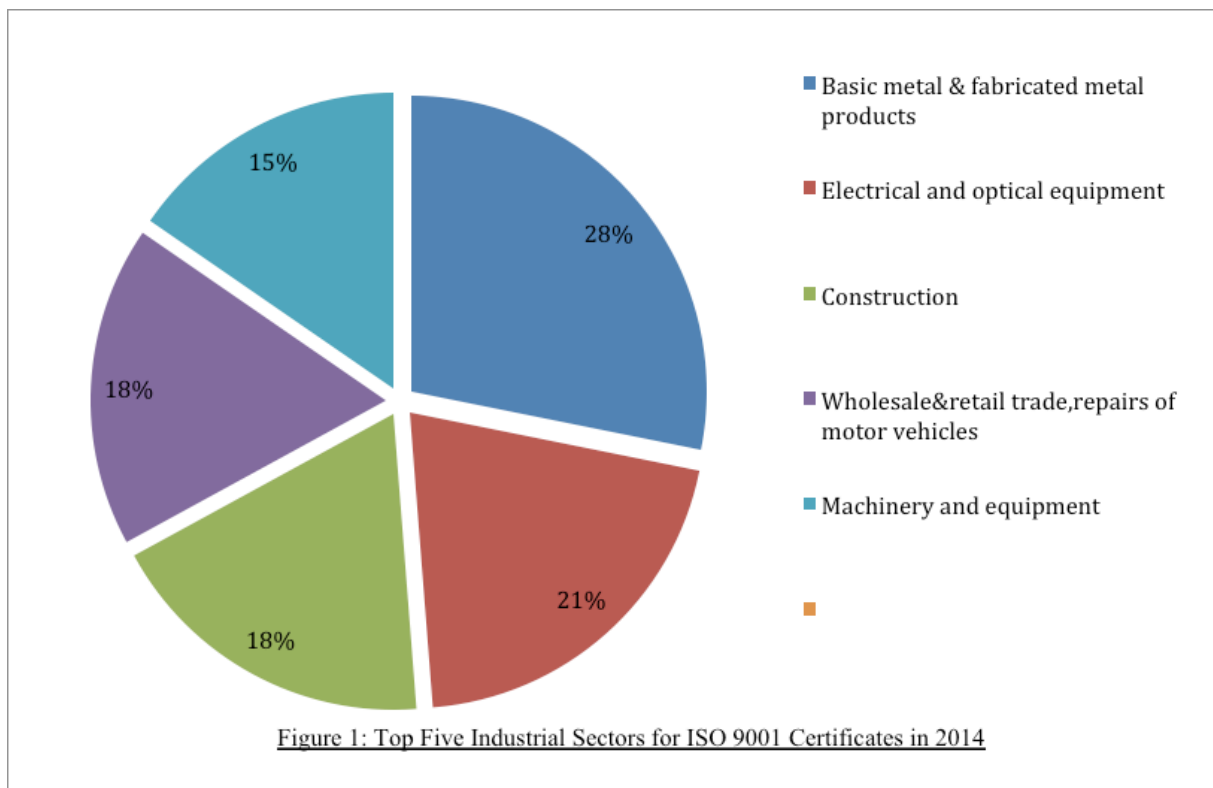
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Appendix

Rank	Industry	Number of Certifications
1	Basic metal & fabricated metal products	118 272
2	Electrical and optical equipment	86 523
3	Construction	76 862
4	Wholesale&retail trade,repairs of motor vehicles	73 676
5	Machinery and equipment	64 699

Table 1: Top five industrial sectors for ISO 9001 certificates 2014



Rank	Country	Number of Certifications	Percentage from total certifications
1	China	342 800	30,12%
2	Italy	168 960	14,85%
3	Germany	55 363	4,86%
4	Japan	45 785	4,02%
5	India	41 016	3,60%
6	United Kingdom	40 200	3,53%
7	Spain	36 005	3,16%
8	USA	33 008	2,90%
9	France	29 122	2,56%
10	Australia	19 731	1,73%

