

POSSIBILITIES OF USING QUALITY MANAGEMENT SYSTEMS TO UNDERTAKE INNOVATION ACTIVITIES IN AN ORGANISATION BELONGING TO THE CHEMICAL INDUSTRY

Marek BUGDOL^{1*}, Dawid HAJDUGA²

¹Jagiellonian University, Department of Quality Management; marek.bugdol@uj.edu.pl,
ORCID: 0000-0001-9993-7765

²Jagiellonian University, Doctoral School of Social Sciences; Dawid.hajduga@doctoral.uj.edu.pl

* Correspondence author

Purpose: The main objective of this article is to identify the possibilities of using quality management systems to undertake innovation activities in an organisation representing the chemical industry.

Design/methodology/approach: A literature review was carried out to find out the state of the research on the subject. It was conducted according to the research methodology proposed by J.W. Creswell (2013). Ten employees from one of the key departments of an organisation belonging to the chemical industry were interviewed.

Findings: The interviewees are of the opinion that their organisation's quality management system is a useful tool. However, if the system is to support innovation activities, employees should be trained more extensively, they should be provided with information on the potential benefits of quality improvement and innovations, competitions for best organisational solutions should be organised and the quality management system itself should be improved so that it is less documentation-intensive.

Research limitations/implications: A literature review is not a perfect way to obtain information. Previous research has been conducted in different organisations and in different cultures. Secondly, it is important to remember the limitations inherent in qualitative research.

Practical implications: Based on the results of the research, those responsible for the functioning of management systems can take appropriate measures aimed at increasing the scope of innovation activities of employees.

Originality/value: Quality management systems conducive to innovation activities in the chemical industry are not a frequent research topic.

Keywords: quality management system, innovation, chemical industry, knowledge.

Category of the paper: research paper.

1. Introduction

The functioning of quality management systems has been an interesting research topic for a long time. Various analyses of its usefulness, possibilities for improvement, or combination with other management systems or concepts have been undertaken. This article focuses on how a management system based on the ISO 9001:2015 standard can be used to support innovation activities in a chemical industry enterprise. For this purpose, we will use a literature review and the results of a qualitative study conducted in one organisation belonging to the chemical industry. We will first identify the factors that are important for innovation activities and in the subsequent step we will review those studies that have addressed the relationships between quality management systems and innovation.

After the diagnostic research, we will try to answer the question of what needs to be done in order for a quality management system to support innovation activities.

Organisations producing various chemicals are specific due to the hermetic nature of their processes, which are carried out according to the laws of physics and chemistry. This characteristic also makes the knowledge and skills of the personnel conducting and supervising such processes unique. This is essential to ensure work safety at the highest level. The uniqueness of the processes also has a negative side, as it generates training problems for those people who support the production processes but do not have the particular technological knowledge. Various studies indicate the need to develop competencies in knowledge management as well as quality management (Dźwigoł-Barosz, 2018). In chemistry, innovations often consist in improving existing products, using new production technologies, but technological progress is not possible without knowledge, good work organisation and support provided by various management systems.

The main objective of this article is to identify the possibilities of using quality management systems to undertake innovation activities in an organisation representing the chemical industry.

2. Innovations and their drivers

An innovation is a new or improved product or process (or a combination thereof) that differs significantly from an entity's previous products or processes and that has been made available to potential users or put into use by the entity (Oslo Manual, 2018). In practice, many employees understand innovations as simply ideas, inventions or improvements (Slade, 2020). Innovation is rather a process of information and knowledge creation that is carried out by generating and defining a problem to solve or a task to perform (Nonaka, 1990).

Innovations are customarily divided into those related to products, processes, marketing activities and organisational aspects. Due to the interest in new technologies aimed at reducing negative environmental impacts, the term eco-innovations is used more and more frequently (Yuan et al., 2022), which means that innovations can also refer to individual areas of activities.

In quality management, any type of innovation plays an important role. However, in the case of manufacturing enterprises, any technological innovation that contributes to improving product quality is significant (Nasierowski, 2000).

Therefore, the implementation of improvement and not necessarily innovation activities undertaken within well-functioning quality management systems should be integrated with employee innovation management programmes.

In quality management, it is employees that constitute the source of innovations (Oakland, 1995). A critical prerequisite for undertaking innovation activities is an appropriate organisational culture (Slade, 2020) characterised by high levels of trust (Bugdol, 2010), positive psychological capital of employees and a climate of innovation (Ren, Zhang, 2015).

