

ANALYSIS OF SELECTED MODELS OF MANAGEMENT SYSTEM INTEGRATION – PREVIOUS EXPERIENCE AND DEVELOPMENT PROSPECTS

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Purpose: Comparison of management system integration models.

Design/methodology/approach: The analysis of management system integration models was based on a review of available literature.

Findings: Systematizing current knowledge about models for integrating standard management systems. Indication of the differences in these models.

Originality/value: The article schedules the further direction of research of integration of management systems.

Keywords: integration of management systems, models of integration, quality management system, environmental management system, occupational health and safety management system.

Category of the paper: review article, review of the literature.

1. Introduction

In a dynamic and changing environment, the organization is looking for effective solutions in terms of quality, environment and occupational safety. Ensuring product quality, limiting the negative impact on the organizational environment and ensuring occupational safety are becoming one of the most important tasks of today's global management staff. The International Organization for Standardization (ISO) develops management standards in the above-mentioned aspects, which facilitates the planning of management activities in the organizations.

This is possible thanks to the ISO 9001, ISO 14001, ISO 45001 standards, which contain guidelines for managers regarding quality, environmental and safety management. The individuality of standards and the systems often implemented on their basis make the integration of these systems in order to rationalize managerial practices in the mentioned areas extremely important (Roszak, 2016; Molenda, 2015; Algheriani et al., 2019; Daneshjo et al., 2021; Domingues et al., 2016; Popescu et al., 2006; Luchian, I., Luchian, C.E., 2017; Velmakina et al., 2018; Maier et al., 2014; Barbosa et al., 2022; Niculare et al., 2019).

Taking into account the importance and topicality of management system integration issues, the article analyzes the current development of management system integration models.

Due to the important context of the time of creation of the models, they are presented chronologically from 1990 to the present.

2. General concept and benefits of integration management system

The organizations may have one certified management system, or the organization may decide to implement another system. Combining independent, accredited management systems in the organization results in integration. This activity aims to improve and optimize processes inside the organization. The integration process allows collaboration between individual systems, which considers external activities by suppliers and subcontractors (Matuszak-Flejszman, 2010).

In source literature, many authors, e.g., Fresner and Engelhardt (Fresner, Engelhardt, 2004), Karapetrovic (Karapetrovic, 2002) or Labodová (Labodová, 2004), define the integration management system as a combination of a quality management system, an environmental management system, and an occupational health and safety management system (Asif et al., 2009). The integrated system combines all management systems into one coherent system to achieve the company's intended purpose (Olaru et al., 2014).

The concept of an integrated management system was created from the need to provide the customer with a high-quality product or service, considering many issues, e.g., processes operating in the company, work environment, and impact on the surrounding environment. Implementing and using one standard management system in the organization brings many benefits (Asif et al., 2009). We can include (Olaru et al., 2014):

- Increasing prestige in the organization and competitiveness in the market.
- Reducing the costs of audits and the certification process due to having only one integrated system.
- Reducing the quantity of documentation.
- A holistic approach to management.

Indeed, managing an organization within one standard system is more straightforward. When implementing a single management system, the organizations use the appropriate ISO standard for the management system, which contains the minimum requirements for functioning the implemented system, planning, supervision, and improvement that the organization should take. The International Organization for Standardization (ISO) does not provide strategies and methods for integrating management systems (Asif et al., 2009). Regarding integration, the BSI British Standards Institution issued only the PAS 99:2012 specification (Publicly Available Specification of standard management system requirements as a framework for integration). The PAS specification defines the basic requirements for integrating a management system (PAS 99:2012, 2012).

Every year, the International Organization for Standardization researches certificates regarding management system standards. The ISO report for 2022 shows, among others, the total number of valid certificates for the 16 - ISO management system standards. The following standards occupy the first three positions: ISO 9001:2015, ISO 14001:2015, and ISO 45001:2018, which confirms that they are the most frequently certified standards in organizations – table 1 (ISO: Global standards..., 2023).

Table 1.

Number of valid certificates for implemented management systems in 2022 (own elaboration based on [<https://www.iso.org/home.html>])

ISO Standards	Number of valid certificates
ISO 9001:2015	1 265 216
ISO 14001:2015	529 853
ISO 45001:2018	397 339

An integrated management system can be built from the moment the decision is made to implement management systems in the organization, or the implementation of management systems and their integration takes place in stages, which rely on implementing systems into one already implemented and functioning management system. The last possible scheme is the function of systems independently - autonomous systems. System integration variants are shown in Figure 1 (Ejdys et al., 2012).

