

Tools and methods used by the Polish leading automotive companies in quality management system. Results of empirical research

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ABSTRACT

Purpose of this paper: The presentation of the results of empirical research in the leading automotive companies in Poland. The study concerned the quality management system in those organizations. In this study, there were presented chosen research results in terms of used tools, methods and thinking for quality management system (QMS) in those companies.

Design/methodology/approach: The studies involved 68 decision makers representing the leading automotive companies in Poland. The basic research tool was the questionnaire survey and non - structured interview. There was used a method of non-random sampling-purposive sampling.

Findings: The automotive industry is one of the leading sectors in Poland. This trade includes vehicle or spare parts makers. Poland is called European basin of spare parts [21]. Analysing the quality management system in the companies, the following was established. Companies of automotive industry have the numerous and diverse QMS implemented. The most of companies have implemented quality system, which is compatible with ISO 9001, 14000 and ISO/TS 16949 standards. Companies of automotive industry are not restricted only to ISO standards. Decision makers showed the implementation of issues typical for TQM or Kaizen. In order to demonstrate the developed structure of QMS, the decision makers indicated the tools and methods used to measure and monitor the effectiveness and efficiency of those systems. The details are contained in this study.

Research limitations/implications: The study population is limited. The research was conducted on the group of decision makers. According to the author, the research needs to be expanded on the other groups of employees in the future. Especially those, who use QMS tools and methods every day.

Practical implications: Presentation of the research results could be concerned as a comparative analysis for the other companies within and outside the sector. Systematized research results can be also an overview for employees of the organization. They can also encourage the employees to think over the meaning of used QMS tools and methods .

Originality/value: The author of this article presented selected results of the original empiric research, conducted among employers in automotive industry in Poland.

Keywords: Quality Management System (QMS); Leading automotive companies; Poland; Empirical research

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INDUSTRIAL MANAGEMENT AND ORGANISATION

1. Introduction

The approach to issue of quality varies from country to country. It is conditioned by many factors, first of all it depends on the level of development and the situational context of the particular society, e.g. the socioeconomic, cultural, technical, technological and political framework. Currently, there are promoted three key quality management concepts: TQM, ISO and Kaizen [2,5,7,8,10,12,13,18,23]. Despite the fact that they differ from each other and that each suggests employing distinct politics, strategies, methods and tools, they seem to have one common underlying idea: **to consolidate the results of the activities, which aim to increase profits of organization.**

The quality management concepts emerged as a result of search for solutions that would allow decision-makers to optimize both expenditure and the results of their activities. It is worth mentioning, however, that the idea to control and to standardize systems, which would regulate quality level, existed since the dawn of time. On the other hand, all the time (though with different intensity) people have been searching for additional profits in order to improve the results. The quality systems have emerged and have been gaining the increasing popularity due to belief that their comprehensive application, in the entire value chain, may help to achieve the main goal of every organization, which is to increase different kinds of profits.

2. Work methodology

The studies involved 68 decision makers representing the leading automotive companies in Poland. The basic research tool was the questionnaire survey and non-structured interview. There was used a method of non-random sampling – purposive sampling.

Moreover, the analysis was based on Polish and English literature of studied subject. The desk research was implemented on the basis of available secondary data such as: publications, industry reports, statistical data provided in the reports, newsletters, databases, catalogues and information available on web pages of automotive companies [3,4,6,9,11,14-16,22,24].

3. Description of achieved results of own researches

3.1. General remarks and scope

Scope: Industrial Management and Organisation, mainly Quality Management.

In this paper, there will be presented selected results for the following general research problem: How do the leading automotive companies monitor the effects of QMS activity? The research purposes, which are connected with the research issue, were defined in the following way: term of QMS, type of implemented QMS, tools and methods of QMS.

In this article there were presented elements of scientific research conducted by the author in Poland among decision makers in leading companies of automotive industry in 2011-2013. The term of "leading company" is concerned as the best one in a particular industry [1,19,21,25,26]. In the conducted empirical research, the criteria of selecting companies to the leading group was the income of sales.

