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# Life Cycle of Quality Management System in Organizations

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**Abstract:** Considering that some organizations implemented the ISO 9001 standard more than 25 years ago, while others did it a while ago, some quality management systems (QMS) are older than others. This fact led authors to question whether there are differences between long and recently implemented quality management systems. Is there a pattern that QMS follows in its aging that could be considered as a life cycle of QMS? From October 2013 to June 2014, authors have conducted a survey in 186 certified companies using structured questionnaire in order to learn whether there was a significant difference between long and recently implemented QMSs. Collected data were processed using the ANOVA test with a confidence interval of 95%, i.e.,  $\alpha=0.05$ . Results show that there is a difference between quality management systems in the mature stage and those recently implemented. However, research pointed out two facts. First, 34.41% of all surveyed companies apply QMS partially and have virtual QMS that has no purpose of improving business performances but only the purpose of maintaining the company's certificate. Second, in companies that apply QMS fully, the frequency of all processes (which are elements of QMS) decreases in the first seven years of implementation, while after that period it begins to increase. Also, the paper describes indicators for determining companies which partially apply QMS.

**Keywords:** Quality management system; process frequency; internal audit; corrective measures; preventive measures.

**JEL Classification:** C11, D22, L25, M11, Y10

## 1. Introduction

The implementation of quality programs or models for quality improvement, which can be based on already existing and suggested models or can be developed for particular company often leads to major change within an organization (Gokul & Sarada, 2015; Hahn, 2012; Almaraz, 1994). Many research works, studies and surveys have been conducted on the effects of most commonly used model for quality improvement, recommended by the ISO 9001 standard, i.e., the quality management system (QMS) model (see: Sampaio et al., 2009; Fotopoulos et al., 2010; Cruciani and Kipping, 2001; Canet-Giner et al., 2010; Sroufe et al., 2008, Franceschini et al., 2016). The ISO 9001 registration efforts benefit a firm's competitiveness, but achieving the ISO 9001 certification alone will not lead to higher profitability (Pires et al., 2013; Sampaio, Saraiva & Monteiro, 2012). However, there are studies that claim that firms reported that some specific activities and relationships did not change after a QMS adoption (Fouayziet et al., 2006; Hadidi et al., 2017).

The QMS model is based on process approach (Grochau & ten Caten, 2012; Nestic et al., 2015; Yu, To & Lee, 2012) and sees an organization as a system of processes. Therefore, it would be expected that QMS implementation would directly affect processes of company forcing them to change. Furthermore, the logic

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conclusion indicates that processes will change as long as QMS is properly used in the company, because continuous improvement is a major principle of ISO 9001. Still, the nature of changes in the organization's processes after QMS implementation is not clear. The aim of this paper is to explain what happens to QMS during its application period, from the moment the company is certified for the first time up to now.

## 2. Background of research

Goetsh and Davies (2005) indicated that the quality management system "consists of all the organization's policies, procedures, plans, resources, processes, and delineation of responsibility and authority, all deliberately aimed at achieving product or service quality levels consistent with customer satisfaction and the organization's objectives. When these policies, procedures, plans, etc., are taken together, they define how the firm works, and how quality is managed." Therefore, the QMS consists of a number of interrelated processes (Anttila & Jussila, 2017; Domingues, Sampaio & Arezes, 2015; Zivaljevic, Mitrovic & Petkovic, 2013; Phenget al., 2008), all described by the QMS documentation. The QMS is actually a set of documents but when applied, quality management system consists of the organizational structure and processes necessary to implement a quality policy (Alper, 2013; Davis et al., 2012; Zelniket al., 2012).

Companies of the same business type, those that have the same processes, products and services, may have differently designed quality management systems. The difference originates from various approaches in designing and implementing the QMS. It is known that the same process, depending on the designer's logic and on the required detailed level, can be designed in various ways and described differently by QMS documents. The same record, part of the QMS documentation, can have a completely different form and can require different information in two different companies. Therefore, quality management systems can be designed better or worse, can to a lower or higher degree fit the company and therefore can be more or less implemented as an integral part of the company. It is expected that those quality management systems which are designed worse or integrated less in a real business system will reach optimal design or become fully integrated at some point in time by using continual improvements.

An optimal quality management system conformed to ISO 9001 can be understood as an integral part of the company which brings benefits. Simply explained, it is a set of documents that describes processes of the company while those processes are conducted in reality exactly as they are described in documents. An optimal QMS is a system that does not live a life parallel to the real business system's life. On the contrary, a Parallel QMS is a formal system which is not implemented fully – it is set of documents which describes processes while those processes are conducted differently in reality. Therefore, it is either a burden for the company or is periodically applied only to maintain the certificate. After some time following application, parallel system will either improve to become optimal and fully adopted, or it will be completely rejected.