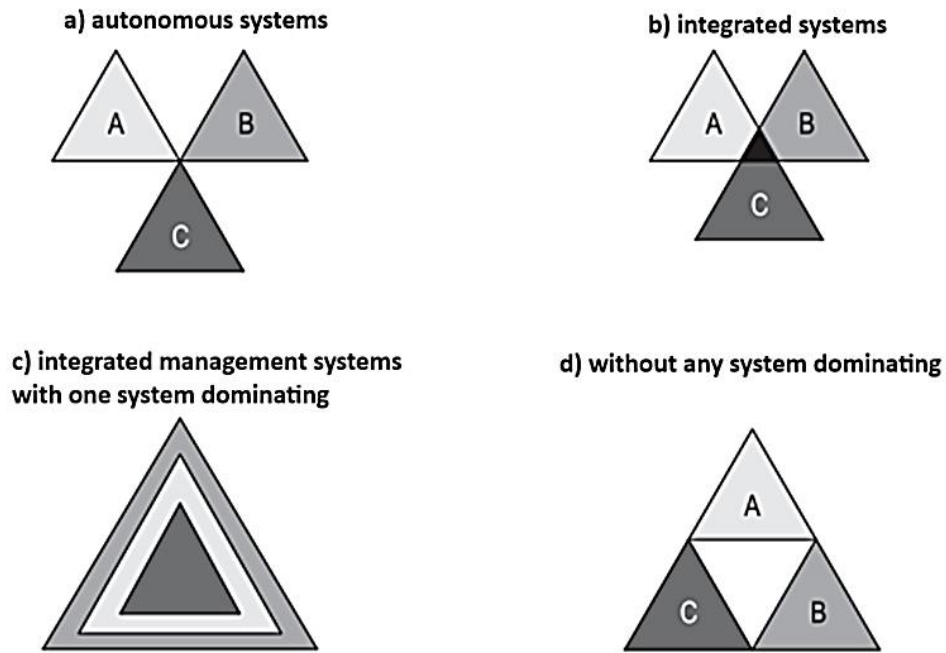


Figure 1. Variant of system integration.

Source: Nowosielski, 1999.

By analyzing the integration process of management systems, it is also possible to determine its level. The essence of integration is between the level of no integration, i.e., individual systems operate independently of each other in the organization, and the level of full integration, where all systems function within one standard system (Figure 2) (Kafek, 2017).

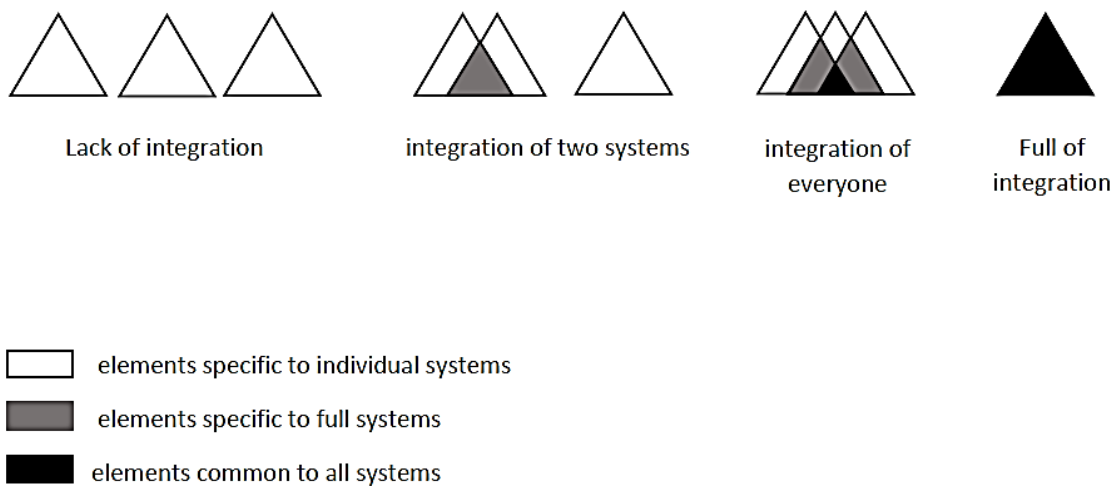


Figure 2. The essence of integration of management systems.

Source: Kafel, 2017, pp. 84-91.

An integrated management system provides advanced agreement with requirements, including specific needs or expectations. The quality requirements the customer sets are essential for the quality management system. However, the requirements raised in the extent of the environmental management system and occupational health and safety mainly concern domestic and international legal requirements. Each of these systems requires compliance with

regulations. Obtaining only a certificate requires identifying the relevant legal regulations for an organization (Ejdys, 2012).

Integration of management systems should be implemented simultaneously on two levels: strategic and operational. Integration at the strategic level should lead to the development of an integrated management system policy because it will be possible to define common aims, plans, and operational programs for the integrated systems. At the operational level, the integration of management systems should be based on the documentation, which is required by standards and standardization of documentation (Figure 3) (Ejdys, 2012).