3.2. Analysis and results of empirical research

According to the approved schedule of research, in the first place decision makers defined the term of QMS. QMS was determined by the entrepreneurs as¹:

- a set of interrelated or interacting elements (38.46%),
- arrangement of elements having a particular structure and forming a logically ordered whole (36.92%),
- a complex of elements being in the interaction (30.77 %),
- a set of elements interrelated and connected with the environment (29.77%).

Entrepreneurs showed, that QMS perceive the strategic point of view holistically. They do not consider them from the perspective of particular structures, standards, methods or tools, although they can list them and they know their general rules. For entrepreneurs, QMS is generally one of

¹ The resulting values do not add up to 100% because respondents could choose more than one answer.

the elementary, implemented at the highest level, comprehensive and effective strategy of management. Respondents emphasized in the interviews, that the implementation of QMS in the automotive industry became widespread due to the expected benefits of this implementation. Comprehensive and systematic application of QMS rules enables to pursue the strategic goal of the organization, which is to multiply the profits in various forms. Thereby, respondents highlighted the essence of consolidation effects of measures implemented within the QMS and their impact on the development of the organization's profits.

The concepts of quality management in organizations resulted from the decision-makers seeking solutions to optimize the effects of their actions in relation to costs. Therefore, as the respondents showed in the research, in automotive companies there are used several quality standards at the same time. Because of the large area of diffusion between those systems, the decision makers indicated the synergistic effects resulting from their synchronous usage. That is why, as they claimed, there are implemented various types of QMS standards in their organizations. Respondents finally pointed out the following types of implemented QMS:

- Quality Management System according to ISO 9001 (60.00%),
- Environmental Management System ISO 14001 (41.54%),
- Quality System in the automotive industry ISO/TS 16949, VDA, AVSQ, QS 9000, EAQF (27.69%),
- Management System Occupational Health and Safety 18001 and/or OHSAS 18001 (15.38%),
- Kaizen (10.77%),
- Total Quality Management – TQM (7.69%),
- the internal control system and/ or standards 19001 and Information Security Management System ISO 27001 (3.08%),
- other, including Integrated Management System, AQAP, private enterprise system, 5s, TPM (15.38%),
- I do not know (4.62%).

Achieved research results show, that the basis of QMS in the leading automotive companies is ISO 9001 standard. Basing on ISO 9001, the organization creates its own structure, forms the actions, behaviours and attitudes in the quality management rules, especially the process approach [18]. In time, the basic QMS is expanded with the other elements such as: environmental management, quality in motorization, health and safety requirements, ICS (Internal Control System), information security and other required systems.

In case of QMS- ISO/TS 16949 standard plays an important role in the car industry. The specification ISO/TS 16949² was developed by IATF, in combination with the ISO. IATF is formed by the international group of vehicle manufacturers: BMW, Group. DaimlerChrysler, Fiat, Ford Motor Company, General Motors Corporation, PSA Peugeot-Citroen, Renault & Volkswagen and national trade associations AIAG (America), VDA (Germany), SMMT (UK), FIEV (France), ANFIA (Italy).

The primary objective of ISO/TS 16949 is to develop the QMS in terms of continuous improvement, prevent defects and reduce variability and loss in supply chain. This specification reflects the rules typical for the ISO 9001 standard, especially process approach, the involvement of top management, focus on the customer and taking into account the individual requirements of car manufacturers. Requirements defined by ISO/TS 16949 regarding automotive products are used in all production facilities or services in the automotive industry and include: production and raw materials, heat treatment, welding, painting, coating and other surface treatments, production of assembled components and production of spare parts.

These requirements apply also to the basic tools used in car industry (Automotive Core Tools), regarding to Advanced Product Quality Planning (e.g. APQP), Production Part Approval Process (e.g. PPAP), Measurement System Analysis (MSA) and FMEA, SPC.