The aims of ISO 9001 are to facilitate the business (De Oliveira, 2013; Psomas, Kafetzopoulos & Fotopoulos, 2012; Baldassarre et al., 2012) and to encourage the organization's improvement (Pellicer et al., 2012). Those aims should be performed internally and externally. Internal performance should be done by optimization and standardization of processes. The standardization reduces the cycle time of processes (Duncan et al., 2015), therefore the number of times of process's performance would increase per period i.e., process frequency would increase. External performance should be done by ensuring successful development process which would perform constantly, ensuring that the company can keep up with changes in the environment.

The process of internal audit is one of the foundations of the ISO 9001 standard and it is usually introduced in the company for the first time along with the QMS implementation. The process of continual improvement of the QMS is based on an internal audit process, while audits identify non-conformities in the organization and collect data on the state of quality management system in order to perform a management review which directs the system towards real and possible improvements. Root causes of non-conformities are eliminated by the process of corrective actions control in order to disable reappearance of the same non-conformance.

Internal audits bring the QMS and the real operating system closer to each other and improve them together (Bernardo et al., 2012; Biasini, 2012; Karapetrovic et al., 2000; Ni et al., 2003) while the internal audit process is inseparable from the process of corrective actions control. Quantity and type of identified non-conformities in internal audit can be understood as indicators of full or partial implementation of a quality manage-

ment system. If non-conformities relate mainly to incorrect filling of records, incorrect placing of the records or some other formal mistakes, the quality management system is either not understood as an integral part of the system or internal auditors are not doing their job properly. Since the internal auditors are part of the organization, it can be concluded that such company is using procedures and records in order to maintain certificate, or that the QMS and the real operating system are not integrated.

The process of preventive action control is conducted to eliminate any possibility of potential non-conformance appearance by applying preventive measures on the causes of possible nonconformities. A company that fully implements the QMS understands its business system well, therefore it is able to predict and avoid possible mistakes. As the company reduces nonconformities over time (see: Karapetrovic et al., 2006), it is expected that the number of corrective actions should decrease. Consequently, in such companies, the ratio between preventive and corrective measures would be higher than in those companies that implement the QMS partially.

It could be concluded that over the time of two systems of the QMS application, the real business system and the QMS will become closer until they integrate completely and continue with further changes as one inseparable system. This merging is impossible without changes in processes which are basic elements of both systems, the real one and the QMS. The main goal of any organization, besides surviving on market, is to develop; therefore it is expected that the process of development will become easier to conduct, i.e., its cycle time will decrease and it would deliver more certain results. Also, it is expected that merging of business and quality management system will cause changes in the type and number of nonconformities, as well as in the ratio between preventive and corrective measures.

### 3. Research method

The authors conducted a survey in 186 certified companies from October 2013 to June 2014. The aim of the research was to identify whether there is a difference between long and recently implemented quality management systems and, if so, to determine the pattern that the QMS follows in its aging that can be considered as a life cycle of the QMS. The research is based on the following hypothesis:

H1: If the QMS is fully implemented, then there will be a change in the frequency of processes which are required by the ISO 9001 standard.

H2: If the process frequency changes through time of the QMS application, the change will pass different stages which will create a life cycle of the QMS.

The research used a questionnaire structured in three parts. The first part of the questionnaire focused on general information about the company, about the method the company used to design and implement the QMS and about the year of its first certification. The year of the first certification indicates the company's QMS maturity. Also, the first part of the questionnaire contained a question which enabled the classification of companies into two groups: those companies that integrated the QMS in their daily business life and those companies that have two parallel systems. This question related to whether the company applies the QMS fully, i.e., all processes are performed according to the relevant valid QMS documentation, whether the company applies some of processes according to valid QMS documents and avoids applying some, or the company applies the QMS documentation only before the external audit in order to maintain the certificate.

The second part contained questions related to the type of documentation which the company uses to describe and control the processes required by the ISO 9001. The same part of questionnaire contained questions about the frequency of each process that is required by the ISO 9001 standard. The frequency of process relates to the number of the process conduction per year. Those questions were meant to indicate whether there were differences between long and recently implemented quality management systems. The processes of production or service delivery were not taken into consideration, given that company performs those processes constantly in order to survive on the market.