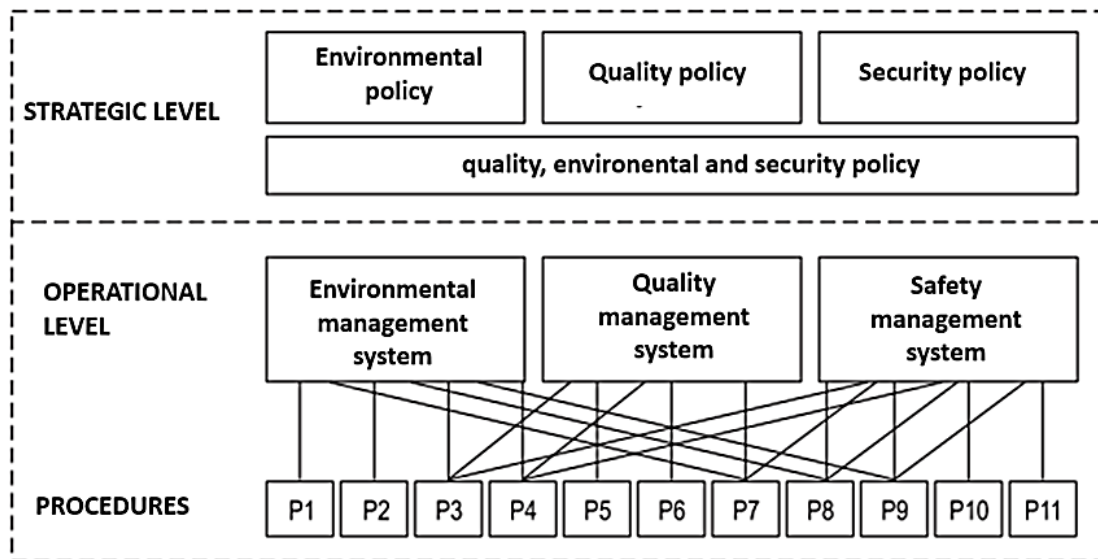


Figure 3. Areas of integration of management systems.

Source: Ejdys, Kobylńska, Lulewicz-Sas, 2012, pp. 5-25.

Benefits of integrating management systems (Węgrzyn, 2007):

- Facilitation of management process in the organization within one standard system.
- Simplifying system documentation.
- Minimization of system procedures and instructions in connection with the development of documents containing simultaneously quality, environmental, and occupational health and safety requirements.
- Saving technical resources and effortfulness by doing joint audits and corrective actions.
- Reducing the costs of the certification process and system control.
- The use of the Deming cycle for one system means that related systems are also improved.
- Improve the image of the company, Increasing employee involvement.

3. Review of integration of management system models

The amendment of ISO standards for the quality management system, environmental management system, and occupational health and safety management system over the years has significantly impacted the interpretation of the management system integration model. The rest of the article will present an analysis of management systems integration models available in the literature, taking into account the chronology of their creation and changes in published standards in the field of management systems. The history of changes in standards in the field of management systems is the reason why the authors divided them into three periods. The first period was until 2000 due to the revolutionary amendment of the ISO 9000 series standard family. The fundamental changes include adopting a process approach to managing organizations and modifying and making the requirements for documentation of management systems more flexible. The second period, between 2000 and 2015, was due to the amendment of standards in management systems dictated by the regulations constituting Annex SL, which currently defines the structure of standards in management systems. The last period is after the ISO 9000 and 14000 standards amendment in 2015 (Cierpiół, Wąsikiewicz-Rusnak, 2021). This article presents management system integration models that can be used on models based on PAS and scientifically on implementing systems into the organization. These include:

- model acc. to Analizy Renfrew and Muir,
- model of integration of documentation system based on TQM,
- model acc. to Zeng S.X., Shi J.J., Lou A.X.,
- model of PEDIMS,
- model integrated management system acc. to PAS 99:2012,
- model of management system consistent with HLS guidelines

Based on the analysis of Renfrew and Muir, a model of the evolution of management systems was created in 1998 (Figure 4). The diagram presents changes taking place in management systems and, as a result, creates a new model. The starting point is implementing a management system based on the ISO 9001 standard in the organization. The next stage is the development of the IMS matrix, which refers to identifying similar requirements in various management systems. Then, according to the scheme, the integration of procedures and processes begins, ultimately creating QUENSH (Qu-quality; EN-environment; SH- occupational health and safety) and a consistent management standard (Domingues et al., 2011).

