

What would QMS implementation really bring to a company? - Theoretical review on benefits and disadvantages researched in practice

QMS
implementation

805

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Abstract

Purpose – This study aims to provide information on particular combination of benefits or disadvantages with exact timing of their appearance in the company after its first certification, along with the information on the value range each benefit and disadvantage would take, as well as on the duration period of expected values.

Design/methodology/approach – Survey was conducted from October 2015 to January 2019 in 306 certified companies with respondent rate of 58.82%. A questionnaire, structured using literature review to identify all possible benefits and disadvantages of QMS, was used to determine the time of appearance, value range and duration of each identified benefit or disadvantage. Results were used to define indicators for fully applied QMS in each age of its maturity, then the indicators were verified using the records of two ISO certified companies.

Findings – There is a difference in the set of benefits and disadvantages in companies with fully implemented QMS and those that are using QMS only to maintain the certificate. In each age of QMS application a specific set of benefits and disadvantages can be expected as well as the volume range of each of them. These timely sets of benefits and disadvantages can be used as indicators to distinguish well-implemented QMS from those partially implemented.

Research limitations/implications – The sample consists of companies from Balkan area, therefore economy, politics and culture could have influenced results, predominantly regarding the value ranges of some benefits and disadvantages.

Practical implications – Companies which already have implemented or are about to implement QMS may use results of the research to plan its effects in years ahead, concerning costs and profit dynamics, as well as to prepare themselves for upcoming probable issues. Auditors can use results in addition to certification criteria to determine the level of QMS implementation and to forecast whether audited company would keep the certificate in the future.

Social implications – Supply chain management could use research findings in selection of chain members to support and speed up third party audits since the benefits and disadvantages of fully implemented QMS are known for each QMS age. This would further imply better structure of supply chains, which would consequently lead to lower production costs, higher quality and competitive prices at the market, which has beneficial implications on the whole society.

Originality/value – For each age of QMS maturity, starting from the first year of certification, expected combination of benefits and disadvantages along with its expected value range and duration are defined. A set of indicators with their expected values.

Keywords Benefits, Disadvantages, ISO 9001, Quality management system, Volume range

Paper type Research paper



1. Introduction

ISO 9001 is world's most widely used standard for quality management (Bounabri *et al.*, 2018; Cívica *et al.*, 2014) according to which many companies designed their quality management systems (QMS). Therefore, ISO 9001 standard has become a synonym for quality management in Europe, the United States and elsewhere (Ragothaman *et al.*, 1999). From the moment ISO 9001 faced the light of the day, until nowadays, scientists and professionals argue if QMS (designed according to ISO 9001) would bring any benefits to organizations and what would those benefits be. There are numerous studies conducted on this topic, some of them evidencing benefits brought to company by QMS (Shaikh and Sohu, 2020; Tari *et al.*, 2017; Duh *et al.*, 2012; Lee, 2012; Lee *et al.*, 2009; Molina-Azorín *et al.*, 2009; Tari' *et al.*, 2014; Yunis *et al.*, 2013), while there are other authors stating that benefits of ISO 9001 implementation are just a myth (Djofack and Camacho, 2017; Murmura and Bravi, 2017; Abaker, 2016; Taouab, 2016; Prajogo and Han, 2012; Lo *et al.*, 2011; Yeung *et al.*, 2006). Some studies prove that ISO 9001 implementation brings disadvantages to companies (Bekele and Zewedie, 2017; Prajogo and Han, 2012; Tari' *et al.*, 2012; van der Wiele and Brown, 1997; Casades and Karapetrovic, 2005; Singh *et al.*, 2006; Chen and Paulraj, 2004; Heikkilä, 2002; Wisner and Tan, 2000) as well, although these studies are much less represented in scientific opus and are based predominantly on employees' opinions rather than on evidences.

In most of the papers mentioning disadvantages of QMS those came as a result of employees' answers on open questions in unstructured surveys and interviews and came as side value from conducted research on some other phenomenon. Considering that benefits of QMS were researched in numerous papers while there is far less number of papers written on disadvantages of QMS, one can get impression that ISO 9001 implementation almost guaranties results to a company, while risk of bad side effect is negligible. This difference in number of conducted studies on benefits and on disadvantages can be a consequence of two facts: either researchers assumed that papers which promote ISO 9001 application would be easier and more certain to be published or journals discriminated papers which prove bad sides of ISO 9001.

Each research focused on different set of benefits or disadvantages of QMS implementation which company would experience. Although there is no consensus on QMS benefits and disadvantages yet (Blessner *et al.*, 2013; Psomas and Pantouvakis, 2015; Singh, 2008; Martinez-Costa and Martinez-Lorente, 2008; Prajogo, 2011; Sampaio *et al.*, 2011, 2012; Ilkay and Aslan, 2012), there is obviously a need to find out what would be the most probable set of benefits or disadvantages that would appear after QMS implementation in the company. Additionally, neither benefits nor disadvantages of QMS have been researched in the context of most probable time after the first certification each one would appear in company, as well as in the context of value range each benefit or disadvantage would take and also in the context of duration each one would last in the company.

Another fact is spoken in professional and scientific circles, yet very "quietly" and more on the conferences than in scientific journals: There is a certain percentage of certified companies which claim to have QMS implemented, while they are only maintaining certificate (Wright, 2000; Kim *et al.*, 2006; Živaljević *et al.*, 2017; Dementyev and Semenov, 2019). This QMS systems cannot have the same characteristics as those with fully implemented and continually improved QMS, therefore benefits and disadvantages of those two kinds of QMS cannot be the same.

There are researches on the changes in QMS characteristics through time which show that QMS has different features in earlier than in later years of its implementation (see: Morsal *et al.*, 2009; Novokmet and Rogošić, 2017; Sfreddo *et al.*, 2018; Zaloha *et al.*, 2018; Živaljević *et al.*, 2017; Ginević ius *et al.*, 2015). Therefore, it is expected that benefits and disadvantages of young and mature QMS would differ as well.

This paper provides two originalities. First, it summarizes in one place all the benefits and disadvantages of QMS implementation discussed and researched across scientific opus by putting each of them into the timely frame of its most probable occurrence after the first ISO 9001 certification. This information was lacking in the scientific opus even that the valuable fact for any business decision making is the time in which results of certain business decisions can be expected to appear. Second originality offers the differentiation between the results (benefits and disadvantages) of partially applied QMS for the sake of ISO 9001 certificate maintaining and fully implemented QMS in the companies which are continually improving the system for the sake of its efficacy and effectiveness. Therefore, the readers of the paper will have the valuable information of what can be expected to happen if they appreciate certificate before the system itself and decide to develop QMS documentation without applying it constantly and fully. Authors hope that the second originality will open additional questions about the existence of constant recertification of partially applied QMS systems, and that these questions will lead to the improvements of certification process or to new solutions which would disable possibility of awarding certificates to the systems which exist only in documentation but not in the reality.

Identification of most probable timely set of benefits or disadvantages of QMS implementation determined by the value range each benefit or disadvantage would take could be of importance for:

- (1) External auditors to identify whether the business system they are auditing should be recommended for certification or not
- (2) Internal auditors to identify most probable outcomes in the future of well implemented QMS as well as most critical areas for its improvements
- (3) Top management of the company when deciding on future QMS implementation or on maintaining certificates
- (4) Supply chain management in selection of chain members to support and speed up third party audits
- (5) To the scientific community, since the paper sorts and classifies accomplishments of previously published researches on benefits and disadvantages of QMS implementation, and provides contribution to judgment on what QMS would bring to the company more, benefits or burden

2. Background and research method

Most of researches on benefits or disadvantages of QMS did not use any classification to structure survey questionnaires, rather the research data were extracted from the statements of companies about their experience with QMS. However, there are several authors who proposed classification of ISO 9001 benefits into external and internal categories (Fonseca and Domingues, 2017; Rusjan and Alič, 2010; Sampaio *et al.*, 2009; Poksinska *et al.*, 2006; Casadesus and Gimenez, 2000) although each author used different combination of benefits within both categories.

Seen as a system, company consists of processes' network where each process uses inputs in order to deliver outputs to other processes or to the surrounding external environment. Each process within this network can be considered as core, supportive or managerial type of process. Core processes are delivering products or services to company's customers, supportive processes are enabling quality and performance of core processes, while managerial processes are setting directions for core and supportive processes, as well as for the company in whole. All processes use energy, material and information to run, while being

conducted by employees and equipment. Suppliers and customers are directly linked to company's processes, influencing their conduction or being influenced by company's image. Profit, costs and waste are consequences, i.e. results of processes' conduction and of their interactions with company's customers and suppliers, therefore those can be taken as outcomes. Any benefit or disadvantage of QMS implementation has to effect one or all of the explained elements of company's business system. In order to develop questionnaire for the survey, authors decided to follow explained logic when classifying all the benefits and disadvantages of QMS that could be found in the literature review.

Authors used Google Scholar search engine to identify papers about benefits or disadvantages of QMS implementation. Synonyms in English for benefits and disadvantages, as well as exact words "benefits" and "disadvantages" in combination with the term "QMS" were used to obtain list of existing papers in the scientific journals. Each paper from the list was approached through EBSCO bases, analyzed and taken into consideration only if benefits or disadvantages of QMS in the paper were consequence of primary research, i.e. case study or survey taken by authors themselves. Therefore, the research in this phase concentrated on real case studies evidenced in the literature (see [Tables 1 and 2](#)).

Only two papers contained empirical proofs from primary research on both benefits and disadvantages of QMS implementation. All the rest of the papers focused either on benefits or on disadvantages. List of all benefits and disadvantages proven to appear in certified companies came as a result of analysis of those papers, and then each benefit or disadvantage was classified in one of the groups proposed by [Figure 1](#) (See [Tables 3 and 4](#)).

Benefits and disadvantages of QMS listed in [Tables 3 and 4](#) were used to create structured Questionnaire for obtaining the data on the first moment of appearance of each benefit and disadvantage and on the values of each existing benefit and disadvantage through time.

Authors have conducted a survey in 306 certified companies in Balkans from October 2015 to January 2019 with respondent rate of 58.82%. The aim of research was to identify all benefits and disadvantages of QMS, as well as to determine most probable time of their appearance after the first certification, their duration and value range each benefit and disadvantage would take during its lasting period.

The research used questionnaire consisted of three parts. First part referred to general data on company and its first certification. Second part contained semi opened questions on benefits and disadvantages which company has experienced through time of QMS application. Each question in the second part referred to one element given in [Figure 1](#), assuring that all elements are researched and structuring in certain level possible answers of the respondents while asking them to state all benefits and disadvantages linked to the element, and to provide data on time of its first occurrence, time of their termination and its value during the lasting period. Each company was advised to state if provided data were derivate from company's records, otherwise given answers would considered as personal opinion of respondent and were not taken in further processing and analysis in order to decrease subjectivity in research method. Third part of questionnaire contained questions on motives and reasons for ISO 9001 implementation, on the way QMS is applied in company (fully or partially in order to maintain the certificate), number of nonconformance, corrective and preventive measures in last three years, along with number of internal audits conducted during that time. Third part of questionnaire was meant to be used as an indicator of how well QMS is maintained in company, i.e. to determine whether company has fully implemented QMS or only maintains the certificate.