The huge number of publications that address the conditions conducive to innovation activities point to the need to train employees and to shift the organisation's focus towards learning (Seleshi, Birnberg, 2012; Halvarsson, Gustavsson, 2018; Engelen et al., 2018). Employees must want to share knowledge and the influx of new knowledge must be ensured. A work environment that supports learning practices can increase organisational innovativeness (Smith, 2017). Employees must have both technical and soft skills that enhance their ability to innovate and that are being continuously developed from the initial training phase (Zergout et al., 2020).

The cultural basis of innovation activities is the responsibility of managers. Their role consists in rewarding employees for innovative solutions (Campbell-Allen et al., 2008), fostering a culture of learning (Lin, Lee, 2017), developing a system of incentives and objective indexes for evaluating ideas (Day, Shea, 2020), properly selecting tools and procedures for the preparation, implementation, monitoring and evaluation of innovative ideas (Butt et al., 2021), planning innovation activities, ensuring effective communication and developing unambiguous guidelines (Hiltunen et al., 2021).

A significant proportion of innovative solutions are initiated in practice by various quality improvement teams. The prerequisites for working out innovative solutions, however, are the disjunctive type of tasks, the adequate size of a team and, above all, the organisation of work that ensures cooperation among individual team members (Wuchty et al., 2007). If an adequate level of high quality innovations is to be ensured, the heterogeneity of quality teams must be taken into account (Hu et al., 2021).

The prerequisites for successful innovations listed above can be applied to any organisation. Additionally, what should be emphasised in the case of quality-oriented organisations is the need for a process-based approach to innovation activities. Quality management systems based on the ISO 9001:2015 standard incorporate risk-based thinking and strongly focus on process

management (SILVA et al., 2016). Process improvement is closely linked to both quality improvement and innovations (Waddock, Bodwell, 2004). In the industrial sector, the knowledge of technological processes (Bello-Pintado et al., 2019) allows for the implementation of technological innovations (Nasierowski, 2000).

In such circumstances, employees must possess the knowledge of process analysis, integration and optimisation, as well as the knowledge of particular chemical processes.

3. Quality management systems and innovativeness

Many innovative solutions can be achieved through the use of quality improvement methods (Mättö, 2019). The use of quality management systems provides many opportunities for practical innovative solutions. Various research projects on the relationships between quality management systems and innovation activities have already been undertaken (Martínez Rojas et al., 2020; Saadia, 2021). Although proving the existence of such relationships, the results of such research are not conclusive. Most of the studies conducted so far have indicated a direct relationship between quality management and innovations, ignoring, however, potential variables that may influence this relationship (Escrig-Tena et al., 2018).

The studies cited suggest that a quality management system facilitates continuous quality improvement, but is not a strong factor in undertaking innovation or development projects (Martínez Rojas et al., 2018). The results of other studies conducted using structural equation modelling show the direct impact of the hard dimension of quality management (e.g. data collected, quality records) on product and process innovations, while the effects of the soft dimension of quality management are created through proactive behaviours of employees (Escrig-Tena et al., 2018). Quality management systems based on the ISO 9001 standard can foster innovations and statistically better financial performance, but what also needs to be ensured is an innovativeness strategy and policy (Latan et al., 2020).

A quality management system based on the ISO 9001 standard has a positive effect on innovativeness, which is confirmed by some of the analysed innovation indexes. And therefore, in order to significantly improve innovation performance, organisations must have a solidly established quality system (Saadia, 2021).

Among other things, a quality management system fosters innovations because it increases organisational knowledge. Through knowledge management practices, ISO 9001 certificate holders improve their quality systems and consequently achieve productivity gains (Matos et al., 2022). Issued in 2015, ISO 9001:2015 is the first standard to include a specification of organisational knowledge. There are many relationships among quality, process and knowledge management systems. It can even be argued that there is a complementarity between quality management and knowledge management (Wilson, Campbell, 2020). The accumulation of

knowledge should also be fostered by improvement activities. Similarly to Lean, quality management systems provide for employees to be able to learn from their mistakes as well as to propose measures aimed at preventing the occurrence of mistakes. Organisations must ensure that outputs that do not meet their requirements are identified and monitored to prevent their unintended use or delivery. They should take appropriate preventive measures based on the nature of non-compliance and its impact on the conformity of products and services (Wolniak, 2020). One of the conditions for the accumulation of useful knowledge in innovation activities is the acquisition of useful data. Various publications constantly emphasise that organisations should evaluate the effectiveness of their quality management systems and monitor their processes on a continuous basis. A system based on KPIs can be particularly useful for evaluating processes under implementation (Wolniak, 2021).