Observation and analysis of quantitative data over time for implementation of ISO/TS 16949 in the world, made it possible to define the following conclusions. Due to the occurring processes of concentration and relocation in the automotive industry, a significant part of the production was moved into the East Asia and Pacific territories. It has consequences in the development of standards for quality management. Europe was a leader in the world in the implementation of ISO/TS 16949. This situation has completely changed since 2005. In a dynamic way, the number of implementations within ISO/TS has increased many times in the East Asia and Pacific area, locating companies implementing ISO/TS 16949 standard at the forefront of the world (Table 1).

Analysis of quantitative data about Europe and of the participation of individual countries in the implementation of ISO/TS 16949 allowed to define the following conclusions (Annex, Table 2). In Europe, in 40 countries, companies run active policy connected to development of quality standards in automotive industry. The most active countries in this area include: Germany, Italy, France, Spain, Turkey, Czech Republic, United Kingdom, Poland, Hungary and Slovakia. This situation is reflected in

² Among others, American standards – QS 9000, the German – VDA 6.1, Italian – AVSQ, French – EAQF.

a number of active production plants in Europe. It should be noticed, that in Europe production in the automotive industry is primarily focused on the assembly and making of spare parts, including car engines. In this case, the biggest share in the number of factories presented: Germany, France, Russia, United Kingdom, Italy, Spain, Turkey, Poland, Sweden and The Netherlands. Poland is eight again in this ranking.

It should be noticed, that the numbers of factories showed in ISO and ACEA statistics are not convergent: it is due to the calculation methodology. ACEA presents data of companies that are its members. ISO shows instead the quantitative results for all those companies, that in a formal way will carry out an implementation and certification of standard compliant with ISO/TS 16949.

If compared to the number of certificates for ISO/TS 16949, the number of those for Poland are at the following level (Fig. 1). On the basis of data, the following findings are made (Table 3). According to the general data, in Poland there are 14 working factories, in which vehicles are assembled and spare parts are made. At the same time, there were 538 implementations within ISO/TS 16949 in 2013. It means that the automotive market in Poland is more extensive than it is shown by widely available data with number of factories. Poland has been labelled European basin for spare parts, as the real number of firms in sector is 2 819 [26]. It means that as a consequence, the number of implementations of ISO/TS 16949 will probably grow in the coming years, due to the stringent requirements of manufacturers of OEM (Original Equipment Manufacturer) on the suppliers of tier type (direct or indirect supplier).

From the perspective of a defined research problem, there were conducted studies on the determination of tools and methods used to monitor the activities of the QMS in the leading automotive companies.

Respondents stated that the monitoring of the functioning of the QMS in the company is made by monitoring of the functioning of the QMS in the leading automotive companies is carried out by:

1. QMS tools:

- using classical tools of quality management, i.e. the analysis of Pareto-Lorenz, histogram, correlation charts, Shewhart control charts, Ishikawa diagram, sheet counting data (40.00%),
- using the new tools of quality management, i.e. the affinity diagram, the interrelationship digraph, a tree diagram, the prioritization matrix, the matrix diagram, the process decision program chart, the process decision program chart (12.31%).

2. QMS methods:

- Failure Mode and Effects Analysis – FMEA (35.38%),
- Balanced Scorecard – BSC (27.69%),
- Statistical Process Control – SPC (21.54%),
- Six Sigma method (20.00%),
- Mystery Shopping method (15.38%),
- other methods, i.e. internal documentation, certificate of good performance, internal monitoring systems (7.69%),
- Quality Function Deployment – QFD (4.62%),
- Critical Incident Technique – CIT and Servqual method (1.54%).

Table 1.

ISO/TS 16949 – Quality management systems – Particular requirements for the application of ISO 9001 for automotive production and relevant service part organizations

No	Year	Overview									
		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1.	TOTAL	10019	17047	27999	35198	39320	41240	43946	47512	50071	53723
2.	Africa	144	316	342	415	447	440	447	472	464	479
3.	Central/South America	394	734	1270	1383	1454	1476	1531	1575	1581	1585
4.	North America	4517	4571	5230	5929	5903	5411	5217	5334	5410	5592
5.	Europe	3212	6290	8943	10159	10771	10533	10624	10891	11017	11263
6.	East Asia and Pacific	1479	3884	9983	14569	17719	19910	22378	24968	26985	29831
7.	Central and South Asia	226	956	1593	2016	2260	2672	2991	3388	3817	4260
8.	Middle East	47	296	638	727	766	798	758	884	797	713