Respondents of the survey were Quality managers or Managers responsible for Quality Management System although they have access to most of data necessary for the survey filling, and although they should know the evolution of company's QMS the best of all employees. Sampled companies were classified into two groups according to their statements in the third part of questionnaire. First group [Group A] consisted of companies which implemented and maintained QMS according to ISO 9001 fully, while companies which do not

maintain or implement QMS as it is recommended by ISO 9001 were set in second group [Group B]. A company was classified to apply QMS partially if:

- (1) stated that it applies QMS partially or
- (2) did not perform at least two internal audits per year (ISO 9001, 2014, p. 73)
- (3) number of nonconformance and corrective measures was 0 all the time within the year

Also, according to [Živaljević et al. \(2017\)](#), it is expected that number of preventive measures overcome number of corrective measures after certain time of QMS application, therefore all companies with older QMS which had far more corrective actions than preventive were considered as those which are not maintaining and applying QMS as it is recommended (see [Table 5](#)).

Companies in both groups were divided into 10 subgroups according to their QMS age considering that the oldest QMS in survey was 10 years. Benefits and disadvantages were analyzed separately for each subgroup. Minimal value of benefit or disadvantage of all stated values within subgroup was taken as the minimum of value range, while maximal value of benefit or disadvantage of all stated values within subgroup was taken as the maximum of the value range for the subgroups and for the benefit or disadvantage. Companies were asked to provide data on the percentage of change of certain parameter that refers to benefit or disadvantage. Each stated benefit and disadvantage within Group A was processed only if company had measured and recorded the value of a parameter which assured that analyzed benefits and disadvantages are not subjective observation of company's employee. The same procedure would be performed for Group B, but in Group B neither one company has provided data on the value of stated benefit or disadvantage.

Finally, the list of all benefits and disadvantages for Group A was analyzed from the perspective of its frequency within the age subgroup. Those benefits and disadvantages which were stated by more than 50% of companies within the same age subgroup in Group A were used to define a list of expected benefits and disadvantages for the companies applying QMS fully. In order to test value range of each benefit and disadvantage in the list, two companies holding ISO 9001 certificate for more than 10 years now were selected randomly from both of groups; group A (companies which apply QMS fully) and Group B (companies which apply QMS partially). Authors analyzed historical records of both companies which hold evidence of their performance in last 10 years against the value range of each benefit and disadvantage from the list (see [Figure 2](#)).

Key words used in search engine	Number of papers obtained	Number of papers with primary research data on benefits of all the papers within groups
QMS benefits	56	42 Papers with primary research data on benefits of QMS
Benefits of QMS	134	
QMS advantages	2	
Advantages of QMS	45	
QMS effects	19	15 Papers with primary research data on disadvantages of QMS
Effects of QMS	83	
QMS disadvantages	4	
Disadvantages of QMS	18	
QMS difficulties	11	
difficulties of QMS	1	
QMS issues	51	
Issues of QMS	9	

Table 1.
Number of papers in scientific journals on benefits and disadvantages of QMS

	Paper	Methodology used in research	Sample
1	Beattie and Sohal (1999)	Content analysis	50 Australian certified companies
2	Bakele and Zewedie (2017)	Questionnaires and interviews to collect data with Pearson correlation test to process the data	167 employees in Ethiopia's certified companies
3	Bevans-Gonzales and Nair (2004)	Focus Groups to obtain the data and content analysis to process them	9 certified technical schools in Pennsylvania
4	Blessner et al. (2013)	Content analysis of companies' records with Chi-square tests	1 certified company
5	Brown et al. (1998)	Questionnaires and interviews to collect data and Factor analysis to process the data	160 certified companies in Australia
6	Buttle (1997)	Questionnaires and interviews to collect data with calculating Mean and Standard deviation to process the data	1221 certified companies
7	Casadesús et al. (2001)	Survey to obtain the data and cluster analysis to process the data	502 companies in Spain
8	Casadesu's et al., 2004	Surveys to obtain the data and percentage calculation to process the data	399 companies in Catalonia
9	Casades and Karapetrovic (2005)	Two surveys to obtain the data and comparison analysis to process the data	682 companies in Catalonia
10	Chen and Paulraj (2004)	Questionnaire to obtain data and percentage measures used in content analysis	46 companies
11	Cousins et al. (2006)	Survey to obtain data with context analysis to develop the model	111 manufacturing organizations in the United Kingdom
12	Das et al. (2006)	Survey to obtain the data and factor analysis to process the data	122 companies
13	Douglas et al. (2003)	Questionnaire to obtain the data and comparison analysis to process the data	104 certified companies
14	Flynn et al. (2010)	Questionnaire to obtain the cumulative percentage analysis to process the data	617 companies in China
15	Gamboa and Melão (2012)	Designed model validation using questionnaire to obtain data	5 Portuguese vocational schools
16	Gębczyńska (2018)	Quantitative questionnaire survey to obtain the data and percentage analysis to make conclusions	495 public administrations in Poland
17	Grover and Malhotra (2003)	Transaction cost analysis	203 manufacturing firms in the OEM electronics industry
18	Heikkilä (2002)	Content analysis	6 cases
19	Huang et al. (1999)	Questionnaire to collect the data, <i>t</i> -test and factor analysis	376 certified companies
20	Kasperaviciute (2013)	Content analysis	30 case studies
21	Lee and Klassen (2008)	Content analysis of obtained data from questionnaires	254 healthcare organizations
22	Leung et al. (1999)	Correlation study	405 companies
23	Lo and Chang (2007)	MANOVA test of collected data by structured questionnaire	171 certified company
24	Magodi et al. (2022)	Structured questionnaire to collect the data and inferential analysis to test hypotheses	70 companies
25	Mak (2015)	Comparative study	20 tourist agencies in China
26	Moreland and Clark (1998)	Content analysis	3 certified educational institutions

Table 2.
Data on papers used in
research

(continued)

Paper	Methodology used in research	Sample
27 Nair and Prajogo (2009)	Structured questionnaires to collect the data and content analysis to derivate conclusions	328 certified companies in Australia and New Zealand
28 Poksinska <i>et al.</i> (2003)	Questionnaire used in several studies for cross country analysis was used to obtain the data in Sweden	142 certified companies in Sweden
29 Poksinska <i>et al.</i> (2006)	Interviews, document studies and a questionnaire survey of employees in companies to obtain data. Content analysis to derivate conclusions	91 certified company
30 Prajogo (2009)	Structured questionnaire to collect data and content analysis to drive conclusions	328 companies
31 Prajogo <i>et al.</i> (2012)	Questionnaire to collect data and common method variance to process the data	321 middle and senior managers of ISO 9001 certified firms in Australia
32 Psomas and Pantouvakis (2015)	Questionnaire to collect data and comparison analysis to process the data	198 certified service companies in Greece
33 Quazi and Padibjo (1998)	Questionnaire to collect data and comparison analysis to process the data	40 certified companies in Singapore
34 Ragothaman and Korte (1999)	Questionnaire to collect data and comparison analysis to process the data	212 certified companies in USA
35 Rönnbäck <i>et al.</i> (2009)	Interviews to collects data and content analysis to derivate conclusions	26 respondents in 2 companies
36 Sampaio <i>et al.</i> (2009)	Questionnaire to collect data and percentage analysis of previously identified factors to derivate conclusions	143 certified companies in Portugal
37 Sampaio <i>et al.</i> (2012)	Records of companies to collect the data and content analysis to derivate conclusions	6 certified companies
38 Santos and Leodegario (2021)	Questionnaire to collect data and factor analysis to drive conclusions	749 certified companies
39 Santos and Escancino (2002)	Interviews to collect the data and context analysis to derivate conclusions	25 employees from 3 state universities in Philipini
40 Shaikh and Sohu (2020)	Structured questionnaire to collect data and percentage analysis to drive conclusions	51 construction professionals from ISO certified companies
41 Singels <i>et al.</i> (2001)	Questionnaire to collect the data and content analysis to derivate conclusions	192 certified companies
42 Singh <i>et al.</i> (2006)	Questionnaire to obtain data and reliability (measured with Cronbach's alpha coefficient) and validity (i.e. content, construct and predictive) tests to process the data	309 certified companies
43 Singh (2008)	Structural equation modeling technique	418 certified manufacturing plants in Australia
44 Stevenson and Barnes (2001)	Questionnaire to collect the data and content analysis to derivate conclusions	164 certified companies
45 Tracey and Tan (2001)	Questionnaire to collect the data and analysis of variance (ANOVA) utilizing Tukey pairwise comparisons across every item on the survey to control for firm size, type of manufacturing operation, and industry classification	249 companies
46 Tsiotras and Gotzamani (1996)	Content analysis of records	30 companies in Greece

(continued)

Table 2.

Paper	Methodology used in research	Sample
47 van den Berghe (1997)	Context and factor analysis	1 company for education and training
48 van der Wiele and Brown (1997)	Content analysis	500 employees in Australia
49 Vloeberghs and Bellens (1996)	Survey to collect data and percentage calculation to process and analyze data	150 companies in Belgium
50 West (2002)	Questionnaire to collect data and percentage calculations to process the data	67 certified companies
51 Wisner and Tan (2000)	Survey to collect data and Cronbach-Alpha tests were performed on the scaled data	101 companies
52 Zaramdini (2007)	Questionnaires to collect data and using reliability tests, validity tests, <i>t</i> -test of the means, factor analysis and correlation analysis to derive conclusions	209 companies in UAE
53 Zgirskas et al., 2021	Content analysis	10 companies in Lithuania
54 Zhao et al. (2008)	Questionnaire to collect data and factor analysis	587 companies in China
55 Zimon (2016)	Questionnaire to collect data and analysis of percentages	30 certified companies

Table 2.

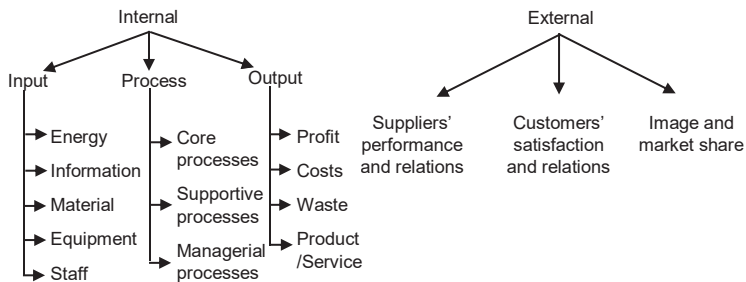


Figure 1.
Classification of QMS benefits and disadvantages used for questionnaire development

Disadvantage and benefits stated by all companies in the same age group can be considered as those that must occur if QMS is applied properly. Therefore, benefits and disadvantages in the list could be considered as indicators of fully applied QMS and could be used to distinguish such companies from those with partially implemented QMS.