The third part of the questionnaire contained questions related to the number and type of nonconformities that were identified in the company by internal and external auditors, to the number of preventive and corrective measures. Those questions were to give data on the ratio between preventive and corrective measures, as well as an insight into the company's understanding of the QMS.

The questionnaire was sent to a management representative of each surveyed company. The sampled companies were classified into two groups according to their statement about the way they apply QMS and according to their statement about the number of internal audits a company performs per year. In case the company did not perform at least two internal audits per year, then it will not recognize the status and importance of the processes, as well as the results of previous audits (these are important requests of the ISO 9001 standard (ISO 9001, 2014, p.73)). The first group included those companies which implement the QMS fully, while the second group included those which apply the QMS partially or only for maintaining certification. All companies which did not apply the QMS fully were excluded from further analysis of process frequency.

The companies which implement the QMS fully were classified according to the maturity of their quality management systems into 11 groups. Each group consisted of companies which were certified for the first time in the same year and each group of companies was processed separately. The second part of the questionnaire contained questions about the process frequency where for each process the company could answer by choosing one of 16 offered answers. For the purpose of data processing, a value between 0 and 365 was assigned to each offered answer in the questionnaire. Assigned values represent the number of the process beginnings in a single year and they are shown in Table 1.

**Table 1:** Assigned values for offered answers in questionnaire for process frequency

Offered answer in questionnaire	Assigned value	Offered answer in questionnaire	Assigned value
once a day	365	once in eight months	1.52
once a month	12	once in nine months	1.35
once in two months	6	once in ten months	1.22
once in three months	4	once in eleven months	1.11
once in four months	3	once a year	1
once in five months	2.4	once in two years	0.5
once in six months	2	once in three years	0.33
once in seven months	1.4	never	0

The frequency of processes for each group of the sample was calculated as an average of assigned values related to the answer which each company had chosen as an answer about its process frequency. Average was also used as a statistical method for processing the rest of the obtained data. In order to learn whether there was a significant difference between those eleven groups the ANOVA test was applied on the processed data with a confidence interval for of 95%, i.e.,  $\alpha=0.05$ .

#### 4. Research results and analysis

The QMS is partially applied in 34.41% of all sampled companies. Those companies were excluded from further analysis. The structure of the sample according to full or partial implementation of the QMS and according to QMS age is shown in Table 2.

**Table 2:** The structure of the sample

Age of QMS		1 year	2 years	3 years	4 years	5 years	6 years	7 years	8 years	9 years	10 years	> 10 years	Total
Companies which apply QMS fully	[1]	12	9	10	10	12	14	9	10	12	10	14	122
	[%]	57.1	56.3	50.0	71.4	75.0	77.8	60.0	66.7	75.0	66.7	70.0	65.6
Companies which apply QMS partially	[1]	9	7	10	4	4	4	6	5	4	5	6	64
	[%]	42.9	43.8	50.0	28.6	25.0	22.2	40.0	33.3	25.0	33.3	30.0	34.4
Total No. of companies in maturity group	[1]	21	16	20	14	16	18	15	15	16	15	20	186

The minimal time of the QMS design is nine months in companies which stated to apply the QMS fully, while all of those companies used help of consultants. Their reasons for the QMS implementation are different, but they all state that benefits of the QMS implementation are: better organization of work, costs reduction, higher percent of plan realization, better anticipation of customer needs, managers' better understanding of company. The average frequencies of their processes, considering the age of their QMS, are given in Table 3.

**Table 3:** Average frequencies of processes required by ISO 9001 depending on QMS maturity in companies that fully apply QMS