Table 2: Top 10 countries for ISO 9001 Certificates in 2014

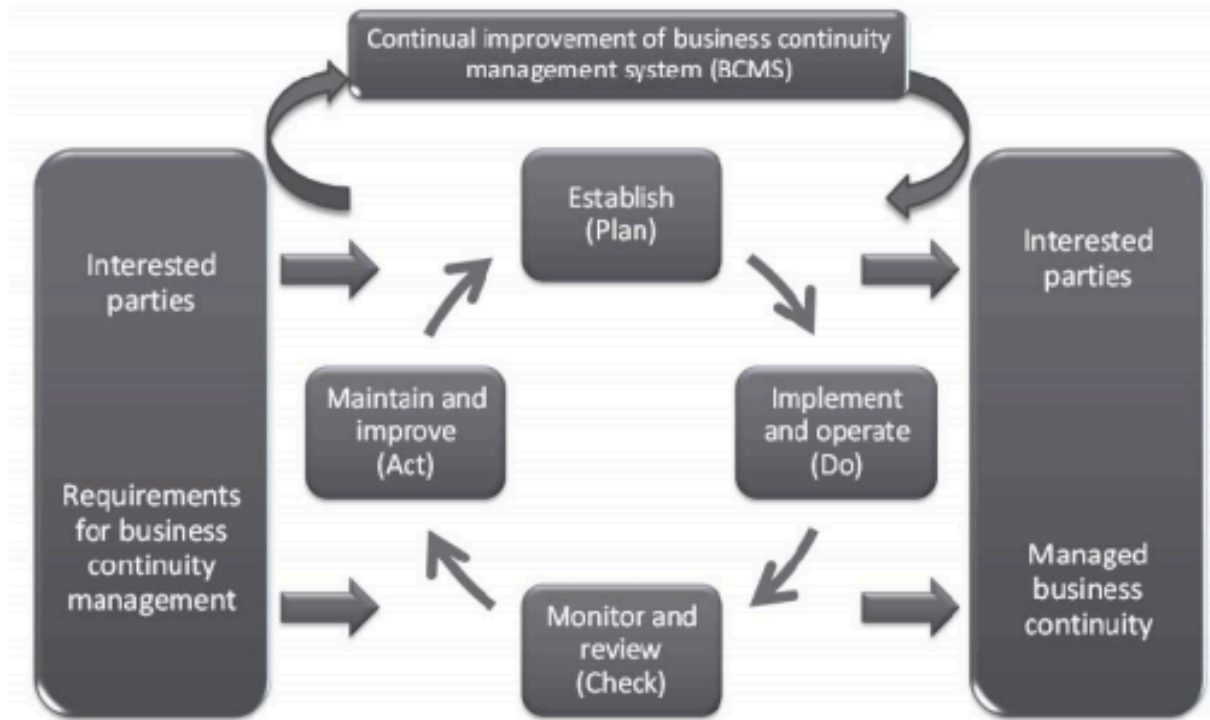
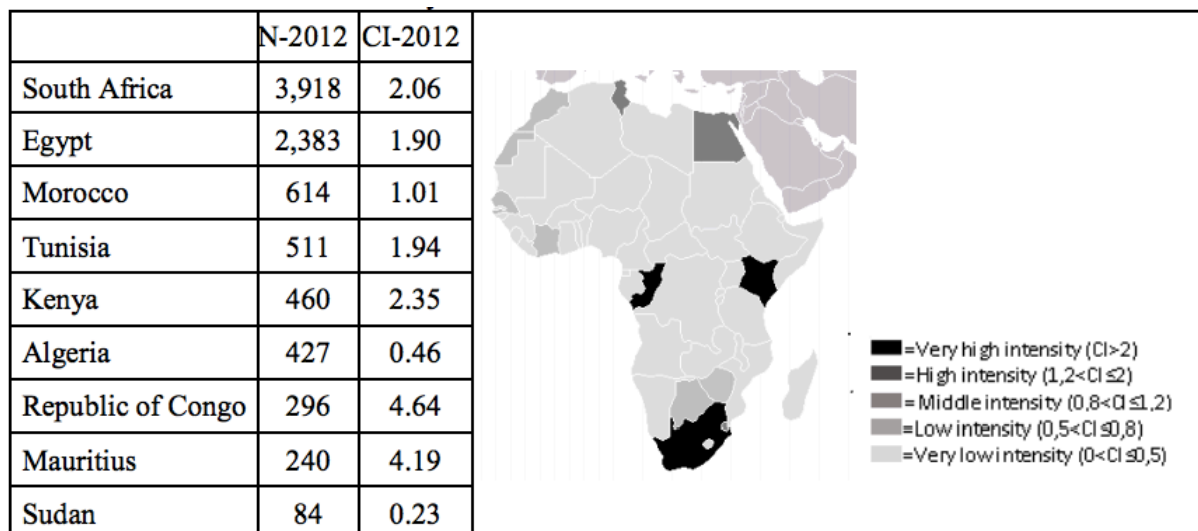