2.1 Deficiencies of the research

There are two deficiencies of this paper. First one is that the method used in the research is qualitative therefore contains a certain level of subjectivity. It uses questionnaires with open-ended questions to obtain the data on all possible benefits and disadvantages of QMS implementation from 306 certified companies. However, direct measuring of value range each benefit or disadvantage takes at a certain time after the first certification would be possible only in extremely small sample during very long time. Small sample makes research findings difficult to compare and generalize, therefore authors decided to use questionnaires on a large sample and to decrease subjectivity of qualitative research by asking of companies to prove each stated data with company's records. This led to the second deficiency of the research that refers to inability to collect all relevant data from companies because some answers

Classification category		Benefits found in literature	Authors of paper on benefits
Internal benefits	Core processes	Variation reduction	Shaikh and Sohu (2020), Prajogo <i>et al.</i> (2012), Zaramdini (2007), Santos and Escancino (2002), Singels <i>et al.</i> , (2001), Beattie and Sohal (1999), Quazi and Padibjo (1998), van der Wiele and Brown (1997), Tsiotras and Gotzamani (1996)
		Decrease of product defect rate, rework and scrap	Gebczyńska (2018), Bekele and Zewedie (2017), Sampaio <i>et al.</i> (2009)
		Better operational performance and efficiency	Magodi <i>et al.</i> , 2022, Shaikh and Sohu (2020), Gebczyńska (2018), Bekele and Zewedie (2017), Blessner <i>et al.</i> , 2013, Kasperaviciute (2013), Poksinska <i>et al.</i> (2003), Santos and Escancino (2002)
		Productivity	Magodi <i>et al.</i> (2022), Zaramdini (2007)
		Upgrade of current processes	Joubert (1998)
	Supportive processes	Consistency of processes	Joubert (1998)
		Internal process control	Prajogo <i>et al.</i> (2012), Singh <i>et al.</i> (2006), Casades and Karapetrovic (2005), van der Wiele and Brown (1997)
		Process capability improvement	Zgirskas <i>et al.</i> (2021), Gebczyńska (2018), Blessner <i>et al.</i> (2013), Prajogo <i>et al.</i> (2012), Singh <i>et al.</i> (2006), Casades and Karapetrovic (2005), van der Wiele and Brown (1997)
		Better quality of processes	Zgirskas <i>et al.</i> (2021), Zaramdini (2007)
		Improvement of consistency in process corrections	Gebczyńska (2018), Joubert (1998)
Managerial processes	Improved employees' communication	Shaikh and Sohu (2020), Tari <i>et al.</i> (2012), Joubert (1998)	
	Sharing information efficiently	Joubert (1998)	
	Better identifying non-value-added activities	Quazi and Padibjo (1998)	
	Better employee training	Quazi and Padibjo (1998)	
	Better identification of the needs and expectations of customers	Kasperaviciute (2013)	
Product/Service	Better managerial control	Prajogo <i>et al.</i> (2012), Zaramdini (2007), Santos and Escancino (2002), Beattie and Sohal (1999), Quazi and Padibjo (1998), van der Wiele and Brown (1997)	
	Easier and faster problems identification	Shaikh and Sohu (2020), Prajogo <i>et al.</i> (2012), Nair and Prajogo (2009), West (2002)	
	Easier solution identification	Kasperaviciute (2013), Prajogo <i>et al.</i> (2012), Nair and Prajogo (2009), West (2002)	
	Better improvement of process management	Kasperaviciute (2013), Nair and Prajogo (2009), West (2002)	
	Better supervising processes	Prajogo <i>et al.</i> (2012)	
Staff	Quality uniformity	Prajogo <i>et al.</i> (2012), Zaramdini (2007), Santos and Escancino (2002), Quazi and Padibjo (1998), Beattie and Sohal (1999), van der Wiele and Brown (1997)	
	Improved product and service quality	Magodi <i>et al.</i> (2022), Zgirskas <i>et al.</i> (2021), Shaikh and Sohu (2020), Blessner <i>et al.</i> (2013), Prajogo <i>et al.</i> (2012), Tari <i>et al.</i> (2012), Zaramdini (2007), Poksinska <i>et al.</i> (2003)	
	Improved employees' capabilities and knowledge	Tari <i>et al.</i> (2012), Singels <i>et al.</i> , (2001), Joubert (1998), Quazi and Padibjo (1998), Tsiotras and Gotzamani (1996)	
	Better employee involvement and commitment to quality	Kasperaviciute (2013), Joubert (1998), Quazi and Padibjo (1998)	
	Improvement of employees' job satisfaction	Shaikh and Sohu (2020), Bekele and Zewedie (2017), Kasperaviciute (2013), Tari <i>et al.</i> (2012)	
Information	Improved employees' motivation	Tari <i>et al.</i> (2012)	
	More clear roles and responsibilities	Kasperaviciute (2013), Tari <i>et al.</i> (2012)	
	Clear goals and strategy	Kasperaviciute (2013)	
Energy Material Equipment Profit, Costs and Waste	Better procedures	Zaramdini (2007)	
	<i>No benefits identified in literature</i>		
	<i>No benefits identified in literature</i>		
	<i>No benefits identified in literature</i>		
	Reduced transaction costs to new supplier	Prajogo <i>et al.</i> (2012), Zhao <i>et al.</i> (2008), Chen and Paulraj (2004), Grover and Malhotra (2003), Heikkilä (2002), Wisner and Tan (2000)	
	Reduced total costs because of suppliers involvement in design	Lee and Klassen (2008), Das <i>et al.</i> (2006), Tracey and Tan (2001)	
	Cost reduction from less scarp and rework	Bekele and Zewedie (2017), Blessner <i>et al.</i> , 2013	
	Internal costs reduction	Gebczyńska (2018), Zaramdini (2007)	
	Higher profitability	Gebczyńska (2018), Shaikh and Sohu (2020), Tari <i>et al.</i> (2012)	
	Increase in ROI	Casadesús <i>et al.</i> (2001)	

(continued)

Table 3.
Classification of
benefits found in
literature review

Classification category		Benefits found in literature	Authors of paper on benefits
External benefits	Customers' satisfaction and relations	Better customer activities	Flynn <i>et al.</i> (2010)
		Closer relationship with customers	Prajogo <i>et al.</i> (2012), Singh (2008), Lo and Chang (2007), Singh <i>et al.</i> (2006), Casades and Karapetrovic (2005), Beattie and Sohal (1999), van der Wiele and Brown (1997)
		Enhanced confidence of customers	Prajogo <i>et al.</i> (2012), Vloeberghs and Bellens (1996)
		Decrease of need for seeking new customers	Prajogo <i>et al.</i> (2012)
		Improved customer satisfaction	Magodi <i>et al.</i> (2022), Zgirskas <i>et al.</i> (2021), Shaikh and Sohu (2020), Gębczyńska (2018), Bekele and Zewedie (2017), Blessner <i>et al.</i> (2013), Zaramdini (2007), Casades and Karapetrovic (2005)
	Suppliers' performance and relations	Reduced customer complaints	Zaramdini (2007), Casades and Karapetrovic (2005)
		Enhanced customer loyalty	Lo and Chang (2007), Huarng <i>et al.</i> (1999), Buttle (1997)
		Better customers' responsiveness and feedback	Prajogo <i>et al.</i> (2012), Poksinska <i>et al.</i> (2003)
		Enhances companies' confidence in their suppliers	Prajogo <i>et al.</i> (2012), Chen and Paulraj (2004), Heikkilä (2002), Wisner and Tan (2000)
		Increase delivery reliability	Blessner <i>et al.</i> , 2013, Prajogo <i>et al.</i> (2012), Poksinska <i>et al.</i> (2003)
Image and market share	Suppliers' involvement in product design process	Reduces inspection of suppliers delivery	Prajogo <i>et al.</i> (2012), Chen and Paulraj (2004), Heikkilä (2002), Wisner and Tan (2000)
		Decrease of need for seeking new suppliers	Prajogo <i>et al.</i> (2012)
		Better internal supplier activities	Magodi <i>et al.</i> , 2022, Flynn <i>et al.</i> (2010)
		Close relationship with suppliers	Prajogo and Han (2012), Tari <i>et al.</i> (2012), van der Wiele and Brown (1997), Casades and Karapetrovic (2005), Singh <i>et al.</i> (2006), Chen and Paulraj (2004), Heikkilä (2002), Wisner and Tan (2000)
		Internal audits and documentation can fix supplier-related problems	Chen and Paulraj (2004), Heikkilä (2002), Wisner and Tan (2000)
	Image and market share	Better information sharing with suppliers	Magodi <i>et al.</i> (2022), Zhao <i>et al.</i> (2011), Cousins <i>et al.</i> (2006)
		Suppliers' involvement in product design process	Lee and Klassen (2008), Das <i>et al.</i> (2006), Tracey and Tan (2001)
		Increase of market share	Zgirskas <i>et al.</i> (2021), Bekele and Zewedie (2017), Blessner <i>et al.</i> (2013), Prajogo <i>et al.</i> (2012), Tari <i>et al.</i> (2012), Zaramdini (2007), Santos and Escancino (2002), Beattie and Sohal (1999), Quazi and Padibjo (1998), van der Wiele and Brown (1997)
		Easier entering new international markets	Shaikh and Sohu (2020), Blessner <i>et al.</i> , 2013, Tari <i>et al.</i> (2012)
		Perceived improved quality	Bekele and Zewedie (2017)
Image improvement	Enhanced competitive position	Zgirskas <i>et al.</i> (2021), Bekele and Zewedie (2017), Blessner <i>et al.</i> , 2013, Kasperaviciute (2013), Tari <i>et al.</i> (2012)	
	Image improvement	Zgirskas <i>et al.</i> (2021), Shaikh and Sohu (2020), Kasperaviciute (2013), Tari <i>et al.</i> (2012)	

Table 3.

required confidential records, which could not be given to the authors to prove their validity, therefore those data, were consequently excluded from the research.

2.2 Appropriateness of the method

There are 2 reasons authors chose qualitative research method using questionnaires. First, literature review resulted in a wide range of numerous benefits and disadvantages with no clear indication whether QMS is more beneficial or harmful to the company. Authors needed in-depth insights on topic that is still not well understood. Second reason to choose qualitative research method is the need to look on benefits and disadvantages in continuum of time instead of capturing data of a single moment.

3. Research results and analysis

3.1 Internal benefits and disadvantages in the Group A

Table 6 represents surveyed internal benefits and disadvantages within the group of companies which perform QMS fully. For each benefit and disadvantage, table contains data on its first appearance in the company after the first certification, changes in its value range through time, as well as its duration.