Age of QMS \ Process	1year	2years	3years	4years	5years	6years	7years	8years	9years	10years	> 10 years
Control of documents	1.242	2.099	4.351	4.904	5.337	9.333	0.266	0.923	2.630	3.583	5.865
Identification of custom.requirements	27.348	14.853	14.125	10.904	7.571	7.390	7.800	6.540	7.880	8.667	12.291
Quality policy review	3.388	3.735	1.423	0.714	0.786	0.250	0.766	0.333	2.300	0.722	0.291
Quality objectives setting	2.583	2.471	1.131	1.727	1.857	1.0773	1.0866	1.500	1.900	1.682	2.375
QMS planning	4.500	2.853	1.495	1.584	0.857	0.523	0.900	0.526	0.665	1.432	2.188
Management review	5.667	4.176	1.286	1.571	1.429	1.750	1.400	1.250	1.900	1.300	7.375
Human resources training	26.348	6.412	1.305	1.189	0.071	0.105	0.018	10.458	23.165	26.070	29.729
Evaluating the effect. of HR trainings	8.182	3.912	1.097	1.119	0.016	0.073	0.006	10.273	23.121	25.333	28.351
Identification of requirem.for product	24.167	3.931	0.282	1.714	0.143	0.125	0.866	2.111	1.210	1.682	19.988
Review of requirem. related to the product	23.167	3.206	0.114	0.357	0.286	0.273	0.67	0.523	0.415	2.403	18.886
Customer communication	23.167	21.559	22.952	22.286	24.013	25.083	25.200	26.068	27.011	24.015	48.063
Design and developm. planning	7.212	5.152	2.149	1.311	0.169	0.108	0.099	4.330	4.478	8.583	13.563
Design and development review	6.737	2.716	2.649	1.299	0.584	0.833	0.900	4.750	4.500	6.167	13.590
Design and developm.verification	6.598	2.623	3.013	1.299	0.357	0.750	1.100	4.500	4.665	6.250	13.660
Design and developm.validation	6.432	1.912	1.448	1.370	1.941	0.375	1.140	2.398	6.315	6.348	13.125
Control of design and developm.changes	2.682	1.814	1.435	1.013	1.441	3.440	1.118	0.498	4.210	8.265	12.900
Design and devel.changes review	1.530	1.240	1.299	0.311	1.941	0.750	0.436	0.333	1.330	10.182	11.438
Purchasing	276.120	69.176	68.988	61.156	54.571	52.023	39.200	53.023	53.045	53.515	199.125
Verification of purchased product	259.167	77.941	64.441	64.013	66.857	44.770	39.999	62.25	62.545	62.265	243.488
Control of monitoring and measuring equi.	7.417	1.854	0.429	2.026	0.156	0.375	0.400	1.300	2.430	8.722	15.910
Monitoring & measuring cust.satis.	16.167	14.882	5.649	3.857	2.013	0.750	0.532	3.068	1.665	2.320	17.875
Monitoring & meas. processes quality	19.167	12.471	8.305	12.429	12.143	10.500	10.600	10.887	13.500	14.555	24.375
Monitoring & meas. product quality	61.182	59.957	57.370	48.740	48.286	34.150	29.932	31.645	48.045	49.515	53.938
Internal audit control	5.250	5.941	3.143	3.214	3.857	3.500	3.340	3.750	3.500	3.750	4.938
Corrective action control	14.033	14.188	11.107	10.514	8.76	7.867	6.947	4.191	4.143	4.182	3.700
Preventive action control	1.917	1.059	1.1407	1.233	1.3538	1.167	1.286	4.333	5.375	7.5	12.188
FREQUENCY OF ALL PROCESSES	841.37	342.133	282.127	261.854	246.796	207.341	176.008	251.761	311.943	349.008	829.215

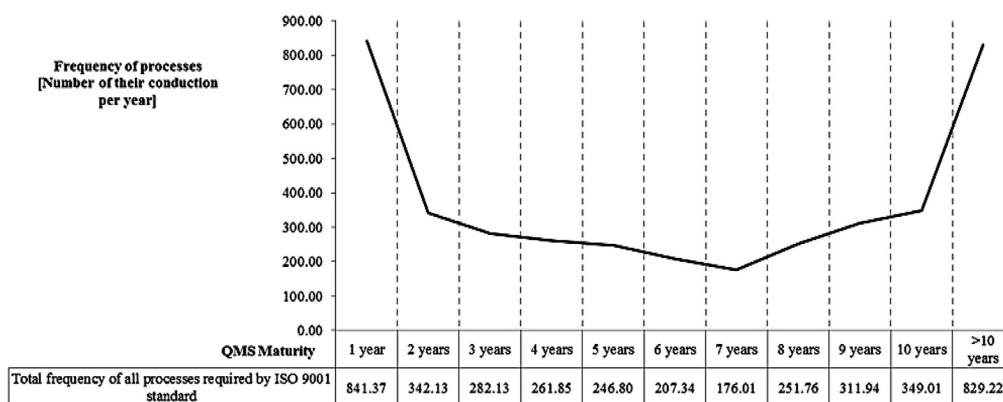
As the aim of research was to find out whether there is any difference between eleven groups of companies, i.e., whether the QMS maturity influences the frequency of processes, the ANOVA method was applied with confidence interval of 95%, i.e.,  $\alpha=0.05$ , and the F-test was used. The results of the ANOVA are given in Table 4.

