Metody i techniki zarządzania jakością

Methods and techniques
of quality management

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1. IDENTIFICATION AND SIGNIFICANCE ASSESSMENT OF QUALITY MANAGEMENT METHODS AND TECHNIQUES ON THE EXAMPLE OF AUTOMOTIVE INDUSTRY SUPPLIERS. METHODICAL ASSUMPTIONS OF RESEARCH

1. Introduction

The automotive industry is a highly developed network of suppliers providing components direct for OEM. The suppliers cooperate with one another in various areas of activity and under diverse contracts e g. providing supplies for production lines, service stations or the aftermarket of spare parts and equipment In each case, the supplier has to meet strict requirements related not only to product quality, but also, above all, to management system. Companies make efforts to obtain the status of an OE/OES [17] supplier, since this type of references makes it possible for them to expand on the OEM market. Quality management can play a key role here It is based on different sets of requirements which vary in respect of how detailed they are and how difficult it is to implement them Without any doubts QMS requirements which should be met by suppliers play a key role when their success on the market is concerned. The scope of requirements themselves is considerably wide – from those determined by economic aspects to all elements of a standardised Quality Management System to industry specific and customer specific requirements.

Thus, using quality management methods and techniques is a key component of a system approach to quality management in the automotive industry

In case of many companies, quality management methods and techniques are not well-known and if used, they are only used only in a partial way. At the same time, there is vast literature [1–16, 18–22] available on the market which characterises a wide spectrum of tools for improvement These tools can be helpful when monitoring non-compliances and taking corrective and preventive actions is concerned. In case of automotive industry, using the said tools when identifying causes of non-compliance and determining priorities for improvement is an everyday practice Based on the conducted research, the author is trying to find an answer to the question of which methods mentioned in the literature are used and what motivates organisations to implement specific methods.

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2. Research objectives

To explain any scientific problem, a research objective has to be determined and realised In this very case the objective is narrowed down to identifying methods and techniques which are used in the automotive industry by OE/OES suppliers and assessing how significant each one of them is for the QMS to be effective

In order to realise the general research objective, the following tasks need to be carried out:

- verifying reference literature on quality management in the automotive industry, an specifically literature which is directly related to the formulated research problem,
- gathering documents, standards, procedures which are sets of required methods and techniques which are determined in particular in customer specific requirements (CSR),
- identifying requirements which are not formalised and have the nature of 'know-how' used by OEM suppliers,
- describing key methods and techniques for quality management which are used in the automotive industry,
- studying the significance of requirements on a sample of companies which undergo a comprehensive assessment both from the perspective of certifying bodies and customers, as well as companies which realise their own priorities aimed at improving the effectiveness and efficiency of their management systems and the overall business efficiency,
- drawing conclusions in the form of recommendations both specifically for actual and potential suppliers for the automotive industry and more generally for all organisations aiming at improving their QMS

The following scientific hypothesis (and more specifically its working version) is to be verified so as to realise the research objective: *The most significant methods and techniques for quality management used by suppliers in the automotive industry are the 'PFMEA' and '8D'*

The results of the conducted research and conclusions resulting from it shall make it possible to identify the directions for effective development and improvement of QMS for actual and potential OEM suppliers (both 1-st and 2-nd tier) Taking into consideration the universal character of the methods and techniques used by the companies taking part in the research, its results can also be universal for all organisations which realise the TQM strategy.

3. Significance of research results

Assessing the significance of quality management methods and techniques together with their efficiency and studying the automotive industry in this respect (on the basis of suppliers based in Poland holding ISO/TS 16949 certificates) can seem purposeful for the following reasons:

- the results of the research may be a considerable source of information to build a quality management strategy with regard to implementing, maintaining and above all developing QMSs in companies,
- taking into account globalisation of the automotive industry (companies based in Poland supply not only inside Poland, but also around the world), the conclusions can be generalised to all organisations irrespective of their geographical location and of where the OEM clients they cooperate with are based,
- the automotive industry is a pioneer in so far as system approach to quality management is concerned; thus the obtained results can be used not only in relation to this industry, but also by all companies which respect the TQM principles,
- in the face of OEM and OEM supplier migration to countries with low production costs, Poland (beside above all China, the Czech Republic, India and Hungary) is considered the most attractive location; this results in extending the logistic chain with business entities based in Poland; moreover, a high level of investments in the automotive industry can be observed in Poland, made mainly by independent 1st tier suppliers (the biggest of them: AE Group, Autocam Poland, Automotive Lighting, Bosch /Denso, Bridgestone) owing to which the economic conditions in the automotive industry are improving; each new workplace is connected to another four in companies already existing in Poland, thus the number of companies which can be directly interested in the research results is rising in a very dynamic way,
- Poland is characterised by a high number investments made by 1st tier suppliers; however it can be assumed that the deadlock will be resolved and some planned OEM investments will be realised (e g PSA and Mercedes-Benz); this, in turn, will make the supply chain 'more Polish', in other words the suppliers based in Poland will develop more dynamically and there will be a need to develop quality management systems,
- the preliminary analysis of literature in this field indicates that no research with an objective of this type has been performed so far; papers which are related to the subject matter usually discuss the significance of factors related to QMS or present particular quality management methods and techniques which are used in the automotive industry; the results of research within this project will be of pioneer character and the way in which the respondents are chosen does not limit the universal character of conclusions,
- consequently, the results will be presented in the form of a scientific paper which will also discuss the requirements which have to be met in the automotive industry (there has been no paper regarding quality management in the automotive industry for 10 years)