Internal disadvantage	Core process	Efficiency decrease	Rönnbäck <i>et al.</i> (2009)
		Inflexibility increase	Rönnbäck <i>et al.</i> (2009)
	Supportive process	Delays in core processes	Rönnbäck <i>et al.</i> (2009)
		Internal problems	Rönnbäck <i>et al.</i> (2009)
		Indistinct routines	Rönnbäck <i>et al.</i> (2009)
		Communication deficiencies	Santos and Leodegario (2021), Rönnbäck <i>et al.</i> (2009)
	Managerial process	Quality follow-up	Rönnbäck <i>et al.</i> (2009)
		Increased bureaucracy	Zimon (2016), Jorge Gamboa and Filipe Melão (2012), Rönnbäck <i>et al.</i> (2009), Moreland and Clark (1998), van den Bergh (1997), Bevans-Gonzales and Nair (2004)
		Unprofessional managing	Rönnbäck <i>et al.</i> (2009)
		Hierarchy increase	Rönnbäck <i>et al.</i> (2009)
		Lack of comprehensive view	Rönnbäck <i>et al.</i> (2009)
		Outlook and breaches of agreement	Rönnbäck <i>et al.</i> (2009)
		Indistinct agreement	Rönnbäck <i>et al.</i> (2009)
		Bad core process planning	Rönnbäck <i>et al.</i> (2009)
		Too much formalization of actions	Zimon (2016)
		Product/Service Staff	<i>No disadvantages identified in literature</i>
	Attitude problems		Rönnbäck <i>et al.</i> (2009)
	Personal-related problems		Rönnbäck <i>et al.</i> (2009)
	Lack of engagement		Rönnbäck <i>et al.</i> (2009)
	Lack of knowledge concerning agreement		Rönnbäck <i>et al.</i> (2009)
Low level of educational attainment	Rönnbäck <i>et al.</i> (2009)		
Lack of knowledge in core process	Rönnbäck <i>et al.</i> (2009)		
Lack of staff commitment, support and motivation	Kasperaviciute (2013), Jorge Gamboa and Filipe Melão (2012)		
Constraint on creative freedom	Kasperaviciute (2013)		
Lack of quality culture shortage	Kasperaviciute (2013)		
Information	Staff members	Increase of pressure on staff members	Mak (2015)
		Perception of increasing workload	Santos and Leodegario (2021), Mak (2015)
		Ambiguous about who is qualified to conduct audits	Mak (2015)
		Possible leakage of confidential info. on technology and process	Mak (2015)
		Indistinct Information	Rönnbäck <i>et al.</i> (2009)
	Energy	Too many routine documents	Santos and Leodegario (2021), Mak (2015)
		Too much paper work	Mak (2015)
		<i>No disadvantages identified in literature</i>	
		The lack of resources	Kasperaviciute (2013)
		Poorly functioning equipment	Rönnbäck <i>et al.</i> (2009)
Profit, Costs and Waste	High certification and maintenance costs	Zimon (2016), Kasperaviciute (2013), Jorge Gamboa and Filipe Melão (2012), Casadesu's <i>et al.</i> (2004), Stevenson and Barnes (2001), Leung <i>et al.</i> (1999)	
		Rönnbäck <i>et al.</i> (2009)	
External disadvantage	Customers satisfy. And relations	Slow handling customer complaints	Rönnbäck <i>et al.</i> (2009)
		Bad procurement process and regulations	Rönnbäck <i>et al.</i> (2009)
		Still using suppliers without ISO 9001 certification	Sampaio <i>et al.</i> (2009), Douglas <i>et al.</i> (2003), Brown <i>et al.</i> (1998)
		Relationship deficiencies	Rönnbäck <i>et al.</i> (2009)
	Suppliers' performance and relations	Delays in payments	Rönnbäck <i>et al.</i> (2009)
		Destroying outsourced value	Rönnbäck <i>et al.</i> (2009)
		Decrease of attractiveness	Rönnbäck <i>et al.</i> (2009)
Image and market share			

Table 4.
Classification of disadvantages found in literature review

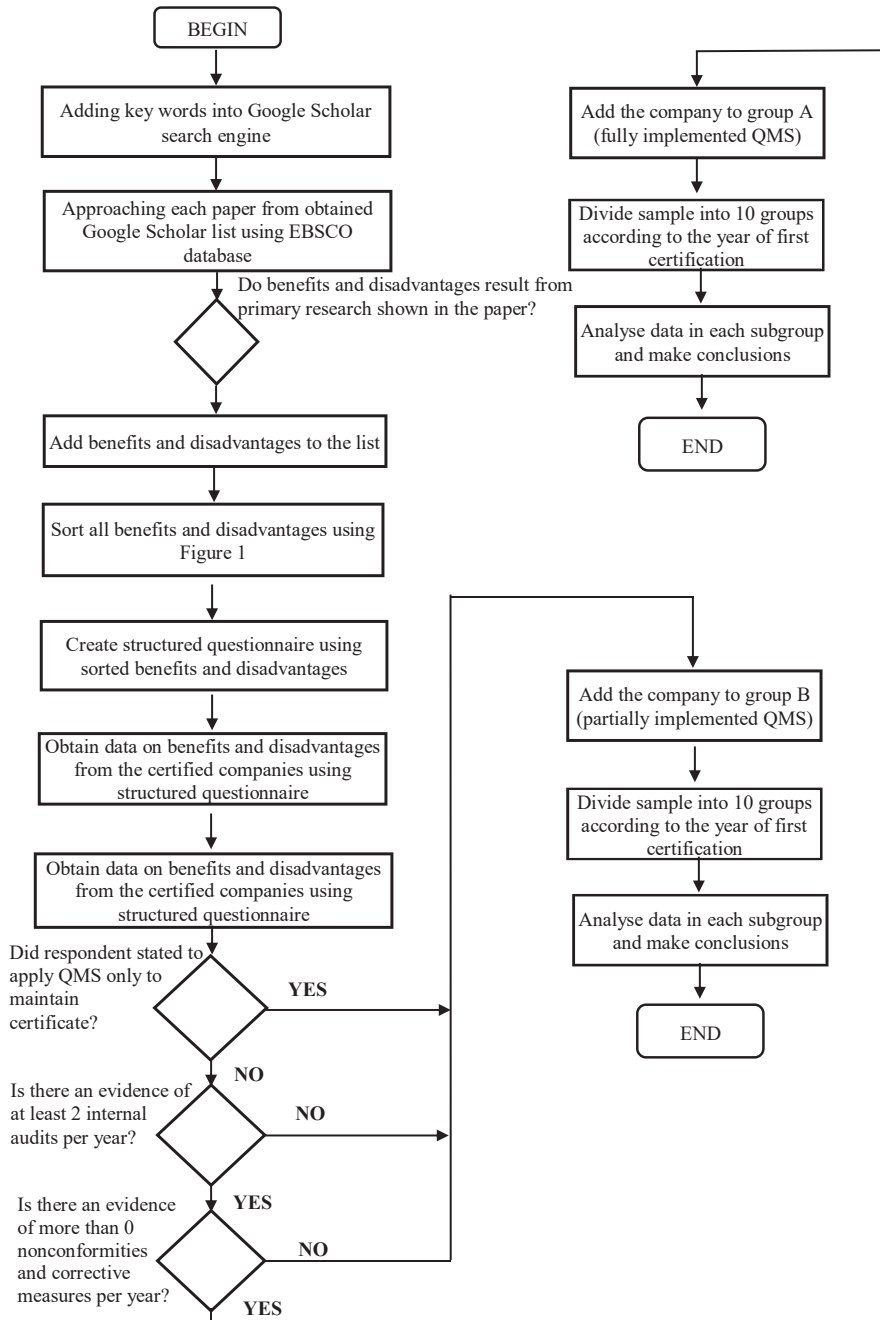


Figure 2. Flow chart of the research method used in the research

Table 6.
Results on internal
benefits and
disadvantages in
surveyed companies,
which apply QMS fully

Element	Benefits	Direction of the change in parameter	Reported value of change in parameter										
			1	2	3	4	5	6	7	8	9	10	
Core processes	Decrease in	Mistakes in activities [%]	Minimal	2	2.7	6.6	6.5 ^⑥	8.7 ^⑥	6.5 ^⑥	5.7 ^⑥	5.2 ^⑥	4 ^⑥	4 ^⑥
			Maximal	5.4	2.6	8	8.7 ^⑥	7.9 ^⑥	6.7 ^⑥	6.5 ^⑥			
	Variation rate [%]	Minimal	14.4	2.8									
		Maximal			0.5	0.5							7.8
	Increase in	Efficiency [%]	Minimal			1.9	2						16.4
			Maximal									6.7	
	Utilization [%]	Minimal											8.9
		Maximal											3.9*
	Productivity [%]	Minimal											3.9*
		Maximal											4.8
Process capability [%]	Minimal											14.4	
	Maximal											5.1	
Activities which are automated [%]	Minimal											6.6	
	Maximal											27.1*	
Disadvantages	Increase in	Mistakes in activities [%]	Minimal	17 ^⑥	7 ^⑥	4 ^⑥	3	3	2				
			Maximal	62 ^⑥	10 ^⑥	13 ^⑥	12	9	8.9				
	Production cycle time [%]	Minimal	4	11	7								
		Maximal	36	29	9								
Delays in the production start [hours]	Minimal	4	2 ^⑥										
	Maximal	24	32 ^⑥										

(continued)

Element	Direction of the changes in parameter	Benefits	Reported value of change in parameter	The age of the QMS after the first certification																	
				1	2	3	4	5	6	7	8	9	10								
Supportive processes	Increase in	Time for training the staff [%]	Minimal 63.7	16.2																	
		Maximal 76.6	16.6																		
	Staff participation in improvements [%]	Minimal 77.8	5.5												77.8						
		Maximal 82	88.6												82						
	Suitable staff that resulted from new employees' selection process [%]	Minimal 11.1	4.9																		
		Maximal 73.3	6.6																		
	Training results conformed to planned [%]	Minimal 9	23.1	3.1																	
		Maximal 10.2	63.6	22.3																	
	Decrease in	Time of defining and implementing solutions [%]	Minimal 66.6	63.7	14																
		Maximal 66.8	72.9	29.6																	
Time for new staff training [%]	Minimal 47*																				
	Maximal 47*																				
Disadvantages	Increase in	Time for gathering and processing data [%]	Minimal 17.6*																		
		Maximal 17.9*																			
Time to estimate customers' and employees' satisfaction [%]	Minimal 56*	44.2																			
	Maximal 56*	73																			
Time for corrective activities implementation [%]	Minimal 36.3	40*	61																		
	Maximal 98	40*	68																		
Time for suppliers selection and validation process [%]	Minimal 42.3	32.9 [@]																			
	Maximal 51.1	37.6 [@]																			
Time for contract review process [%]	Minimal 41.4	39																			
	Maximal 51.3	41																			

(continued)

Table 6.

Element	Direction of the change in parameter		The age of the QMS after the first certification																		
			1	2	3	4	5	6	7	8	9	10									
Staff	Benefits	Increase in	Rate of highly educated stuff [%]							2	2.2	2.1									
		Maximal								3.1	6.1	4.7									
	Disadvantages	Decrease in	Rate of professionally certified stuff [%]			7.1	7.5	4.8													
		Maximal				8.6	9	6													
	Benefits	Increase in	Employees' satisfaction [%]	Work load in [%]	26.6	21	13.3														
					31.3	27.4	32.6														
		Decrease in	Employees' satisfaction [%]	Rate of resigning the job [%]	39.6	4.4	4.1	1.9	1.3*												
					7.3	12.1	4.7	2.8	1.3*												
		Increase in	Detailed job description [%]	Processes described by procedures and instructions [%]	12.5	17.6	11.1														
					13.7	19.5	15.2														
Decrease in	Clarity in type of needed information and its source [%]	Number of documents [%]	30																		
			100																		
Information	Benefits	Increase in	Time to process the information [%]	80	100																
				100	100																
	Disadvantages	Decrease in	Number of documents [%]	22	60	82	100														
				64	100	100	100														
	Benefits	Increase in	Usage of renewable energy in [%]	50																	
				70																	
		Decrease in	Usage of alternative energy sources in [%]	1																	
				2																	
		Increase in	Energy savings in [%]	99																	
				57.4																	
Energy	Benefits	Increase in	Usage of renewable energy in [%]	7.6	6	6	5.8	4.5	4.5	4.5	4.6										
				10.3	9.8	7.5	7.3	6.6	4.9	4.9											
	Disadvantages	Decrease in	Usage of alternative energy sources in [%]	3	4	5	5	9	15												
				10	10																
	Increase in	Energy savings in [%]	28	34																	
			70.8	66.6																	
	Decrease in	Number of documents [%]	36.9	20.9	8.7																
			56	41.3	16.6																
	Increase in	Types of information required for processes to run properly [%]	50																		
			70																		
Decrease in	Energy savings in [%]	1																			
		2																			
Increase in	Usage of renewable energy in [%]	99																			
		57.4																			

(continued)

Table 6.