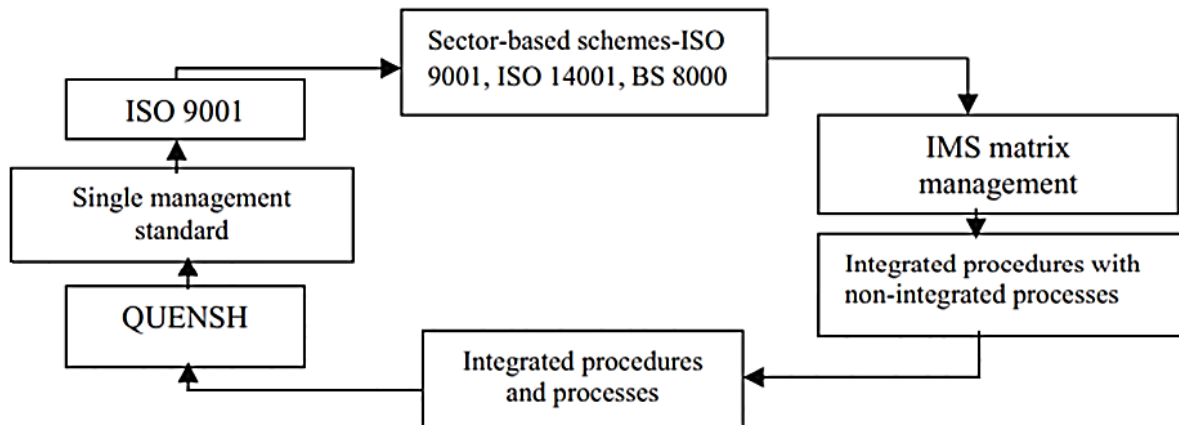


Figure 4. Model of evolution of management systems acc. to Renfrew and Muir 1998.

Source: Domingues, Sampaio, Arezes, 2011, pp. 31-44.

The integration of management systems within TQM – Total Quality Management, is becoming more and more popular. The TQM approach does not have a dominant system. It only requires defining the vision of the organization's development, mission, and values. An essential element integrating the system is the development of policies for the integrated systems and the System Book, which, in addition to the standard system's features, also includes TQM elements. System documentation, i.e., procedures and instructions, are also integrated (Figure 5) (Rajkiewicz, Mikulski, 2016).

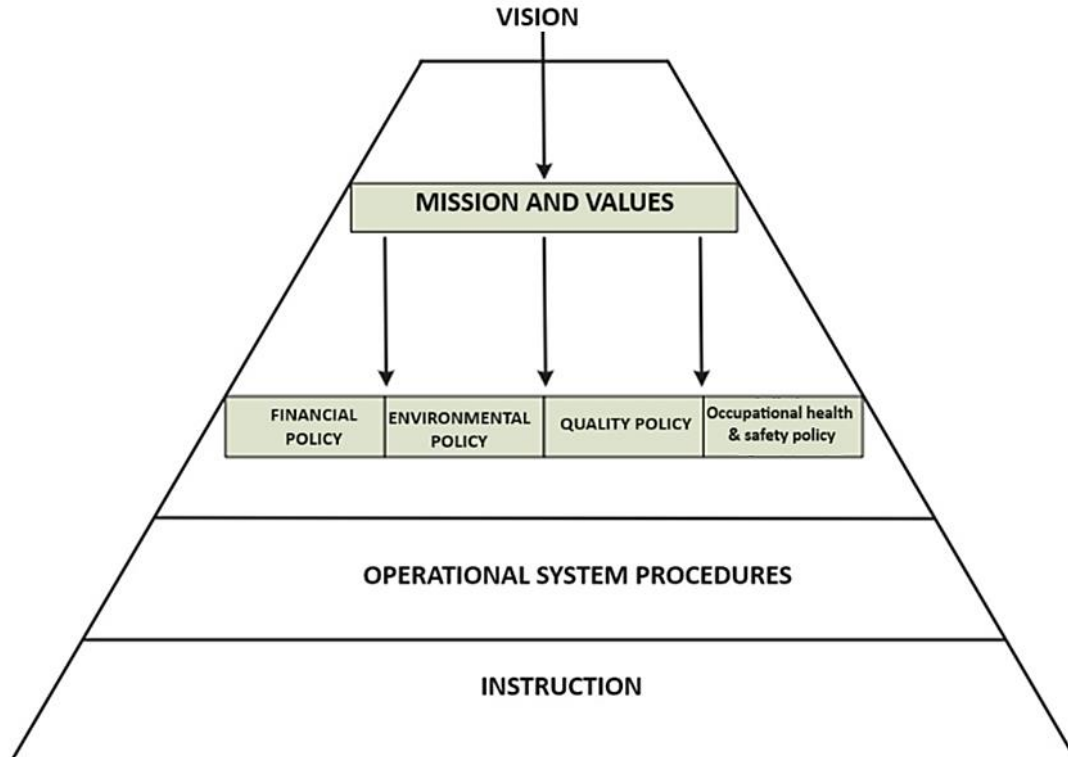


Figure 5. Model of integration of documentation system based on TQM (1998).