Figure 2: PDCA Cycle Applied to BCMS Processes

Area of Improvement	Benefits of ISO 9001	Representative Authors
Construction project	<ul style="list-style-type: none"> • Preventing work repetition and project delays • Buildability factor of most projects can be increased while the project cost is decreased • As an effective and appropriate working platform at both design and construction stage of a project • Efficient in using material resources 	Low and Wee (2001), Low and Abeyegoonasekera (2001), Ofori, Gang and Briffett (2002), Farooqui and Ahmed (2009)
Project management	<ul style="list-style-type: none"> • Consistent and effective control of key processes and project management • More efficient and effective utilisation of scarce resources. 	Farooqui and Ahmed (2009), Watson and Howarth (2011)
Quality	<ul style="list-style-type: none"> • Failure to meet specifications can be minimized • Promoting control of suppliers and subcontractors and the development of effective supply chain management • Provide a corporate quality advantage 	Low and Wee (2001), Farooqui and Ahmed (2009), Watson and Howarth (2011)
Organisation performance	<ul style="list-style-type: none"> • World-wide recognition and be chosen to bid in both local and global market contracts • Provides a means of achieving a top-quality performance in all areas/activities • Reduced inspection costs hence improved corporate profitability • As a tool to help contractors establishing and measuring their performance indicators 	Ofori, Gang and Briffett (2002), Turk (2006), Farooqui and Ahmed (2009), Lordsleem, Duarte and Barkokébas (2010), Watson and Howarth (2011)
Management system	<ul style="list-style-type: none"> • Improvement of organisation communication system and working environment • Better efficiency • Continual improvement • Greater emphasis on leadership, team spirit and motivation • Change management and adequacy of training • Planning and review process to ensure that the system in place remains suitable • Effective and capable of identifying new opportunities • Provide clear and valid operating procedures 	Low and Abeyegoonasekera (2001), Ofori, Gang and Briffett (2002), Farooqui and Ahmed (2009), Lordsleem, Duarte and Barkokébas (2010), Leonard (2010), Watson and Howarth (2011)

Source: Willar, 2012

Table 4: Benefits of Applying ISO 9001 in Construction Organizations



Source: Aran-Landin, Allur, & Heras-Saizarbitoria, 2012

Figure 3: Certification Intensity in African Countries

1. Dominant Characteristics		Now
A	The organization is a very personal place. It is like an extended family. People seem to share a lot of themselves.	
B	The organization is a very dynamic entrepreneurial place. People are willing to stick their necks out and take risks.	
C	The organization is very results oriented. A major concern is with getting the job done. People are very competitive and achievement oriented.	
D	The organization is a very controlled and structured place. Formal procedures generally govern what people do.	
	Total	
2. Organizational Leadership		Now
A	The leadership in the organization is generally considered to exemplify mentoring, facilitating, or nurturing.	
B	The leadership in the organization is generally considered to exemplify entrepreneurship, innovating, or risk taking.	
C	The leadership in the organization is generally considered to exemplify a no-nonsense, aggressive, results-oriented focus.	
D	The leadership in the organization is generally considered to exemplify coordinating, organizing, or smooth-running efficiency.	
	Total	
3. Management of Employees		Now
A	The management style in the organization is characterized by teamwork, consensus, and participation.	
B	The management style in the organization is characterized by individual risk-taking, innovation, freedom, and uniqueness.	
C	The management style in the organization is characterized by hard-driving competitiveness, high demands, and achievement.	
D	The management style in the organization is characterized by security of employment, conformity, predictability, and stability in relationships.	
	Total	