4. Research problem, objective and method

A literature review was used to gain insight into the state of the research on the subject. It was conducted according to the methodology proposed by J.W. Creswell (Creswell, 2013).

The applied procedure was consistent with the principles of research conducted in management sciences. First, key words for the issues under review were identified (innovation, quality management system, chemical industry, process approach, knowledge). The review focused on publications collected in databases subscribed to by universities (Academic Search Ultimate, Business Source Ultimate, Eric).

A qualitative approach was used in the empirical part of the research. Interviews were conducted in 2023 among 10 specialists (management staff, engineers) working in the chemical industry.

The aim of the research is to show the potential for using quality management systems in innovation activities. Once we have identified the factors facilitating such activities, we intend to confront them with the ISO 9001 criteria. The performed qualitative research aims to establish the level of familiarity with quality management systems. On this basis, practical recommendations for the organisation participating in the study will be formulated.

Pursuing the stated objective, the authors formulated the following research problems:

1. In the opinion of the employees, does the quality management system functioning in the organisation contribute to the development of employees' competencies?
2. According to the respondents, does the organisation's management show commitment to improving the system and leadership in undertaking improvement and innovation activities?
3. According to the interviewees, are the conditions for the recognition of and rewarding for innovation activities clearly defined in their organisation?

4. In the opinion of the employees, does the management take steps to identify the internal context and try to remove barriers to innovation activities?
5. In the opinion of the employees, do the existing forms of work enable quality problems to be solved by teams?

The conducted literature review shows that knowledge, pro-innovation leadership, an incentive system, an appropriate organisational climate and teamwork ensuring cooperation among individual employees are of key importance to taking up innovation activities.

A quality management system based on the ISO 9001 standard can be a tool for creating new knowledge, integrating it with existing resources, as well as developing knowledge for quality improvement (Lin, Wu, 2005).

Knowledge is one of the elements of competence, and in quality systems, according to criterion 7.2 of ISO 9001, the organisation should “identify the necessary competencies of the people performing the work affecting the performance and effectiveness of the system and ensure that employees are competent through education, training or experience” (EN ISO 9001: 2015, 2016).

Thus, if the system is functioning properly, it should foster competence development and, indirectly, innovation activities (Z1).

Strong leadership has a direct impact on commitment, people management and process management, and indirectly on employee satisfaction (Calvo-Mora et al., 2005).

In organisations, we have a variety of managers who are not necessarily leaders. However, ISO 9001 recognises that the top management of an organisation should demonstrate leadership and commitment to the system, which manifests itself in, among other things, taking responsibility for the effectiveness of the system and promoting a process-based approach (EN ISO 9001: 2015, 2016).

It can be concluded that a prerequisite for taking innovation activities is the commitment of the management and the manifestation of leadership in undertaking activities aimed at improvement and innovation (Z2).

Another factor is incentive, motivational and remuneration systems. In quality management systems, leadership, support for employees and incentive systems directly or indirectly support the knowledge utilisation process. In order for people to want to share and use knowledge properly, an appropriate remuneration system is needed, as well as appropriate goal setting (Kulkarni et al., 2006/2007).

Thus, it can be assumed that the propensity to undertake innovation activities exists when the conditions for recognising and rewarding innovation activities are clearly defined in the organisation (Z3).

An organisation may obtain the knowledge of its climate – as a condition for innovation activities – through a diagnosis of its internal context (Bugdol, 2018). It is important to constantly diagnose the number of reported corrective and preventive actions and to look for reasons why employees are unwilling or unable to take improvement actions.

Thus, it can be stated that if research is undertaken to identify the organisation's internal context and the management thoroughly analyses the results of such research and uses them in quality management practices, then barriers to innovation activities are removed (Z4).

The last factor under discussion is teamwork ensuring cooperation among individual employees. In many cases, quality improvement requires teamwork, i.e. the establishment of quality circles and process improvement teams whose job will be to implement quality management systems and concepts. Cooperation should be fostered by the knowledge resulting from the analysis of the organisation's internal context and employees' participation in the setting and pursuit of common quality goals. The level of cooperation should be higher where the awareness of quality issues is greater and the application of the full process-based approach is emphasised.

In our research, we assume that when teams of employees discuss various quality issues and try to solve problems with quality together, their knowledge increases, which can have a positive impact on their undertaking innovation activities (Z5).