Source: Rajkiewicz, Mikulski, 2016, pp. 25-33.

Figure 6 shows the synergistic model of implementing the integrated management system proposed by Zeng S.X., Shi J.J., and Lou A.X. in 2007. The model describes a vertical and horizontal path to integrating management systems, considering different levels of organization. The model indicates a multi-level approach to ensure continuous improvement of organizational and management systems. The awareness and commitment of management guide the integration process. The mission and vision permeate the organizational structure and processes (Asif et al., 2009). Analyzing the model, the authors divided it into three stages. The first stage is strategic synergy. The strategy for managing quality, environmental, and occupational health and safety systems refers to strategic goals, plans, and actions. The strategy stimulates the development of values—all business relationships, mission, and vision of the organization. An organization needs more strategic synergy to focus on short-term goals rather than continuously maintaining requirements. The second level consists of structural, resource, and cultural synergy. Structural synergy speaks of top management awareness, commitment, motivation, and supervision of employees. The actions of top management have a significant impact on the integration process and its subsequent maintenance. Cultural synergy is based on the combination of existing principles in the organization, i.e., procedures, programs, and systems. Such a step is necessary to integrate management systems. Resource synergy includes human and financial resources. As said in the third level of the discussed model, the three mentioned synergies should be supported by documentation synergy. Documentation should be developed by the hierarchy of documents, starting with policies, established values, and principles related to the safety, environment, and quality process (Zeng et al., 2006).

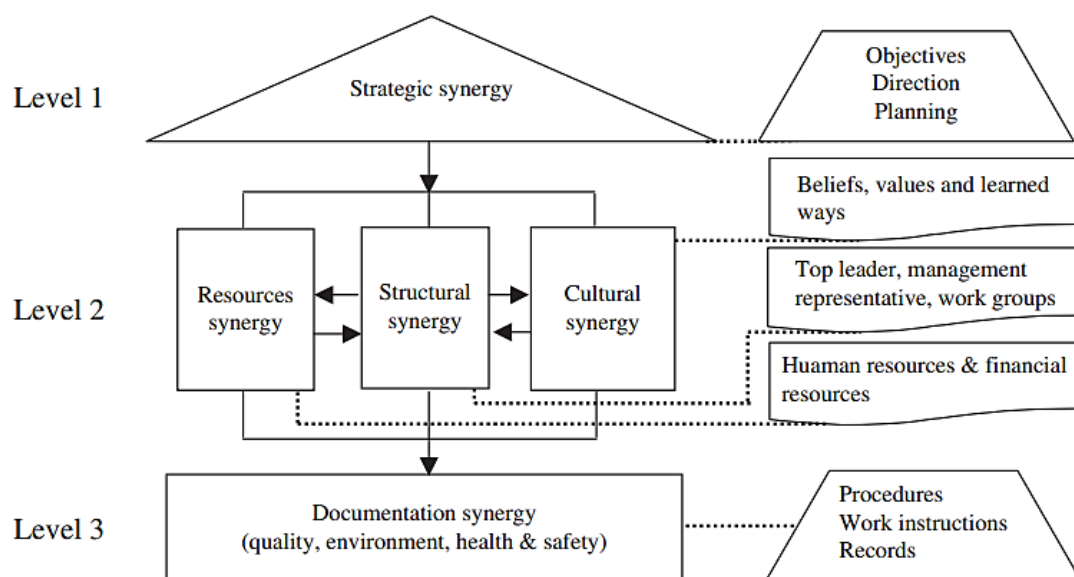


Figure 6. Synergistic model of implementation an integrated management system acc. to Zeng S.X., Shi J.J., Lou A.X.

Source: Zeng, Shi, Lou, 2007.

Another model appearing in the literature is the PEDIMS model (Process Embedded Design of Integrated Management System), which presents four operational activities that are represented by a supplier chain, in which each person is a customer of the previous one and a supplier of the next one in the operational chain (Figure 7). The first stage involves designing the actions to be taken. The next is functional improvement, which consists of improving process management using Pareto Analysis, Six Sigma, Lean Operations, or Lean Sigma. The first two stages are crucial in PEDIMS because they organize the management system integration design process. The third step is integrating strategy and action, i.e., including the requirements of other standards and their integration. In the final stage, business excellence is achieved (Asif et al., 2009).