Source: The ISO Survey of Management System Standard Certifications – 2014

Table 2.
ISO-TS 16949 Countries – Europe

No.	Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOP
	Country (Total)	3212	6290	8943	1015 9	1077 1	1053 3	1062 4	1089 1	1101 7	1126 3	
1.	Austria	77	133	158	188	192	185	188	189	192	191	
2.	Belarus	1	2					1	2	5	6	
3.	Belgium	74	134	125	143	142	138	127	122	121	115	
4.	Bosnia and Herzegovina	2	1	2	6	9	10	14	14	12	17	
5.	Bulgaria	2	4	9	14	18	22	26	30	30	40	
6.	Croatia	1	7	5	20	15	15	18	19	19	17	
7.	Czech Republic	307	352	431	526	565	560	593	604	617	637	6
8.	Denmark		2	20	23	24	21	19	20	24	29	
9.	Estonia	1	3	5	7	9	10	10	10	10	11	
10.	Finland	2	18	32	29	32	30	29	26	23	23	
11.	France	89	854	1127	1165	1183	1096	1033	1059	1039	1021	3
12.	Germany	1043	2115	2763	3068	3243	3205	3178	3210	3184	3209	1
13.	Greece	1	3	7	6	6	3	5	4	3	3	
14.	Hungary	95	156	214	257	287	287	299	311	324	336	9
15.	Ireland	7	7	29	30	27	23	20	21	23	20	
16.	Italy	173	312	935	1024	1088	1070	1118	1155	1147	1171	2
17.	Latvia				3	4	7	8	6	7	7	
18.	Liechtenstein			4	4	3	5	6	5	5	5	
19.	Lithuania		1	2	2	3	3	4	6	8	9	
20.	Luxembourg	4	5	12	13	15	12	15	15	14	15	
21.	Malta		1	4	5	4	4	4	4	4	5	
22.	Monaco		20	5	5	5	4	4	4	4	4	
23.	Netherlands	16	82	114	120	128	127	129	130	133	134	
24.	Norway	13	12	18	22	24	20	20	20	16	18	
25.	Poland	77	191	297	392	436	445	468	476	505	538	8
26.	Portugal	54	53	128	146	149	142	142	154	160	162	
27.	Romania	4	6	115	155	181	194	209	217	229	253	
28.	Russian Federation	5	16	42	78	106	107	131	164	194	237	
29.	San Marino Republic of			2	1	1	1	1	1		0	
30.	Serbia			5	6	10	10	11	15	18	26	
31.	Serbia and Montenegro	7	7								0	
32.	Slovakia	34	76	113	151	193	201	213	227	244	255	10
33.	Slovenia	83	86	79	80	93	102	103	100	102	105	
34.	Spain	526	726	870	928	972	896	869	891	900	902	4
35.	Sweden	21	70	156	207	236	230	230	238	240	234	
36.	Switzerland	77	88	104	115	116	118	120	120	120	117	
37.	The former Yugoslav Republic of Macedonia		2	3	3	2	5	6	6	7	6	
38.	Turkey	98	265	384	504	554	603	643	691	737	780	5
39.	Ukraine		4	8	12	16	19	26	29	30	33	
40.	United Kingdom	318	476	616	701	680	603	584	576	567	572	7

Source: The ISO Survey of Management System Standard Certifications – 2014

3. Other actions, such as:
 - internal audits (86.15%),
 - certification/recertification (72.31%),
 - by a set of indicators and surveys, interviews (67.69%) and internal and external customer surveys (36.92%).