**Table 4:** Results of ANOVA

Number of groups	k	11
Number of data in one group	n	26
Number of data in all groups	$N = k * n$	286
Intergroup variability degree of freedom	k-1	10
Internal variability degree of freedom	N-k	275
Total Average	$\bar{X}_t = \sum_{i=1}^{11} \sum_{j=1}^{26} X_{ij} / N$	14.33410629
Internal variability	$\sum_{i=1}^{11} \sum_{j=1}^{26} (X_{ij} - \bar{X}_i)^2$	275708.99781
Intergroup variability	$\sum_{i=1}^{11} (\bar{X}_i - \bar{X}_t)^2 * n$	21163.26061
Variance of intergroup variability	$\sigma_g^2 = \sum_{i=1}^{11} (\bar{X}_i - \bar{X}_t)^2 * n / (k-1)$	2116.326061
Variance of internal variability	$\sigma_i^2 = \sum_{i=1}^{11} \sum_{j=1}^{26} (X_{ij} - \bar{X}_i)^2 / N-k$	1002.578174
F value for sample	$F = \sigma_g^2 / \sigma_i^2$	2.110883836

As variance quotation is higher than statistics  $F(10;275;0,05) = 1.865224851$ , it can be concluded that there is a difference between different groups of QMS maturity, meaning that QMS maturity influences frequency of processes in the company.

Figure 1 shows the trend in change of processes frequency over the QMS ageing. At the beginning of QMS implementation, everything seemed to be slowing, due to the fact that the frequency of all processes is decreasing. One assumption could be that cause of frequency decreasing lies in the company's tendency to conform newly implemented QMS to the real operating system. At the beginning of QMS implementation all procedures could be designed to fit ideal process flows, but those ideal flows could be far away from reality. Therefore QMS procedures and processes in reality are changing together, trying to meet each other in the optimum.



**Figure 1:** Change of frequency of all company's processes depending on QMS maturity

After the implementation, changes of the QMS should be done by conducting a process of "control of documents". Figure 2 shows a trend of frequency of "control of documents" process depending on QMS maturity. It is obvious that the frequency of all processes has an opposite trend regarding the frequency of "control of documents" until the sixth year of the QMS application. This supports the assumption that the firm is finding the way to conform processes in reality and QMS procedures. This fitting should not be taken as a real improvement of both systems: the QMS and the business system.

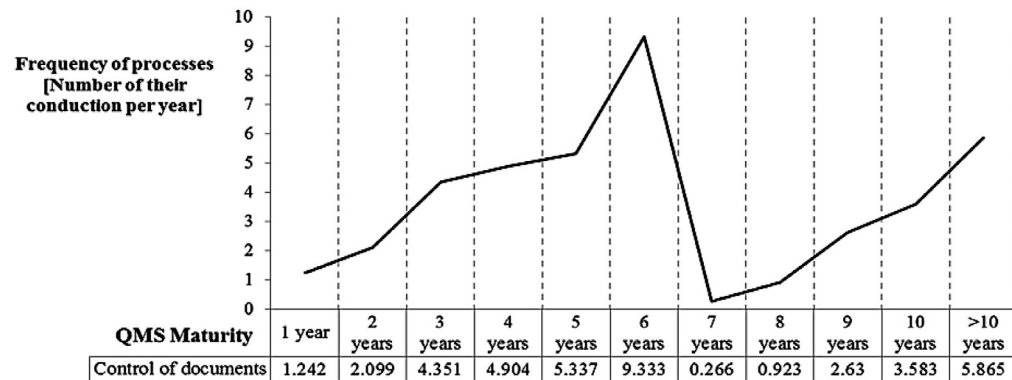


Figure 2: Change of frequency of process “control of documents” depending on QMS maturity

In the seventh year of QMS application, the frequency of “control of documents” process rapidly decreases indicating that the company has conformed its QMS to the business system, therefore processes described by procedures are conducted as they are designed. As there is no need any more for conforming the QMS to business system, the process of change almost stops. A concurrent increase in frequency of all processes and of the process of “control of documents” begins after the seventh year of QMS application. This can be explained by the fact that the business system and the QMS integrated, causing the procedures improvement to be simultaneously adopted in reality after the seventh year.

Figure 3 shows changes in the frequency of the “design and development” process. The frequency of the “design and development” process decreases with the ageing of the QMS, but after seven years of its maturity, the frequency of the “design and development” process begins to increase. Compared to the life cycle of an organization, the frequency of the “design and development” process behaves in an opposite manner. It seems that in the first seven years the company focuses all its efforts on internal changes, but after that period it turns to external environment.