Figure 7. Model of PEDIMS.

Source: Cierpiol, Wąsikiewicz-Rusnak, 2021, pp. 29-40.

The PAS 99:2012 - Publicly Available Specification of standard management system requirements as a framework for integration supports enterprises in integrating standardized management systems, which results in taking management actions as a result of defining legal requirements (Figure 8) (Kafel, 2017).

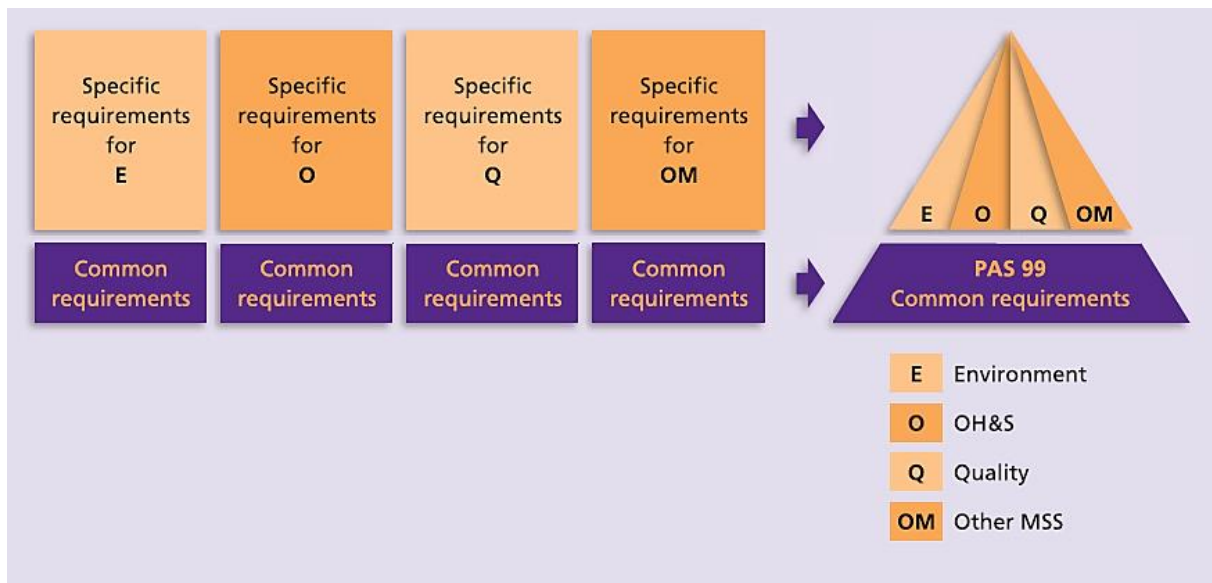


Figure 8. Defining common requirements for management systems in acc. to PAS 99:2012.

Source: BSI, PAS 99:2012 Integrated Management System, ISO, (2012).

The guidelines included in the PAS 99:2012 specification constitute the basis for developing a management system integration model (Kafel, 2017). The document features requirements standard to various systems based on the Deming cycle, which is the basis for integration. The common elements include planning, operational control system, performance assessment, improvement, management review, and management system policy (Figure 9) (Kafel et al., 2013).

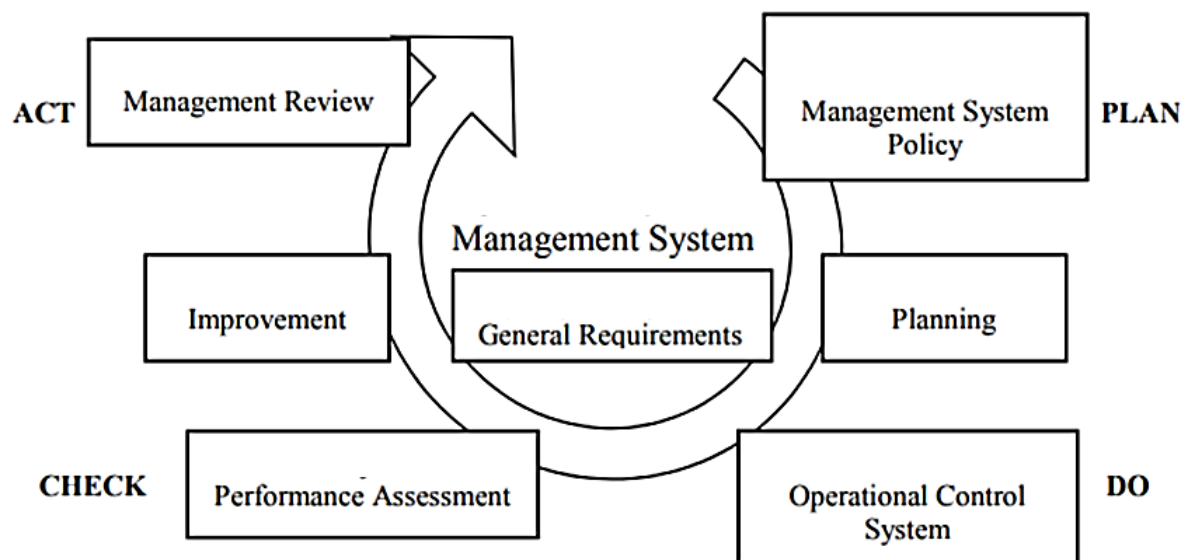


Figure 9. Model integrated management system acc. to PAS 99:2012.