Source: Cameron and Quinn, 2006

Figure 4: The Organizational Culture Assessment Instrument (OCAI) (Part 1)

4. Organization Glue		Now
A	The glue that holds the organization together is loyalty and mutual trust. Commitment to this organization runs high.	
B	The glue that holds the organization together is commitment to innovation and development. There is an emphasis on being on the cutting edge.	
C	The glue that holds the organization together is the emphasis on achievement and goal accomplishment. Aggressiveness and winning are common themes.	
D	The glue that holds the organization together is formal rules and policies. Maintaining a smooth-running organization is important.	
	Total	
5. Strategic Emphases		Now
A	The organization emphasizes human development. High trust, openness, and participation persist.	
B	The organization emphasizes acquiring new resources and creating new challenges. Trying new things and prospecting for opportunities are valued.	
C	The organization emphasizes competitive actions and achievement. Hitting stretch targets and winning in the marketplace are dominant.	
D	The organization emphasizes permanence and stability. Efficiency, control and smooth operations are important.	
	Total	
6. Criteria of Success		Now
A	The organization defines success on the basis of the development of human resources, teamwork, employee commitment, and concern for people.	
B	The organization defines success on the basis of having the most unique or newest products. It is a product leader and innovator.	
C	The organization defines success on the basis of winning in the marketplace and outpacing the competition. Competitive market leadership is key.	
D	The organization defines success on the basis of efficiency. Dependable delivery, smooth scheduling and low-cost production are critical.	
	Total	

Source: Cameron and Quinn, 2006

Figure 4: The Organizational Culture Assessment Instrument (OCAI) (Part 2)

Cultural Dimensions	Culture Types			
	Clan Culture	Adhocracy Culture	Market Culture	Hierarchy Culture
Dominant Characteristics	It is a very personal place. It is like an extended family. People seem to share a lot of themselves.	It is a very dynamic and entrepreneurial place. People are willing to stick their necks out and take risks.	It is very results-oriented. A major concern is with getting the job done. People are very competitive and achievement-oriented.	It is a very controlled and structured place. Formal procedures generally govern what people do.
Organisational Leadership	The leader is generally considered to exemplify mentoring, facilitating, and nurturing.	The leader is generally considered to exemplify entrepreneurship, innovation, or risk taking.	The leader is generally considered to exemplify a no-nonsense, aggressive, results-oriented focus.	The leader is generally considered to exemplify coordinating, organising, or smooth-running efficiency.
Management of Employees	The management style is characterised by teamwork, consensus, and participation.	The management style is characterised by individual risk taking, innovation, freedom, and uniqueness.	The management style is characterised by hard-driving competitiveness, high demands, and achievement.	The management style is characterised by security employment, conformity, predictability, and stability in relationships.
Organisation Glue	The glue that holds the organisation together is loyalty and mutual trust. Commitment to this organisation runs high.	The glue that holds the organisation together is commitment to innovation and development. There is an emphasis on being on the cutting edge.	The glue that holds the organisation together is the emphasis on achievement and goal accomplishment.	The glue that holds the organisation together is formal rules and policies. Maintaining a smooth-running organisation is important.
Strategic Emphases	It emphasizes human development. High trust, openness, and participation persist.	It emphasizes acquiring new resources and creating new challenges. Trying new things and prospecting for opportunities are valued.	It emphasizes competitive actions and achievement. Hitting stretch targets and winning in the marketplace are dominant.	It emphasizes permanence and stability. Efficiency, control, and smooth operations are important.
Criteria of Success	Success is on the basis of the development of human resources, teamwork, employee commitment, and concern for people.	Success is on the basis of having the most unique or newest products. It is a product leader and innovator.	Success is on the basis of winning in the marketplace and outpacing the competition. Competitive market leadership is key.	Success is on the basis of efficiency. Dependable delivery, smooth scheduling, and low-cost production are critical.

Source: Cameron and Quinn, 2006

Table 6: OCAI Traits and Typologies