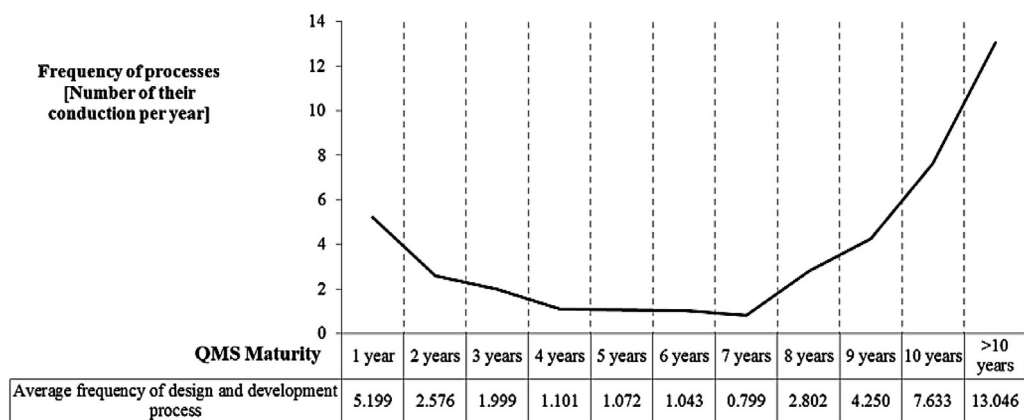


Figure 3: Change of frequency of process “design and development” depending on QMS maturity

The frequency of corrective and preventive actions, shown in Figure 4, is changing in time with the QMS aging, too. The relation between corrective and preventive actions declines with the QMS ageing which indicates that the company is more participant over time, while it acquires the ability to prevent adverse events and understands the QMS is better over time.

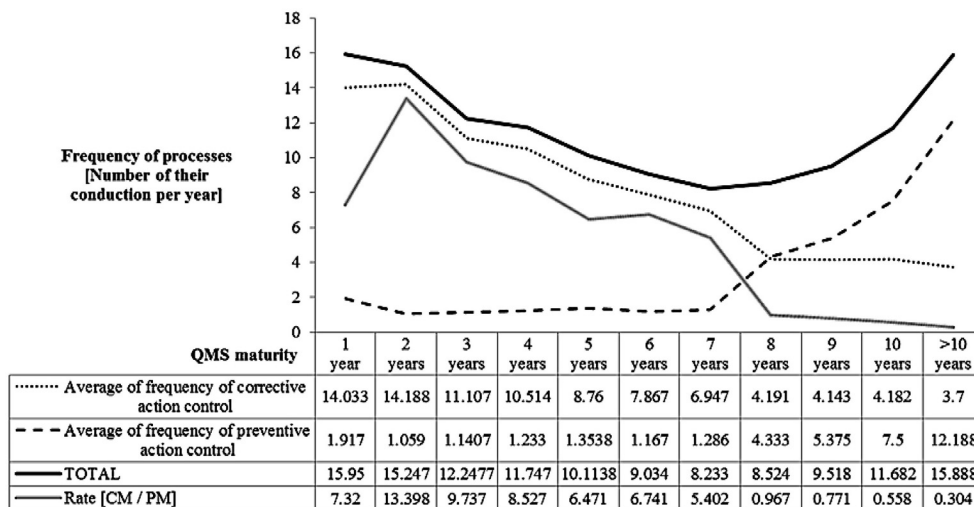


Figure 4: Change in quantity of corrective and preventive measures depending on QMS maturity

The number of nonconformities identified during the internal audit decreases with the ageing of the QMS and the share of nonconformities related to the formal mistakes that do not offer the potential for substantial QMS and business improvement is being reduced (Figure 5). It further means that internal audits are conducted better and that more attention is paid to the substantial improvements of QMS in time.