Source: Kafel, 2017, pp. 84-91.

As a result of the amendment to the standards, the integration of management systems should be simpler and more convenient. 2015 was a breakthrough year when a change in the structure of standards in management systems led to their unification based on the high-level

structure (HLS). It significantly facilitates the integration of management systems. The management system model considering the requirements of customers and other interested parties according to the HLS assumptions is presented in Figure 10. However, it is indicated that the unification of the structure of standards in management systems by the HLS guidelines, other than facilitating the integration of management systems, may also bring adverse effects, such as the loss of individual character systems (Kafel, 2017).

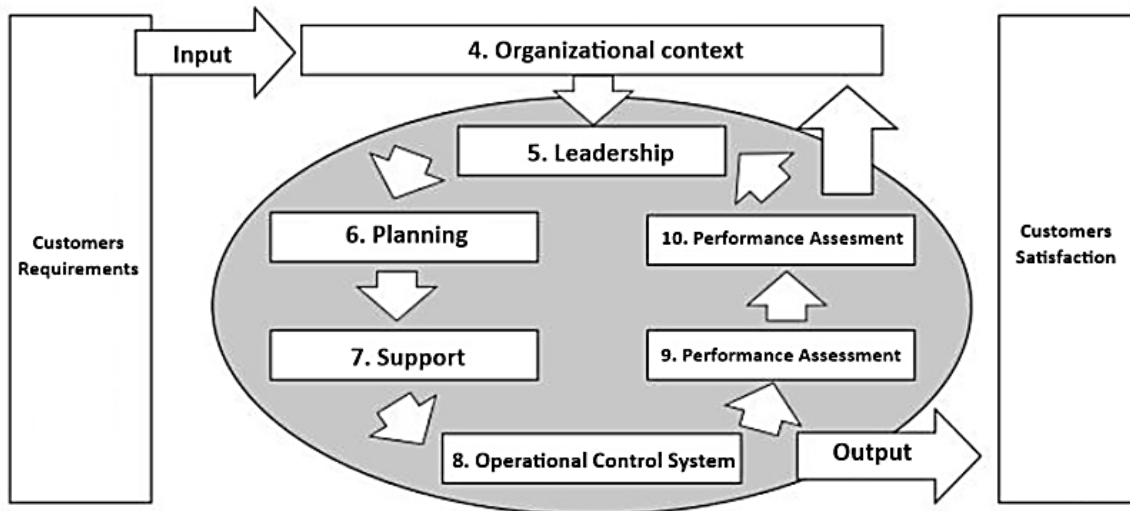


Figure 10. Model of management system consistent with HLS guidelines.

Source: Kafel, 2017, pp. 84-91.

4. Conclusion

The literature review conducted in the field of ideas and methods of integrating management systems allowed the identification of basic integration models such as:

- model acc. to Analyzy Renfrew and Muir, the unique feature of this model is the simplicity of presenting the approach to systems integration; when starting the process of integration of management systems, the need for a quality management system implemented in the organization based on the ISO 9001 standard is indicated, in particular the sequence of activities is shown in the model in the integration process based on the integration of management system documentation and, in turn, processes that determine the functionality of the systems;
- a model of integration of documentation system based on TQM, which indicates that an essential aspect in integration is the development of policies, System books, procedures, and instructions; taking into account the TQM philosophy, there is no dominant system in the discussed model;

- model acc. to Zeng S.X., Shi J.J., Lou A.X, which is a synergistic model of implementing an integrated management system, describes the path of integration at various levels in the organization, the model distinguishes strategic synergy, structural synergy, resource synergy, cultural synergy, documentation synergy that ensure continuous improvement in the organization and management systems;
- a model of PARAMS, presenting four operational activities that lead to the system integration design process in the first stages and to business perfection in the subsequent stages;
- model integrated management system acc. to PAS 99:2012, which distinguishes standard requirements (planning, operational control, ocean of execution, improvement, management review, system policy) in integrated systems based on the Deming cycle;
- a management system model consistent with HLS guidelines, which is the youngest of those described, was created due to the amendment of standards and the introduction of HLS guidelines.