6. Research results

6.1. Quality management systems and the development of employees' competencies

According to the ISO 9001 standard, it is necessary to establish the competencies of the personnel performing work that has an impact on quality and the organisation should take particular measures aimed at improving such competencies.

In the surveyed organisation, employees are trained and periodically have to take tests checking their knowledge of the quality system criteria. One of the interviewees said: "Employees are trained in the quality management system and their competencies in this area are improving, which has an impact on quality, error elimination and continuous process improvement" (woman, specialist, higher education, up to five years' work experience).

Not all respondents share such opinions. Some of them are of the opinion that the system contributes little to competence improvement, but it can have an informative function, familiarising employees with the procedures existing in the organisation.

"The ISO 9001 system with respect to a description of how the company works in terms of procedures and instructions and how they are followed by employees – yes; employees are more aware of quality and the processes in which they are involved" (woman, specialist, higher education, more than ten years' work experience).

Another perceived advantage of the system is problem identification.

"The implemented quality management system allows for the identification of problems, including the monitoring of received complaints. If a particular problem recurs, for example

damaged packaging, the system enables the problem to be effectively solved by, among other things, changing suppliers” (woman, manager, higher education, up to five years’ work experience).

6.2. Opinions regarding the criterion of “leadership and commitment”

Opinions regarding this criterion vary considerably. The respondents feel that they do not have sufficient knowledge regarding the top management’s commitment, claim that this commitment is visible at the corporate level and that rather individual measures are taken. This is reflected in the two following statements: “The organisation’s management is committed to the continuous improvement of the quality management system. The quality management procedures are being improved and new solutions are being implemented” (woman, specialist, higher education, up to five years’ work experience). “With regard to the top management – no; this is due to system management and strategic management at the corporate level; the top management does not fulfil the leadership function, in my opinion; with regard to the middle management – measures aimed at improvement and innovation are probably being taken” (woman, specialist, higher education, more than ten years’ work experience).

6.3. Conditions for the recognition of and rewarding for innovation activities

The majority of the respondents claim that the rules for rewarding employees for innovation activities are defined in the relevant procedures and regulations. One of the survey participants said: “The company has an internal regulation that defines the principles of rewarding employees for innovations. Each proposal for an innovation is considered on an individual basis. In order to encourage employees to engage in innovation activities, each proposal or idea, even one that is not eventually implemented, should be appreciated and somehow rewarded, for example in the form of additional bonus points with a direct impact on the employee’s remuneration” (woman, manager, higher education, up to five years’ work experience). Two other interviewees do not share the above positive opinion: “In my company, the applicable rules are specified in several system documents: two or three instructions and one regulation; I’m not quite familiar with them so I can’t assess whether they’re clear or not” (woman, specialist, higher education, more than ten years’ work experience). “The conditions are not clearly defined, at least not for the rank and file employees. Employees know little about the company’s innovation activities and are unable to use the existing tools to implement their ideas. The incentive system is poorly popularised” (woman, specialist, higher education, more than ten years’ experience).

6.4. Activities aimed at identifying the internal context and removing barriers to innovation activities

Only one respondent explicitly states that actions are taken to identify the organisation's internal context and remove barriers to innovation activities. Some respondents state that innovation-oriented systems and activities probably exist, but employees are not trained and familiarised with them or do not notice such activities: "In my company, the context, including the internal one, is evaluated, but I don't think the result of such evaluation serves anyone to do anything" (woman, higher education, specialist, over ten years' experience). "The management is open to accept innovation activities. If acceptance is seen as removal of barriers, then yes (man, higher education, specialist, from five to ten years' work experience).

The respondents' statements show that they have their own ideas for improving innovation activities: "Innovation activities should be closely linked to a production unit, any office dealing with the development of a new technology or product should respond to the needs of production units. Establishing a separate department responsible for innovation activities and in charge of development significantly hinders the flow and sharing of information and extends the time for the implementation of proposed innovations" (woman, higher education, manager, up to five years' work experience).

6.5. Various forms of teamwork facilitate problem solving

Three employees state unambiguously that the existing forms of teamwork (meetings, quality teams, problem solving teams, project teams, task teams) enable them to work jointly on solutions to quality problems. Other respondents formulate their own ideas for improving teamwork: "In spite of the establishment of various teams to develop various plans or documents, some of this work is dumped on other departments or offices. Such teams should consist of employees who are directly involved in looking for solutions to particular problems. This will ensure that key people have direct access to information, training. When new tasks appear, the established team should be trained or instructed in a particular area" (woman, manager, higher education, up to five years' work experience). "There are too few group tasks and projects for me to comment on what benefits they can bring" (woman, specialist, higher education, up to five years' work experience). "Teamwork in the organisation is at a low level. Introducing this form of work is a potential solution to improve this situation" (man, specialist, higher education, from five to ten years' work experience).