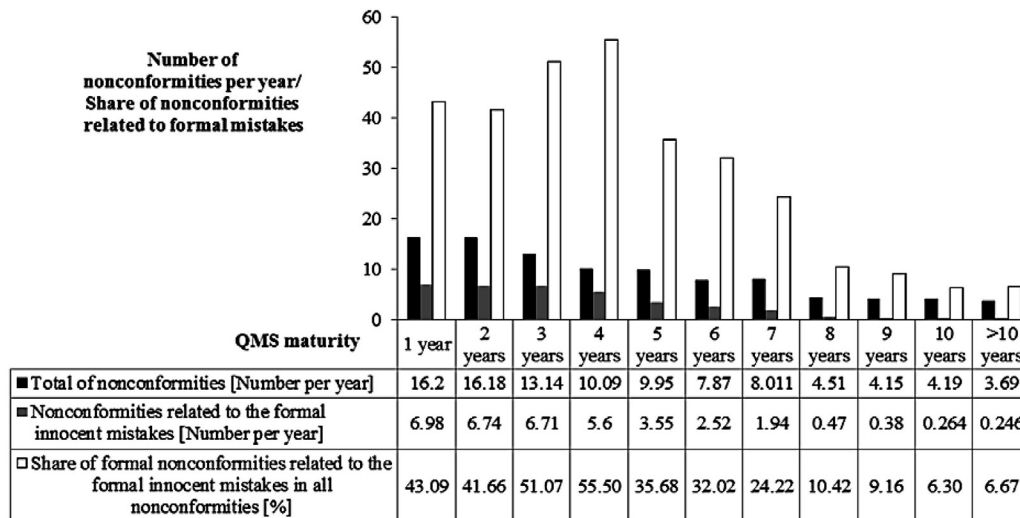


Figure 5: Change in number and type of nonconformities depending on QMS maturity

Table 5 shows a year of maximal and minimal frequencies of each process, together with the change rate which represents a quotient of the maximum and minimum frequencies of the same process. As the rate is higher, the change is larger.



**Table 5:** Minimal and maximal frequencies and change rate

	Maximal frequency of process change	Year of QMS maturity with maximal process frequency	Minimal frequency of process change	Year of QMS maturity with minimal process frequency	Difference between maximal and minimal frequency	Change rate Max / Min
Evaluating the effectiveness of the human resource trainings	28.351	after 10 <sup>th</sup> year	0.006	7 <sup>th</sup> year	28.345	4725.167
Human resources training	29.729	after 10 <sup>th</sup> year	0.018	7 <sup>th</sup> year	29.711	1651.611
Review of requirements related to the product	23.167	1 <sup>st</sup> year	0.114	3 <sup>rd</sup> year	23.053	203.2193
Identification of requirements related to the product	24.167	1 <sup>st</sup> year	0.125	6 <sup>th</sup> year	24.042	193.336
Design and development planning	13.563	after 10 <sup>th</sup> year	0.099	7 <sup>th</sup> year	13.464	137
Control of monitoring and measuring equipment	15.91	after 10 <sup>th</sup> year	0.156	5 <sup>th</sup> year	15.754	101.9872
Design and development verification	13.66	after 10 <sup>th</sup> year	0.357	5 <sup>th</sup> year	13.303	38.26331
Design and development changes review	11.438	after 10 <sup>th</sup> year	0.311	4 <sup>th</sup> year	11.127	36.77814
Control of documents	9.333	6 <sup>th</sup> year	0.266	7 <sup>th</sup> year	9.067	35.08647
Design and development validation	13.125	after 10 <sup>th</sup> year	0.375	6 <sup>th</sup> year	12.75	35
Monitoring and measuring customer satisfaction	17.875	after 10 <sup>th</sup> year	0.532	7 <sup>th</sup> year	17.343	33.59962
Control of design and development changes	12.9	after 10 <sup>th</sup> year	0.498	8 <sup>th</sup> year	12.402	25.90361
Design and development review	13.59	after 10 <sup>th</sup> year	0.584	5 <sup>th</sup> year	13.006	23.27055
Quality policy review	3.735	2 <sup>nd</sup> year	0.25	6 <sup>th</sup> year	3.485	14.94
Preventive action control	12.188	after 10 <sup>th</sup> year	1.059	1 <sup>st</sup> year	11.129	11.50897
QMS planning	4.5	1 <sup>st</sup> year	0.523	6 <sup>th</sup> year	3.977	8.604207
Purchasing	276.12	1 <sup>st</sup> year	39.2	7 <sup>th</sup> year	236.92	7.043878
Verification of purchased product	259.167	1 <sup>st</sup> year	39.999	7 <sup>th</sup> year	219.168	6.479337
Management review	7.375	after 10 <sup>th</sup> year	1.25	8 <sup>th</sup> year	6.125	5.9
Identification of customer requirements	27.348	1 <sup>st</sup> year	6.54	8 <sup>th</sup> year	20.808	4.181651
Corrective action control	14.188	2 <sup>nd</sup> year	3.7	after 10 <sup>th</sup> year	10.488	3.834595
Monitoring and measuring processes quality	24.375	after 10 <sup>th</sup> year	8.305	3 <sup>rd</sup> year	16.07	2.934979
Quality objectives setting	2.583	1 <sup>st</sup> year	1.0773	6 <sup>th</sup> year	1.5057	2.397661
Customer communication	48.063	after 10 <sup>th</sup> year	21.559	2 <sup>nd</sup> year	26.504	2.229371
Monitoring and measuring product quality	61.182	1 <sup>st</sup> year	29.932	7 <sup>th</sup> year	31.25	2.044033
Internal audit control	5.941	2 <sup>nd</sup> year	3.143	3 <sup>rd</sup> year	2.798	1.890232
	Average maximum	Maximal process frequency mostly appeared	Average minimum	Minimal process frequency mostly appeared in	Average difference	Average rate
	37.445	after 10 <sup>th</sup> year	6.153	7 <sup>th</sup> year	31.292	281.316