Element	Direction of the change in parameter	Reported value of change in parameter																			
		1	2	3	4	5	6	7	8	9	10										
Material	Benefits																				
	Increase in accuracy in delivery time in [%]																				
	Decrease in returning shipments to supplier [%]																				
	Disadvantages																				
Equipment	Increase of Material shortage [%]																				
	Delays in shipments [%]																				
	Increase in improved equipment [%]																				
	Disadvantages																				
Profit, Costs and Waste	Increase in unsatisfying characteristics of equipment [%]																				
	Increase in profitability rate [%]																				
	Decrease in Rework production costs [%]																				
	Disadvantages																				
Profit, Costs and Waste	Waste [%]																				
	Costs of product design [%]																				
	Production costs [%]																				
	Cost of certification [%]																				
	Cost of training and skills improving [%]																				
	Cost of corrective actions [%]																				
	Cost of preventive actions [%]																				
	Total costs [%]																				
	Disadvantages																				
	Disadvantages																				

Note(s): *stands when only one company provided data on the extent of benefit or disadvantage; @ stands when all the companies within the group age provided data on parameter value

All companies in group A have reported changes in costs and profitability. Values of parameters “mistakes in activities” and “employees’ satisfaction” are reported by all the companies, however in 4th, 5th and 6th year of age some companies had negative and some positive change in those two parameters.

If analyzing the changes in number of benefits and disadvantages, it can be noticed (Table 7) that they appear mostly in the first three years of ISO 9001 application and then again in 6th, 7th and 9th year.

After the period of first recertification, number of benefits overcome the number of disadvantages more than two times, while the difference between those two numbers is the largest in the seventh and eighth year of QMS implementation. This might lead to conclusion that some kind of major change is happening in this period of company’s QMS life cycle or that in this period companies gain the most from QMS.

With respect to the process approach, all categories of benefits and disadvantages could be classified into those which belong to company’s process, those which refer to inputs or those which are consequents and represent outputs. Change in number of internal benefits and disadvantages regarding to their process, output or input reference within Group A through time is given in Table 8 as well as in Figure 3.

Processes are mostly expected to go through parameters’ changes in first three years after the first certification. However, those changes would be more bad than beneficial. Probably, defining the optimal flow of processes by procedures and instructions and setting a new system of control and audit would cause production time and mistakes in activities to increase, as well as delays in start of production. Although mistakes in activities are mentioned by each company in the sample, this would be the most expected

		Time expressed in years after first certification									
		1	2	3	4	5	6	7	8	9	10
		year	year	year	year	year	year	year	year	year	years
Core processes	Benefits [1]	0	0	1	2	2	2	4	2	1	4
	Disadvantages [1]	3	3	2	1	1	1	0	0	0	0
Supportive processes	Benefits [1]	2	2	0	1	1	2	3	3	1	0
	Disadvantages [1]	4	4	2	0	0	0	0	1	1	1
Managerial processes	Benefits [1]	0	0	0	0	0	1	3	1	1	1
	Disadvantages [1]	4	6	3	1	1	0	0	0	0	0
Product/Service	Benefits [1]	0	0	1	0	0	1	4	3	2	1
	Disadvantages [1]	0	0	0	0	0	0	1	1	0	0
Staff	Benefits [1]	0	0	1	2	3	2	2	1	1	1
	Disadvantages [1]	3	3	3	1	1	0	0	0	0	0
Information	Benefits [1]	3	2	1	1	0	1	1	0	0	0
	Disadvantages [1]	3	0	0	0	1	1	1	0	0	0
Energy	Benefits [1]	0	0	0	1	1	2	1	2	2	2
	Disadvantages [1]	0	1	1	1	1	1	0	0	0	0
Material	Benefits [1]	0	1	1	1	1	1	0	0	0	0
	Disadvantages [1]	2	2	1	0	0	0	0	0	0	0
Equipment	Benefits [1]	0	0	0	0	0	1	0	0	0	0
	Disadvantages [1]	0	0	0	1	0	0	0	0	0	0
Profit, cost and waste	Benefits [1]	1	2	2	2	4	3	1	1	1	1
	Disadvantages [1]	3	2	2	0	0	0	0	1	1	0
All internal benefits		5	6	7	7	10	12	16	19	13	9
All internal disadvantages		22	22	21	14	5	5	3	2	3	2
TOTAL of ALL		27	28	28	21	15	17	19	21	16	11

Table 7.
Change in number of internal benefits and disadvantages within group A in time

disadvantage of QMS implementation in the first three years while it is expected with high probability that mistakes decrease in the QMS age of 7 years.

Output parameters would change pretty even through the time. Mostly expected is that total costs and all types of costs increase in first three years, while companies would experience the highest cost increase in the first year of QMS application. However, production costs and costs of design should start to decrease in the 5th year of QMS application. All the time of QMS application, companies may count to experience increase of profitability rate which would peak in 7th year, since all the sampled companies have claimed this benefit. Product or service would benefit dramatically after 7 years of QMS implementation.

Changes in input parameters are expected mostly to appear in the first and second year of QMS age but disadvantages would overcome the benefits. All companies have stated that employees' satisfaction is decreasing in first three years. In fourth and fifth year of QMS application part of sampled companies stated that this parameter continues to decrease further while the other part of sampled companies claimed that employees' satisfaction would start to increase after 4th year of QMS implementation. Benefits would overcome disadvantage in the fourth year of recertification, while after eight year of QMS application companies should not face any disadvantages regarding inputs.

Table 8.
Distribution of changes in internal benefits and disadvantages within Group A in time

		Time expressed in years after first certification									
		1	2	3	4	5	6	7	8	9	10
		year	year	year	year	year	year	year	year	year	years
Processes	Benefits [1]	2	2	1	3	3	5	10	6	3	5
	Disadvantages [1]	11	13	7	2	2	1	0	1	1	1
Output	Benefits [1]	1	2	3	2	4	4	5	4	3	2
	Disadvantages [1]	3	2	2	0	0	0	1	2	1	0
Input	Benefits [1]	3	3	3	5	5	7	4	3	3	3
	Disadvantages [1]	8	6	5	3	3	2	1	0	0	0
Total	Process [1]	13	15	8	5	5	6	10	7	4	6
	Output [1]	4	4	5	2	4	4	6	6	4	2
	Input [1]	11	9	8	8	8	9	5	3	3	3

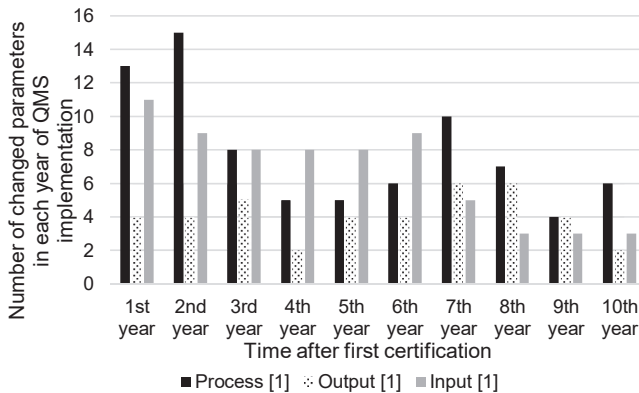


Figure 3.
Number of benefits and disadvantages related to process, input and output during the life cycle of QMS

3.2 External benefits and disadvantages in the Group A

Table 9 represents the dynamics of all external surveyed benefits and disadvantages within the group of companies which perform QMS fully. In addition, Table 10 provides data on change in number of external benefits and disadvantages within Group A in time.

If analyzing the changes in number of external benefits and disadvantages, it can be noticed (Table 10) that they appear mostly in the fourth and fifth year of QMS application, immediately after the first period of recertification cycle is finished.

However, number of internal benefits and disadvantage constantly overcome the number of those external, which contributes to standing that ISO 9001 causes more internal benefits than external ones (see Prajogo, 2009).

3.3 Internal benefits and disadvantages in the Group B

Table 11 represents all external surveyed benefits and disadvantages that would appear in each year of QMS application within the group of companies which perform QMS partially. However, neither one of these companies provided values of stated benefits and disadvantages.

Table 12 shows sum of each category benefits and disadvantage for companies in Group B in each year of QMS maturity.

Benefits and disadvantages related to core processes, product or service, energy and equipment were not claimed by any of companies within Group B. Furthermore, there are no benefits related to any element except staff (which can easily quit the job in the company). This leads to conclusion that decision to partially implement QMS brings to the company numerous issues in internal surrounding and with no reasonable expectations of any internal benefit.

Neither one of the Group B companies has provided data on the value of stated disadvantage which leads to a conclusion that companies in Group B probably do not monitor and analyze quality of internal elements of their business system. Therefore, all disadvantages could be understood rather as opinions of respondent, than as facts. Another possibility arises further: companies, which partially apply QMS, are not improving their business systems and are chocking in burden imposed by false QMS although they only face disadvantage of it.

3.4 External benefits and disadvantages in the Group B

Table 13 shows all external benefits and disadvantages surveyed in companies that would appear in each year of QMS application within the group of companies which perform QMS partially (see Table 14).

The number of external benefits overcomes the number of external disadvantages constantly with tendency to decline through time, both. However, the number of internal disadvantages is larger than the number of external benefits from the beginning of QMS application until to its seventh year, indicating that partially implemented QMS brings more harm than good to a company in the first seven year of application. After seven years of implementation the number of external benefits overcomes the number of internal disadvantages. Considering that external benefits after the seventh year of partial QMS application refer to holding certificate as the only company in the industry, it can be concluded that only companies within the industry which lacks of certified companies may expect to be finally reworded after seven years of suffering.

4. Proposed indicators of fully applied QMS

Some benefits and disadvantages are stated by all the companies within certain QMS age group while the others appear in only few of the companies within certain QMS age group or even in none (see Table 15).