The author decided to realise the following research project because of the reasons stated above. The conclusions presented by the author can be the basis for designing strategies for QMS development in case of many companies, and as such strategies are realised HR training programmes and practices related to using specific methods and techniques of management can be created As a result of this Poland can become even more attractive for investors as a country with highly qualified human resources and effective QMSs, which are key elements in the qualification and development of suppliers. The results of the research and the conclusions of the author resulting from them will allow entrepreneurs to build professional paths for the development and improvement of their QMS

4. State of knowledge regarding the use of quality management methods and techniques in the automotive industry

Research conducted by the author as part of the scientific project is of pioneer character. This particularly applies to the objective specified for the proper research, i e assessing the significance of QM methods and techniques (with regard to the effectiveness of QMS) (used by OE/OES suppliers in the automotive industry) As research objectives were defined and as research scenario was prepared a preliminary query of literature on the same research problems as discussed in the author's research work The initial intention of the author was to gather materials concerning significance assessment of methods and techniques of quality management which are implemented by suppliers in the automotive industry After that, the analysis of literature went beyond the automotive industry and was not limited to standardised management systems

Literature was gathered with the use of the following key words: (e g QMS & automotive, automotive components industry, automobile & customer specific requirements, automotive & supply chain management, auto parts industry & management, ISO/TS 16949, QS-9000, core tools, automotive industry, QM factors, QM criteria, audit criteria, critical factors, critical success factor, CSR, quality management tools, 8D, FMEA, PFMEA, DFMEA, Ishikawa diagram, Pareto analysis, SPC, QFD), and searching the following databases: WDI (World Development Indicators), GMID (GLOBAL MARKET INFORMATION DATABASE), ProQuest, ECONLIT, ACADEMIC SEARCH PREMIER, BUSINESS SOURCE COMPLETE MASTER FILE PREMIER, EMERALD, together with library collections of numerous Polish and American universities

The author has not come across any papers in which the significance of QM methods and techniques would be discussed, not only in the automotive industry, but also in other branches of industry

5. Research methodology

The following tasks are to be realised within the research project:
- comprehensive query of literature performed at the planning stage; its results were used to specify the objectives and research hypothesis, as well as to prepare the surveys which are parts of the research; some conclusions were also drawn based on the query,
- a preliminary survey (S1) conducted in cooperation with a group of experts, in which the author was the moderator (research method: the Delphi method, in-depth interview; tool: updated list of quality management methods and techniques; data collection method: the Internet, meetings, telephone conferences, video conferences),
- a proper survey (S2) carried out on the whole population (all companies which certified their QMS against ISO/TS 16949) (research method: structured questionnaire interview; tool: questionnaire; data collection method: the Internet),
- data analysis – study an statistical inference

In the preparatory survey (S1) a questionnaire consisting of a full list of methods and techniques for quality management used in the automotive industry together with an evaluation scale was compiled The questionnaire will be used as a tool in the proper survey (S2) and shall be prepared in a way which will enable this part of the research to be performed with the use of the Internet. The proper research will be preceded by pilot research. Its results will be taken into account when S2 is planned and prepared

The results of the proper survey will be verified by e g evaluating the confidence intervals and precision of errors and calculating the coefficient of variation. The significance analysis will be performed by calculating mean values both for the whole scope of data and for fixed intervals Inference will be also based on values of specific statistical measures (medians, modal values and ranges) Two statistical methods, i e correlation and regression will be used to compile the results of the research and verify the formulated research hypothesis The said methods will also help to analyse the relation between the use of particular methods and techniques and the function of QMS This direction of research will, first of all, allow verifying the research hypothesis Secondly, it will help to rank quality management methods and techniques according to their significance (influence on the effectiveness of QMS) Last but not least, it will point out to the possibility and purposefulness of combining particular methods in an efficient and effective way and using them to the benefit of an organisation.

6. Conclusions

The main source of knowledge on diverse methods and techniques of quality management are above all textbooks which provide a wide scope of information in this matter However, the role of guidebooks, standard interpretations and corporate materials concerning in this respect should not be underestimated Unfortunately, as practice shows the said tools are not always well-known. Moreover, if they are used, they are used to document rather intuitive actions and do not serve the purpose of achieving specific objectives Numerous quality management methods and techniques are described in literature However, when the market is analysed, it can be concluded that not many of them are used in practice. The results of this research will allow to assess how particular tools are and what motivates organisations to implement them The results will also lead to a number of conclusions which can be found useful by actual and potential suppliers in the automotive industry when designing a QMS What is more, the conclusions may be used by any company wishing to develop its management system.

7. Literature

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