The largest change in the process frequency occurs in two processes: in evaluating the effectiveness of the human resource trainings and in conducting human resource trainings. The data in Table 3 show that a rapid increase in frequencies of those two processes starts after seven years of QMS application. Before the seventh year the frequency decreases.

The seventh year of QMS application is obviously a critical year; most processes have a minimal frequency in this year. Furthermore, the number of corrective actions is larger than the number of preventive actions for the last time in the seventh year.

It can be concluded that the QMS life cycle consists of two stages: the fitting stage and the beneficial stage. The fitting stage, characterized by the company's tendency to conform the QMS to the real business system, lasts for seven years. In this stage, the process of development is slowing, the frequency of all changes in processes is constantly increasing and corrective activities are much more frequent than preventive ones. The company learns how to use the QMS and how to benefit from it. Nonconformities are frequent and the company is fixing the already occurred errors. In time, the company understands the QMS better, therefore the number of formal nonconformities is reduced, and the company begins to engage in substantive improvements.

A beneficial stage occurs after seven years of QMS application if the company did not reject its QMS. It is expected in this period that development process constantly increases its frequency, while changes in the QMS documentation start a new cycle of change. Preventive actions are more frequent than corrective; the company anticipates adverse events and threats, tending to eliminate them before errors occur. Almost all nonconformities are substantial but their occurrence is low. Everything in the company wakes, all processes accelerate and the company finally starts to benefit from the QMS implementation.

Nonconformities are related to the formal mistakes in 96.875% of companies with a parallel QMS and nonconformities are identified only by internal audits. In 100% of those companies customer complaints never initiate corrective actions and usually are not recorded anywhere. Therefore, companies with a parallel QMS are not able to analyze the results of complaints resolutions. In 93.75% of these companies internal audits have been conducted only once per year, a QMS has been designed for three to four months by a consultant who is usually (in 68.75%) still maintaining a QMS and conducting internal audits in the company. Most of those companies (84.375%) claimed in the survey that the major problem in their QMS is that procedures and records were too complicated or that the QMS documentation did not describe real processes. Those companies have parallel QMS systems which are pulling them downhill. It is obvious that consultants play an important role in designing successful quality management systems and influence the future development of the QMS and its integration into the business system. Also, companies' attitude towards the importance of the QMS and its improvement depend on consultants (Cruciani and Kipping, 2001).

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## Conclusion

The research has shown that quality management systems have a life cycle each which consists of two stages -each characterized by different trends in frequency of process required by the ISO 9001 standard, the development process, of preventive and of corrective actions. Given that the development process has the least frequency around the seventh year after the QMS implementation, its flow should be recognized as the most important. In the same year of the QMS age number of corrective actions is larger than the number of preventive actions per year for the last time, while the share of substantial nonconformities identified during internal audits rapidly grows. Considering all previously elaborated, the seventh year after the QMS implementation is a critical period for those companies which tend to use the QMS fully in order to improve their performances.

The research has also shown that companies with a parallel QMS can be identified by following indicators: most of nonconformities relate to the formal mistakes; all nonconformities are identified only by internal audit; customer complaints never initiate corrective actions; QMS was designed for three to four months before by a consultant who is usually still maintaining it; procedures and records are too complicated. Therefore, for companies with parallel QMS the only way for making things better is to start designing the QMS from the beginning.

Finally, the research shows that the maturity of the quality management system affects the frequency of all processes in companies that apply the QMS fully. It is expected for frequency of all processes to decline in the first seven years, while the frequency of "control of documents" process increases during that time. A reverse phenomenon will occur in the next five years of application. Also, it is expected that a certain percentage of all QMS is deliberately parallel. As companies with parallel QMS continuously keep their certificates (see: Finkle & Shin, 2007), external auditors should be either better trained or more objective and brave in making decisions about taking away certificates from companies with a parallel QMS.

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