Table 9.
Results on external
benefits and
disadvantages in
surveyed companies,
which apply QMS fully

Element	Direction of the change in parameter	Reported value of change in parameter	1	2	3	4	5	6	7	8	9	10
Customers satisfaction and relations	Benefits	Increase of customers' satisfaction [%]	5.5	2.6	4.3	3.6	11	13.5	12.6	12.7	11.1	5
		Decrease of time for handling customers' complaints [%]	16.6	9.8	21	30	30.1	13.8	17	20.8	23	22.7
		Suppliers involvement in design process				*	*	*				
	D	Increase of time for handling customers' complaints [%]	50	32	27.5	9.4						
		Increase of delivery reliability [%]	147	101.9	70	66.6	7	15.6				
Suppliers' performance and relations		Decrease of time for inspection of supplier's delivery [%]				3.3	6.6	14	10.7			
		Increase of frequency of changing the supplier [%]		28.9		33.3	22.3					
	Disadv	Lack of suppliers with ISO certificate	*	*	*							
		Increase of market share [%]	2			4	12	10	18.8	9.6		
Image and market share		Entering new markets	2.8			7	16	16.9	26.1	16.6	*	*
		Formal recognition because of certificate	*	*	*	*	*	*	*	*	*	*
		Formal recognition because of certificate	*	*	*	*	*	*	*	*	*	*

Note(s): *stands when companies stated benefit or disadvantage without providing minimal or maximal value of it

		Time expressed in years after first certification									
		1	2	3	4	5	6	7	8	9	10
		year	year	year	year	year	year	year	year	year	years
Customers' satisf. And relations	Benefits [1]	1	1	1	2	2	2	2	2	2	1
	Disadvantages [1]	1	1	1	1	0	0	0	0	0	0
Suppliers' perform. And relations	Benefits [1]	0	0	0	2	2	0	0	0	0	0
	Disadvantages [1]	1	2	1	0	0	0	0	0	0	0
Image and market share	Benefits [1]	2	1	1	2	2	2	3	2	1	1
	Disadvantages [1]	0	0	0	0	0	0	0	0	0	0
All external benefits		3	2	2	6	6	4	5	4	3	2
All external disadvantages		2	3	2	1	0	0	0	0	0	0
Total of all		5	5	4	7	6	4	5	4	3	2

Table 10.
Change in number of external benefits and disadvantages within group A in time

If frequency is taken as probability for the event to happen, than analysis of benefit or disadvantage frequency can be taken as the probability of disadvantage or benefit to occur in specific age of QMS. Furthermore, the most probable benefits and disadvantages could be used as indicators of fully implemented QMS to support external audits in recertification. Also, internal audits could use these indicators in order to determine critical area for improvements when indicator is not evidenced in reality. Supplier selection process can use these indicators when deciding whether to accept potential company as a supplier or not. List of indicators which fully applied QMS should evidence in the relevant age of its application is provided in [Table 16](#).

In order to test proposed indicators and their value ranges, records of two companies which hold ISO 9001 certificate for more than 10 years now were selected randomly and their records were audited for each year of their QMS implementation and analyzed against proposed value range of each indicator in the list. First company applies QMS fully since it performs at least two internal audits per year, has number of nonconformance and corrective measures higher than 0 and the number of corrective measures is far lower than the number of preventive measures. Second company applies QMS partially since it stated clearly that QMS is maintained for the purpose of certification a month before external audit is announced. [Table 17](#) shows the audit results of 10 years of QMS application in both of the companies compared to proposed indicators for fully applied QMS ([Table 16](#)).

Since the recorded values of the company with fully implemented QMS are within the value range of each indicator in the list (benefit or disadvantage with probability = 1), while the company which applies QMS partially either has value out of the range or does not have data on it, suggested value ranges could be taken as preliminarily valid, however those should be tested further more using larger sample of companies.

5. Conclusions and implications

5.1 Conclusions of the research

The research presented in the paper imposed 5 most important conclusions:

- (1) Benefits and disadvantages researched and proposed in scientific opus, although different in each paper, can be categorized in 14 groups using process approach logic.
- (2) Each benefit and disadvantage has its most probable timing for appearance after the first certification, duration and volume range.

Element	Direction of the change in parameter	The age of the QMS after the first certification									
		1	2	3	4	5	6	7	8	9	10
Supportive processes	Disadvantage	Time spent on training for auditors increase	x					x			
		Too much data needed to be recorded	x		x						
		Time for estimating customers' satisfaction increase	x	x	x	x					
		Time for defining corrective actions increase	x			x					
		Time of selecting and validating suppliers increase	x		x			x			
Managerial processes	Disadvantage	Too much data for analyze			x						
		Time for writing quality documentation increased	x		x						
		Time for fixing problems in quality management system increased					x			x	
Staff	B Disadvantage	Trained staff to be auditors	x	x	x	x	x	x	x	x	x
		Some staff work overtime on preparing QMS for recertification	x								
		Employees' satisfaction decreased	x	x	x						
		Number of staff quitting the job increase	x			x	x	x			
		Results of audits are used to fire some employees			x	x	x				
		Demotivation and distrust			x	x	x				
		Incompetent staff	x	x	x	x					
Information	Disadvantage	Too much unnecessary procedures	x	x	x	x	x	x	x	x	x
		Too much data writing	x	x		x					
		Too much signing and copying documentations	x			x					
Material	D	Not meeting necessary characteristics	x	x	x	x	x	x	x	x	
Profit, Costs and Waste	Disadvantage	Cost increase because of bonuses for those who worked on certification	x			x					
		Cost increase because of corrective actions implementations	x	x		x					
		Cost increase because of trainings for auditors	x								
		Certification cost increase	x		x			x			x
		Cost increase because of consulting services			x			x			x

Table 11.
Results on internal benefits and disadvantages in surveyed companies, which apply QMS partially

(3) Authors showed that there are companies which are holding ISO 9001 certificate even though their QMS is not fully and properly applied for more than 10 years.

		Time expressed in years after first certification									
		1	2	3	4	5	6	7	8	9	10
		year	year	year	year	year	year	year	year	year	years
Supportive processes	Benefits [1]	0	0	0	0	0	0	0	0	0	0
	Disadvantages [1]	5	1	3	2	0	2	0	0	0	0
Managerial processes	Benefits [1]	0	0	0	0	0	0	0	0	0	0
	Disadvantages [1]	0	0	2	1	0	0	0	1	0	0
Staff	Benefits [1]	1	1	1	1	1	1	1	1	1	1
	Disadvantages [1]	4	2	2	4	3	1	0	0	0	0
Information	Benefits [1]	0	0	0	0	0	0	0	0	0	0
	Disadvantages [1]	3	2	1	3	1	1	1	1	1	1
Material	Benefits [1]	0	0	0	0	0	0	0	0	0	0
	Disadvantages [1]	1	1	1	1	1	1	1	1	1	1
Profit, cost and waste	Benefits [1]	0	0	0	0	0	0	0	0	0	0
	Disadvantages [1]	3	1	2	2	0	2	0	0	2	0
All internal benefits		1	1	1	1	1	1	1	1	1	1
All internal disadvantages		14	2	10	11	3	7	2	3	4	2
Total of all		15	3	11	12	4	8	3	4	5	3

Table 12.
Change in number of internal benefits and disadvantages within group B in time

- (4) Authors showed that there is a difference between fully implemented QMS and those maintained only to keep ISO 9001 certificate regarding the expected set of benefits and disadvantages in each year after the first certification.
- (5) Yearly set of benefits and disadvantages with their most expected values can be used as a set of indicators to distinguish fully implemented QMS from those partially applied for the sake of ISO 9001 certificate maintaining.

Extensive scientific opus suggests different sets of benefits and disadvantages of QMS implementation. However, literature review showed that all suggested benefits and disadvantages in the literature can be classified in 14 categories, and used to distinguish companies with fully implemented QMS from the companies with partially implemented QMS. There are particular sets of benefits and disadvantages for each age of QMS application which appears in all companies with fully implemented QMS but does not exist in partially implemented QMS. Therefore, benefits and disadvantages within those sets could be taken as indicators of fully implemented QMS through time. Value range for each benefit and disadvantage expected in fully implemented QMS in time is proposed in [Table 17](#) and [Table 18](#) [Table 20](#), however one must have in mind that proposed value ranges should be tested furthermore, since the preliminary test used data from only 2 companies.

Research also showed that benefits and disadvantages follow particular pattern in time in the companies with fully applied QMS. It is expected for these companies to have the hardest time in the first three years of QMS application, struggling with issues in employees' satisfaction, mistakes in operations and total cost increase. In this period changes in their processes would be predominantly followed by disadvantages decreasing in time. In the third year of application benefits related to inputs will overcome disadvantages, probably as a result of process optimization. After 7th year of application, companies with fully applied QMS can count on profitability rate increase for the whole time of application, decrease of mistakes, and increase of employees' satisfaction as well.

Partially applied QMS does not provide internal benefits for almost all the time of maintaining false system for the sake of ISO 9001 certificate. Internal disadvantages are present from the very first moment and would decrease in time probably because companies get used to hard operational conditions. All of these companies would face problems with

Element	Direction of the change in parameter	The age of the QMS after the first certification									
		1	2	3	4	5	6	7	8	9	10
Customers satisfaction and relations	Benefit	Holding existing customers because we are the only certified supplier	x	x	x	x	x	x	x	x	x
		Market share increase	x	x	x						
		Winning tenders only because of certificate					x				
	Disadvantage	Getting new customers based on certificate	x								
		Too much time for processing data	x								
		To complicated procedures for complaints	x	x	x	x					
Suppliers' performance and relations	Benefits	Good position in negotiations				x					
		List of potential suppliers	x								
	Disadvantages	Offer widened	x								
		Too much time spending on unnecessary evaluations	x								
		Too complicated procedure for contracting suppliers	x								
		Deciding on supplier according to lowest price				x					
		Changing suppliers constantly				x					
		Material not matching characteristics					x				
		Delays in shipment					x				
		Not enough material from one supplier						x			
		Problems in certification because of having uncertified suppliers							x		
		Problems to evaluate suppliers								x	
		Loosing time on evaluating suppliers because always lowest price supplier gets the job									x
		Image and market share	Benefits	Possibility for winning new tenders	x	x	x	x	x		
Possibility for new contracts				x							
Win on public procurement tenders	x			x	x	x	x	x	x	x	x
Certificate	x			x	x	x	x	x	x	x	x

Table 13. Results on external benefits and disadvantages in surveyed companies which apply QMS partially

high number of usually unnecessary procedures and with material that would not meet necessary characteristics. However, partially implemented QMS companies would experience more good than harm of ISO 9001 implementation, if they endure maintaining

the certificate for at least 7 years because, from the other side, maintaining certificate would assure certain number of customers as well as new opportunities on the market.

In both groups of companies (those with fully implemented QMS and those with partially implemented QMS), different benefits and disadvantages are expected to appear in earlier years of QMS implementation than those that would appear in later years of QMS application. This contributes to the findings of Živaljević *et al.* (2017) that QMS changes through time. However, further research should be conducted in order to examine whether those changes can be considered as a development of QMS or only as a change of its characteristics.

5.2 Contribution of the paper

The results of the research which are contributing to the current scientific opus manifest in following:

- (1) New classification of all benefits and disadvantages consisting of 14 most probable categories of benefits and disadvantages of QMS implementation.
- (2) List of benefits and disadvantages with most probable times after the first certification with most probable duration of each benefit's and disadvantage's appearance.
- (3) Awareness of the existence of ISO 9001 certified systems which do not deserve this prestigious award since they have QMS partially applied
- (4) Set of indicators for good implementation of QMS for each year after the first certification
- (5) Volume range for most expected value of each indicator provided in timely manner.