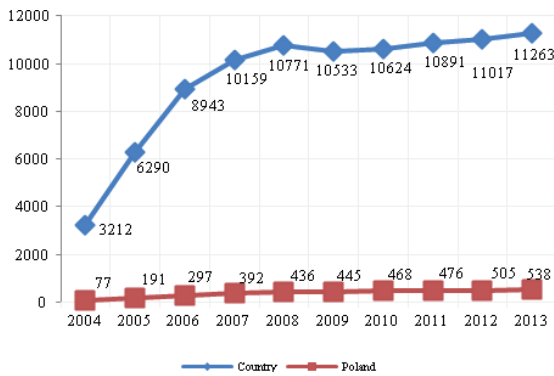


Fig. 1. ISO-TS 16949 Countries; Source: own study based on The ISO Survey of Management System Standard Certifications – 2014

Table 3. Automobile assembly and engine production plants in Europe

COUNTRY PLANT	
DE Germany 43	PT Portugal 6
FR France 34	AT Austria 5
RU Russia 34	KZ Kazakhstan 4
UK United Kingdom 34	HU Hungary 4
IT Italy 22	RO Romania 3
ES Spain 15	RS Serbia 3
TR Turkey 15	SK Slovakia 3
PL Poland 14	HR Croatia 2
SE Sweden 11	BY Belarus 2
NL The Netherlands 9	FI Finland 2
CZ Czech Republic 8	UZ Uzbekistan 2
BE Belgium 9	BG Bulgaria 1
UA Ukraine 7	SI Slovenia 1
Total: all manufactures – 26 and number of plants – 293	
EU28: all manufactures – 19 and number of plants – 226	

Source: own study based on www.acea.be

In the leading automotive companies to monitor the effectiveness and efficiency of the operation of the QMS, the most often are used internal audits, certification/recertification and well-defined group of indicators by which systematic records of occurring phenomena are

carried out. It should be noticed, that these are mainly the tools that are used to analyse the internal efficiency of organization. To a minor extent, but the organizations still take actions that lead to the assessment and analysis of their own actions, basing on the opinions of stakeholders, mainly the clients. What is important, decision makers indicated the fact of using Mystery Shopping method (MS), that is some kind of novum for actions in car sector. During the interviews, the respondents supplemented their statement, that research carried out with MS method let them gather information needed to improve the customer service process.

Furthermore, the employees mostly use seven standard tools of quality management and advanced QMS methods, including: FMEA, BSC, SPC, Six Sigma. The traders less pointed out, that in their companies are also used new QMS tools and the other methods such as: internal documentation, certificate of good performance, internal monitoring systems. However, the result for QFD method is surprising. It is used by the leading companies only in 4.62 %. It is a surprise, because QFD method is widely known and it encompasses analysis of all crucial elements of company's environment, including: the company's own resources, customers, competition.

4. Conclusions

In this paper, there were presented selected results within defined research problem, contained in the question about the methods of monitoring the effects of actions of workers from the leading companies in the automotive industry in the field of QMS. The detailed research goals connected to the research issue were completed. There were determined: QMS term from the perspective of decision makers of leading automotive companies, types of implemented QMS, QMS tools and methods that were used.

The empirical research made it possible to define the following conclusions: Decision makers from the leading organizations of car industry in Poland identify the QMS with the set of useful methods and tools that affect the quality of the products. In the companies like this there are first of all used internal audits, certification/recertification and well-defined group of indicators, by which the current and historical analysis of data within QMS is made. Moreover, there are used may tools of quality management – especially seven standard tools or methods – mainly FMEA, BSC and Six Sigma.

QMS is identified with the standards, by which particular organization conducts the policy and sets the strategy of quality. In case of the leading companies from automotive industry, there are mainly used ISO 9001 and 14000

standards. On the other hand, ISO/TS 16949 specification is a detailed development of defined requirements.

As the respondents emphasize, using of several methods and tools at the same time in a complementary way influence directly on the organization's costs and the efficiency of actions taken to provide the quality standards and meet the client's expectations in the whole supply chain.

It is noted that the study population is limited. The research was conducted on the group of decision makers. According to the author, the research needs to be expanded on the other groups of employees in the future. Especially those, who use QMS tools and methods every day.

Presentation of the research results could be concerned as a comparative analysis for the other companies within and outside the sector. Systematized research results can be also an overview for employees of the organization. They can also encourage the employees to think over the meaning of used QMS tools and methods.

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