6.6. Overall usefulness of quality management systems and employees' suggestions

Opinions on the usefulness of the quality management system are mostly positive. The survey participants are of the opinion that having an ISO certificate shows the maturity and professionalism of the organisation and improves its public image. According to their knowledge, thanks to the quality management system, the company's products have better

quality, as errors during the production process are eliminated. The system is necessary to continuously improve the quality of products. At the same time, however, the respondents believe that too much emphasis is put on the system's documentation, which grows excessively.

They suggest the following:

- introducing applications for the submission of innovation proposals as soon as possible,
- holding meetings directly with employees, rewarding employees (also for ideas that are not put into practice),
- informing employees about what activities are being carried out and how introduced changes will affect their jobs and how they will benefit from them,
- organising problem solving competitions,
- increasing the intensity of training (through active participation of employees in innovation activities).

Below is one of the more interesting statements: "The system in some aspects is too detailed and unfortunately requires sticking to certain standards that can evolve over time. Unfortunately, it requires certain additional responsibilities to be delegated to employees, which in a small team can be very burdensome" (man, manager, higher education, more than ten years' work experience).

7. Discussion and further research

In 2019, the International Organisation for Standardisation (ISO) published the first international management standard for innovation management, ISO 56002:2019, following previous successful management standards such as ISO 9001 and ISO 14001. The first studies on the usefulness of this standard confirm its significance for innovation activities (Mir et al., 2022).

It is important that the knowledge of the applicability of this standard increase in industrial enterprises and that research be carried out to determine which of its criteria are useful in the management practices of chemical companies, as well as to what extent it is possible to integrate ISO 9001 with ISO 56002.

Two other interesting research topics are pressure placed on innovations and the composition of project teams. Previous studies indicate that too much pressure on innovations has a negative impact on the behaviour of team members and overall quality. Diversity in teams made up of top managers promotes innovation, whereas too much functional diversity in teams working on new products can be detrimental (Fay et al., 2006).

It is also known that organisations often lack flexibility in designing and implementing quality management systems and therefore little use is made of employees' skills and knowledge (Kaziliūnas, 2010). The use of tacit knowledge is very important (Wilson, Campbell, 2020).

Therefore, in both practical applications and diagnostic research, a necessary condition for innovation activities is the correct allocation of resources that is consistent with organisational values and especially a sense of fairness.

8. Limitations

First of all, the adopted method of literature review is not a perfect way to obtain information. Previous studies have been conducted in different organisations and in different cultures.

Secondly, it is important to remember the limitations inherent in qualitative research. The interpretation of data obtained through interviews depends on the structure of interviews, the knowledge and skills of researchers and their ability to avoid bias (Easterby-Smith et al., 2015). In the future, research on this subject should be conducted on a larger group of employees and preferably with the use of an additional research method.

It should also be borne in mind that obtained responses may be influenced by the positions held by interviewees in the organisational structure. In this particular case, the respondents represent a capital group, which means that many decisions are taken at the corporate level and the interviewees themselves may not have adequate knowledge of their employer's innovation activities or management systems.

9. Conclusions and practical recommendations

The interviewees are of the opinion that their organisation's quality management system is a useful tool. If the system is to support innovation activities, employees should be trained more extensively, they should be provided with information on the potential benefits of quality improvement and innovations, competitions for best organisational solutions should be organised and the quality management system itself should be improved so that it is less documentation-intensive. The majority of the respondents claim that the rules for rewarding employees for innovation activities are defined in the relevant procedures and regulations.

The organisation's internal context is clearly defined; moreover, it is published in its intranet system. However, the knowledge of the context itself is insufficient.

Teamwork needs to be improved. One of the idea already being introduced and useful in the chemical industry is the introduction of interdisciplinary, multi-tasking teams, which in practice is supposed to reduce business risk by increasing the possibility of replacing key personnel. In order for the quality management system to support innovation activities, it is necessary to:

- integrate improvement activities into the overall innovation activity programme,
- increase employees' knowledge (training is needed on all processes involved),
- use process monitoring data for quality improvement and innovation activities.

Employees must have the knowledge of process analysis, integration and optimisation, but also the knowledge of chemical processes. Joint discussions of quality objectives, problems and non-conformities should contribute to increasing employees' knowledge, which can be useful for undertaking innovation activities.

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