5.3 Implications of research findings

Research findings imply practice predominantly in two main domains:

- (1) External audit practice can be improved since proposed set of indicators could be used to identify should the business system be recommended for certification or not
- (2) Internal audit practice can be improved since proposed set of indicators can be used to identify most probable outcomes of well implemented QMS as well as most critical areas for QMS improvements.

		Time expressed in years after first certification									
		1	2	3	4	5	6	7	8	9	10
		year	year	year	year	year	year	year	year	year	year
Customers' satisfaction and relations	Benefits [1]	1	2	2	2	2	1	1	1	1	1
	Disadvantages [1]	2	1	1	1	0	0	0	0	0	0
Suppliers' perform. And relations	Benefits [1]	2	0	0	1	0	0	0	0	0	0
	Disadvantages [1]	2	0	2	2	1	1	1	1	0	0
Image and market share	Benefits [1]	3	4	3	3	3	2	2	2	2	2
	Disadvantages [1]	0	0	0	0	0	0	0	0	0	0
All external benefits		6	6	5	6	5	3	3	3	3	3
All external disadvantages		4	1	3	3	1	1	1	1	0	0
Total of all		10	7	8	9	6	4	4	4	3	3

Table 14.
Change in number of external benefits and disadvantages within group B in time

Table 15.
Benefit or
disadvantage
frequency within the
QMS age group in
companies which
apply QMS fully

Element	Benefit or disadvantage	Percentage of companies within the QMS age group with related benefit or disadvantage										
		1 years	2 years	3 years	4 years	5 years	6 years	7 years	8 years	9 years	≥10 years	
Internal	Core processes	Mistakes in activities decrease				45.45	50.00	33.33	100.00	100.00	100.00	100.00
		Mistakes in activities increase	100.00	100.00	100.00	18.18	14.29	22.22				
		Variation rate decrease			44.44	81.82						
		Production cycle time decrease					21.43	11.11				80.00
		Production cycle time increase	12.50	22.22	44.44						56.25	
		Efficiency increase									7.8	
		Utilization increase									50.00	
		Productivity increase										33.33
		Process capability increase										
		Percentage of automated activities		68.75	100.00							
Supportive processes	Supportive processes	Delays in production start	31.25	44.44								70.00
		Time for training the staff increase	37.50	77.78								10.00
		Staff participation in improvements increase										
		Suitable staff that resulted from new employees' selection process increase					35.71	38.89	18.75	25.00		
		Training results conformed to planned increase										
		Time of defining and implementing solutions decrease							50.00	66.67		83.33
		Time for new staff training decrease										
		Time for gathering and processing data increase	6.25	0.00		10.00						
		Time to estimate customers' and employees' satisfaction increase	0.00	11.11	22.22							
		Time for corrective activities implementation increase	12.50	11.11	22.22							
Managerial processes	Managerial processes	Time for suppliers selection and validation process increase	50.00	100.00								
		Time for contract review process increase	31.25	55.56								
		Time for planning decrease									38.89	
		Time for control decrease									31.25	
		All objectives reached									100.00	100.00
		Time for planning increase		22.22	44.44	18.18	14.29					
		Time for control increase		11.11	0.00							
		Time for management review process increase	18.75	44.44	11.11							
		Number of problems in all areas increase	6.25	33.33								
		Time for quality improvement process increase	31.25	66.67								
Product/Service	Product/Service	Time for analyzing data increase	12.50	100.00	100.00							
		Certain percentage of objectives fail to be reached			55.56							
		Service uniformity increase										
		Product uniformity increase										
		New product rate increase						22.22	43.75	33.33	66.67	50.00
Production	Production	Product features improved increase										
		Number of additional services introduced										
		Number of new recycle programs for used products										
		Production assortment reduction										

(continued)

Element	Benefit or disadvantage	Percentage of companies within the QMS age group with related benefit or disadvantage										
		1 years	2 years	3 years	4 years	5 years	6 years	7 years	8 years	9 years	≥10 years	
Staff	Rate of highly educated staff increase			55.56	63.64	42.86	38.89	37.50				
	Rate of professionally certified staff increase				63.64	50.00						
	Employees' satisfaction increase				44.55	64.29	100.00	100.00	100.00	100.00	100.00	100.00
	Work load in decrease	31.25	66.67	66.67								
Information	Employees' satisfaction decrease	100.00	100.00	100.00	36.36							
	Rate of resigning the job decrease	31.25	33.33	55.56								
	Detailed job description increase	37.50										
	Processes described by procedures and instructions increase	56.25	44.44									
	Clarity in type of needed information and its source increase	43.75	45.36	47.78	34.55	0.00	22.22	37.50				
	Decrease in number of documents					21.43	16.67	43.75				
	Time to process the information increase											
	Number of documents increase	81.25										
	Approving instances in org. hierarchy to release information increase	87.50										
	Types of information required for processes to run properly increase	25.00										
Energy	Energy savings increase				18.18	28.57	33.33	18.75	41.67	58.33	90.00	
	Usage of renewable energy increase											
	Usage of alternative energy sources increase											
Material	Accuracy in delivery time increase					57.14	50.00					
	Returning shipments to supplier decrease		77.78	77.78	27.27							
	Material shortage increase	12.50	44.44	88.89								
	Delays in shipments increase	56.25	88.89									
Equip	Improved equipment increase									66.67		
	Unsatisfying characteristics of equipment decrease											
Profit, Costs and Waste	Profitability rate increase	100.00	100.00	100.00	63.64	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	Rework production costs decrease		100.00									
	Waste decrease			66.67	36.36	35.71	44.44					
	Costs of product design decrease					28.57						
	Production costs decrease					100.00	100.00					
	Cost of certification increase	100.00										
	Cost of training and skills improving increase	100.00										
	Cost of corrective actions increase			100.00								
	Cost of preventive actions increase											
	Total costs increase	100.00	100.00	100.00								
External	Customers satisfaction and relations	31.25	44.44	47.78	36.36	28.57	44.44	43.75	33.33	40.00	25.00	
	Suppliers involvement in design process											
Suppliers' performance and relations	Increase of time for handling customers' complaints [%]	31.25	33.33	44.44	45.45	42.86	33.33					
	Increase of delivery reliability [%]				27.27	42.86						
	Decrease of time for inspection of supplier's delivery [%]				45.45	42.86						
	Decrease of frequency of changing the supplier [%]				18.18	21.43						
Image and market share	Lack of suppliers with ISO certificate	43.75	33.33	33.33								
	Increase of market share [%]	37.50	44.44									
	Entering new markets											
	Formal recognition because of certificate	43.75	22.22	11.11	27.27	42.86	33.33	31.25	25.00	33.33	40.00	

Table 15.

Table 16.
List of indicators for
fully applied QMS
related to its maturity

Number of years QMS is applied in the company	List of benefits and disadvantages with their probability to occur in respected age of QMS, their ranges and values in both companies											
	Indicators which must occur Probability = 1	Value range	Company A	Company B	Benefits and disadvantages which are most probable to occur 1 > Probability ≥ 0.7	Value range	Company A	Company B	Benefits and disadvantages which might occur 0.7 > Probability ≥ 0.5	Value range	Company A	Company B
1 year	Mistakes in core process activities increase	(17%-62%)	55.56%	X	Approving instances in organizational hierarchy for information release increase	(1 - 2)	2	X	Delays in production start	(4 - 24 hours)	9.5 hours	X
	Employees' satisfaction decrease	(3.9% - 7.3%)	5.77%	X					Processes described by procedures and instructions increase	(80%-100%)	X	X
	Profitability rate increase	(2.1% - 2.7%)	2.48%	-1.5% *								
	Cost of certification increase	(100%)	100%	100%					Delays in shipments increase	(22.3%-25.4%)	X	X
	Cost of training & skills improvement increase	(40.1%-58.6%)	43.59%	100% @	Number of documents increase	(50-70)	61	92	Time for supplier selection and validation increase	(42.3%-51.1%)	50%	X
	Total costs increase	(5.6% - 14.2%)	10.61%	19%								
	Mistakes in core process activities increase	(7%-10%)	7.14%	X	Delays in shipments increase	(19.1%-25.2%)	X	X	Work load in decrease	(21% - 27.4%)	X	X
	Employees' satisfaction decrease	(4.4%-12.1%)	8.16%	2%	Staff participation in improvements increase	(5.5% - 88.6%)	X	X	Time for analysing data increase	(51% - 54%)	52%	X
	Profitability rate increase	(2.6% - 3.2%)	2.82%	2%								
	Cost of training & skills improving increase	(30.6 - 50.3%)	33.93%	X	Returning shipments to supplier decrease	(66% - 72.2%)	66.67%	No	Time for contract review increase	(39% - 41%)	40%	X
2 year	Total costs increase	(6.8% - 9.9%)	7.81%	2.34%								
	Delays in production start	(2 - 32 hours)	2.5hours	X								
	Time for supplier selection and validation increase	(32.9% - 37.6%)	33.33%	X								
	Certain percentage of objectives fail to be reached	(13.3%-16.3%)	14.29%	All objectives reached								
	Rework production costs decrease	(7% - 10.4%)	9.6%	X								

(continued)

3 year	Mistakes in core process activities increase	(4% - 13%)	10%	X	Material shortage increase	(6% - 2.1%)	16.67%	66.67%	Work load in decrease	(13.3% - 32.6%)	X	X
	Employees' satisfaction decrease	(4.1% - 4.7%)	4.44%	3%					Waste decrease	(16.6% - 17%)	12%	X
	Profitability rate increase	(2.8% - 5.6%)	4.13%	0.98%					Rate of resigning the job decrease	(11.1% - 15.2%)	15%	X
	Total costs increase	(3.1% - 7%)	3.88%	1.51%		Returning shipments to supplier decrease	(34.7% - 35.2%)	35%	Service uniformity increase	(2% - 2.5%)	X	X
	Certain percentage of objectives fail to be reached	(12.9% - 19.6%)	16.67%	All objectives reached					Rate of professionally certified staff increase	(7.1% - 8.6%)	8%	X
	Cost of corrective actions increase	(66.6% - 87%)	74.61%	X								
	Profitability rate increase	(2.3% - 5.3%)	5.26%	-0.2% *		Variation rate decrease	(2.6% - 2.8%)	2.67%	Rate of professionally certified staff increase	(7.5% - 9%)	7.5%	X
	Profitability rate increase	(3.1% - 6.7%)	6.42%	-0.09% *					Unsatisfying characteristics of equipment decrease	(3.9% - 8%)	X	X
	Production costs decrease	(11.1% - 20.3%)	16.56%	-2% *					Employees' satisfaction increase	(18.9% - 25%)	20%	X
	Profitability rate increase	(3.7% - 7.5%)	4.02%	0.18%		Improved equipment increase	(46% - 83%)	60%	Accuracy in delivery time increase	(35% - 89.6%)	40%	X
4 year	Production costs decrease	(12% - 18.7%)	13.65%	-4.5% *					Mistakes in core process activities decrease	(2.7% - 6.5%)	3.2%	X
	Employees' satisfaction increase	(26.2% - 27.9%)	26.67%	2%					Accuracy in delivery time increase	(9% - 10.2%)	10%	X
	Mistakes in core process activities decrease	(6.5% - 8.7%)	7.31%	X					Training results conformed to planned increase	(24.2% - 25%)	25%	X
5 year	Profitability rate increase	(4.6% - 8.2%)	4.84%	0.4%					Time of defining & implementing solutions decrease	(66.6% - 66.8%)	X	X
	Profitability rate increase	(33.3% - 35.6%)	34.21%	0%					Training results conformed to planned increase	(23.1% - 65.6%)	25%	X
	Employees' satisfaction increase	(100% - 100%)	100%	100%					Efficiency increase	(6.7% - 8.9%)	X	X
6 year	Objectives reached								Productivity increase	(4.8% - 14.4%)	5%	X

(continued)

Table 16.

8 year	Mistakes in core process activities decrease	(5.7% - 7.9%)	7.89%	X	Time of defining and implementing solutions decrease	(63.7% - 72.9%)	X	Training results conformed to planned increase	(3.1% - 22.3%)	15%	X
	Profitability rate increase	(4.3% - 9.2%)	4.62%	0.32%							
	Employees' satisfaction increase	(32.9%-47.6%)	37.25%	0%							
	Objectives reached	(100% - 100%)	100%	100%							
	Cost of preventive actions increase	(21.6%-28.4%)	23.08%	0%							
9 year	Mistakes in core process activities decrease	(5.2% - 6.7%)	5.71%	X	Time of defining and implementing solutions decrease	(14% - 29.6%)	X	Development of new product rate increase	(11% - 37%)	33.33%	X
	Profitability rate increase	(3.2% - 9.6%)	3.53%	0.2%							
	Employees' satisfaction increase	(25.8%-42.4%)	27.14%	0%							
	Objectives reached	(100% - 100%)	100%	100%							
	Cost of preventive actions increase	(21.6%-59.9%)	27.74%	0%							
10 year	Profitability rate increase	(4.1% - 11%)	4.55%	0%	Energy savings increase	(4.6% - 4.9%)	X	Development of new product rate increase	(29.8% - 66.8%)	50%	X
	Employees' satisfaction increase	(8.9% - 12.1%)	10.11%	0%	Production cycle time decrease	(7.8% - 16.4%)	9.2%				
	Objectives reached	(100% - 100%)	100%	100%	Usage of renewable energy increase	(5% - 15%)	X				
	Mistakes in core process activities decrease	(4% - 6.5)	6.06%	6.06%	Productivity increase	(6.5% - 18.6%)	7%				

Notes(s): *Opposite trend X No evidence @ Only trainings in company are QMS trainings

	Paper	Methodology used in research	Sample
1.	Beattie and Sohal, 1999	Content analysis	50 Australian certified companies
2.	Bakale and Zewedie, 2017	Questionnaires and interviews to collect data with Pearson correlation test to process the data	167 employees in Ethiopia's certified companies
3.	Bevans-Gonzales and Nair, 2004;	Focus Groups to obtain the data and content analysis to process them	9 certified technical schools in Pennsylvania
4.	Blessner, <i>et al.</i> , 2013	Content analysis of companies' records with Chi-square tests	1 certified company
5.	Brown <i>et al.</i> , 1998;	Questionnaires and interviews to collect data and Factor analysis to process the data	160 certified companies in Australia
6.	Burtile, 1997;	Questionnaires and interviews to collect data with calculating Mean and Standard deviation to process the data	1221 certified companies
7.	Casadesús <i>et al.</i> , 2001	Survey to obtain the data and cluster analysis to process the data	502 companies in Spain
8.	Casadesu's <i>et al.</i> 2004;	Surveys to obtain the data and percentage calculation to process the data.	399 companies in Catalonia
9.	Casades and Karapetrovic, 2005	Two surveys to obtain the data and comparison analysis to process the data.	682 companies in Catalonia
10.	Chen and Paulraj, 2004	Questionnaire to obtain data and percentage measures used in content analysis	46 companies
11.	Cousins, 2006	Survey to obtain data with context analysis to develop the model	111 manufacturing organizations in the United Kingdom
12.	Das <i>et al.</i> , 2006	Survey to obtain the data and factor analysis to process the data	122 companies
13.	Douglas <i>et al.</i> , 2003;	Questionnaire to obtain the data and comparison analysis to process the data	104 certified companies
14.	Flynn <i>et al.</i> , 2010	Questionnaire to obtain the cumulative percentage analysis to process the data	617 companies in China
15.	Gamboa and Melão, 2012;	Designed model validation using questionnaire to obtain data	5 Portuguese vocational schools.

(continued)

Table 17.
Audit results of company with fully applied QMS (A) and company with partially applied QMS (B) related to proposed list of indicators

16.	Gębczyńska, 2018	Quantitative questionnaire survey to obtain the data and percentage analysis to make conclusions	495 public administrations in Poland
17.	Grover and Malhotra, 2003	Transaction cost analysis	203 manufacturing firms in the OEM electronics industry
18.	Heikkilä, 2002;	Content analysis	6 cases
19.	Huang <i>et al.</i> , 1999;	Questionnaire to collect the data, t-test and factor analysis	376 certified companies
20.	Kasperawicute, 2013	Content analysis	30 case studies
21.	Lee and Klassen, 2008	Content analysis of obtained data from questionnaires	254 healthcare organizations
22.	Leung <i>et al.</i> , 1999;	Correlation study	405 companies
23.	Lo and Chang, 2007	MANOVA test of collected data by structured questionnaire	171 certified company
24.	Magodi, <i>et al.</i> , 2022	Structured questionnaire to collect the data and inferential analysis to test hypotheses	70 companies
25.	Mak, 2015;	Comparative study	20 tourist agencies in China
26.	Moreland and Clark, 1998;	Content analysis	3 certified educational institutions
27.	Nair and Prajogo, 2009	Structured questionnaires to collect the data and content analysis to derive conclusions	328 certified companies in Australia and New Zealand
28.	Pokinska <i>et al.</i> , 2003	Questionnaire used in several studies for cross country analysis was used to obtain the data in Sweden	142 certified companies in Sweden
29.	Pokinska <i>et al.</i> , 2006	Interviews, document studies and a questionnaire survey of employees in companies to obtain data. Content analysis to derive conclusions	91 certified company
30.	Prajogo, 2009	Structured questionnaire to collect data and content analysis to drive conclusions	328 companies
31.	Prajogo <i>et al.</i> , 2012;	Questionnaire to collect data and common method variance to process the data	321 middle and senior managers of ISO 9001 certified firms in Australia
32.	Pomas and Pantouvakis, 2015	Questionnaire to collect data and comparison analysis to process the data	198 certified service companies in Greece
33.	Quazi and Padibjo, 1998	Questionnaire to collect data and comparison analysis to process the data	40 certified companies in Singapore
34.	Ragothaman & Korte, 1999	Questionnaire to collect data and comparison analysis to process the data	212 certified companies in USA

(continued)

Table 17.

35.	Rönnbäck <i>et al.</i> , 2009;	Interviews to collect data and content analysis to derive conclusions	26 respondents in 2 companies
36.	Sampaio <i>et al.</i> , 2009	Questionnaire to collect data and percentage analysis of previously identified factors to derive conclusions	143 certified companies in Portugal
37.	Sampaio <i>et al.</i> , 2012	Records of companies to collect the data and content analysis to derive conclusions	6 certified companies
38.	Santos & Leodegario, 2021;	Questionnaire to collect data and factor analysis to drive conclusions	749 certified companies
39.	Santos and Escancino, 2002	Interviews to collect the data and context analysis to derive conclusions	25 employees from 3 state universities in Philippines
40.	Shaikh & Sohu, 2020	Structured questionnaire to collect data and percentage analysis to drive conclusions	51 construction professionals from ISO certified companies
41.	Singels <i>et al.</i> 2001	Questionnaire to collect the data and content analysis to derive conclusions	192 certified companies
42.	Singh <i>et al.</i> , 2006	Questionnaire to obtain data and reliability (measured with Cronbach's alpha coefficient) and validity (i.e. content, construct and predictive) tests to process the data	309 certified companies
43.	Singh, 2008	Structural equation modeling technique	418 certified manufacturing plants in Australia
44.	Stevenson and Barnes, 2001;	Questionnaire to collect the data and content analysis to derive conclusions	164 certified companies
45.	Tracey and Tan, 2001	Questionnaire to collect the data and analysis of variance (ANOVA) utilizing Tukey pairwise comparisons across every item on the survey to control for firm size, type of manufacturing operation, and industry classification	249 companies
46.	Tsiotras and Gotzamani, 1996	Content analysis of records	30 companies in Greece
47.	van den Bergh, 1997;	Context and factor analysis	1 company for education and training
48.	van der Wiele and Brown, 1997	Content analysis	500 employees in Australia
49.	Vloeberghs and Bellens, 1996	Survey to collect data and percentage calculation to process and analyze data	150 companies in Belgium
50.	West, 2002;	Questionnaire to collect data and percentage calculations to process the data	67 certified companies
51.	Wisner and Tan, 2000;	Survey to collect data and Cronbach-Alpha tests were performed on the scaled data	101 companies
52.	Zaramdini, 2007;	Questionnaires to collect data and using reliability tests, validity tests, t-test of the means, factor analysis and correlation analysis to derive conclusions	209 companies in UAE
53.	Zgirska, <i>et al.</i> , 2021;	Content analysis	10 companies in Lithuania
54.	Zhao <i>et al.</i> , 2008;	Questionnaire to collect data and factor analysis	587 companies in China
55.	Zimon, 2016;	Questionnaire to collect data and analysis of percentages	30 certified companies

Table 17.

All explained findings imply practice since they could be used to identify whether the business system audited by the external auditors should be recommended for certification or not while internal auditors may use them to identify most probable outcomes of well implemented QMS as well as most critical areas for QMS improvements. These findings are helpful to top management in resolving dilemma on whether to implement QMS fully or to maintain the certificate only, since the consequences of both possibilities are clear now. Supply chain management could use research findings in selection of chain members to support and speed up third party audits since the benefits and disadvantages of fully implemented QMS are known for each QMS age. This would further imply better structure of supply chains which would consequently lead to lower production costs, higher quality and competitive prices at the market which has beneficial implications on the whole society.

Since the paper sorts and classifies accomplishments of previously published researches on benefits and disadvantages of QMS implementation, and contributes the judgment on what QMS would bring to the company more (benefits or burden), this paper implies scientific community as well.

Here, one question arises: how is it possible that some companies hold ISO 9001 certificate for more than 10 years, but not apply it fully? This question predominantly refers to criterions and procedures of audit organizations which are constantly providing credibility for such companies, and also for accreditation bodies which are rewording those audit organizations with valid accreditation for ISO 9001 certification.

Finally, three main recommendations arise from the research. First, this paper challenges ISO organization to find a way for assuring objectiveness and prevent corruption in both processes: accreditation of auditing companies as well as certification of companies which implement QMS partially. Second is the usage of proposed indicators in certification and recertification as assurance of objectiveness. Third, consultants and management of the company should use proposed sets of benefits and disadvantages as guidance toward right path in QMS implementation and improvement.

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