The analysis of selected models proves that integrating systems is a process based on the integration of management system documentation - as indicated by models for integrating system documentation based on TQM, model acc. to Zeng S.X., Shi J.J., Lou A.X. level 3, model of integrated management system acc. to PAS 99:2012, and on process integration – what the models indicate acc. to Model acc. to Renfrew and Muir, model acc. to Zeng S.X., Shi J.J., Lou A.X. level 1 and level 2, model of PEDIMS, model of management system consistent with HLS guidelines.

Requiring managers to precisely determine the method, form, and scope of integration is presented in the model acc. to Zeng S.X., Shi J.J., and Lou A.X., where the integration process is supervised through the awareness and commitment of the management.

The models presented in the literature prove that systems integration occurs not only at the operational level but at a much broader - strategic level. The strategic models mentioned include the model acc. to Renfrew and Muir, model acc. to Zeng S.X., Shi J.J., Lou A.X., and the model of an integrated management system according to PAS 99:2012. Many models go beyond the technical domain - documentation integration or organizational - goal integration.

An advanced integration process approach requires a culture of continuous learning, involvement of interested parties, and continuous improvement of all areas of activity towards sustainable development. The management system model is consistent with HLS guidelines and PAS 99:2012 and emphasizes all the abovementioned aspects.

The analysis of the models shows that a multi-aspect approach to system integration can bring many benefits to the organization, for example:

- homogeneity in management methodologies,
- avoid duplications between procedures of the systems,
- reduction in external certification costs over single certification audits,

- improvement of internal efficiency and effectiveness,
- unification of goals, processes, and resources in various areas,
- synergy effects,
- a holistic approach to managing business risks,
- improve internal and external communication,
- focus organization on business goals,
- time-saving.

The review of selected literature describing management system integration models indicates the need for more presentation of research results regarding assessing the effectiveness of their implementation in organizations. The above allows us to diagnose a gap regarding the lack of description of the practical aspects of implementing these models in organizations, which indicates the need to conduct research in this area, in particular, to assess the effectiveness of individual models depending on the specificity of the organization, business profile or organizational culture.

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References

1. Algheriani, N.M.S., Majstorovic, V.D., Kirin, S., Spasojevic Brkic, V. (2019). Risk Model for Integrated Management System. *Technical gazette*, Vol. 26, No. 6, pp. 1833-1840, doi: 10.17559/TV-20190123142317.
2. Asif, M.J., de Bruijn, E.A.M., Fischer, O. (2009). Process embedded design of integrated management system. *International Journal of Quality & Reliability Management*, Vol. 26, No. 3, pp. 261-282, doi: 10.1108/02656710910936735.
3. de Barbosa, A.S., da Silva, L.B., de Souza, V.F., Morioka, S.N. (2021). Integrated Management Systems: their organizational impacts. *Total Quality Management & Business Excellence*, 32(5-6), doi: 10.1080/14783363.2021.1893685.
4. Cierpiół, A., Wąsikiewicz-Rusnak, U. (2021). *Znormalizowane systemy zarządzania w organizacjach przemysłowych [Standardized management systems in industrial organizations]*. Scientific Publishing House of the WSB University, pp. 29-40.

5. Daneshjo, N., Malega, P., Kóňa, J., Barilová, B. (2021) Integrated Management System and Corporate Risk Management. *TEM Journal*, Vol. 10, Iss. 4, pp. 1689-1693, doi: 10.18421/TEM104-26.
6. Domingues, P., Sampaio, P., Arezes, P.M. (17-18.03.2011). *Management system integration: A3 – dimensional organisational perspective*. Conference: 12th International Symposium on Quality. Osijek, Croatia.
7. Domingues, P., Sampaio, P., Arezes, P.M. (2016). Integrated management systems assessment: a maturity model proposal. *Journal of Cleaner Production*, 124, pp. 164-174, doi: 10.1016/j.jclepro.2016.02.103.
8. Ejdys, J., Kobylińska, U., Lulewicz-Sas, A. (2012). *Zintegrowane systemy zarządzania jakością, środowiskiem i bezpieczeństwem pracy [Integrated management system, environmental and occupational safety management system]*. Oficyna Wydawnicza Politechniki Białostockiej, pp. 5-25.
9. Fresner, J., Engelhardt, G. (2004). Experiences with Integrated Management Systems for two Small Companies in Austria. *Journal of cleaner production*, 12(6), pp. 623-631, doi: 10.1016/j.jclepro.2003.09.013.
10. International Organization for Standardization. Retrieved from: <https://www.iso.org/home.html>
11. Kafel, P. (2017). Integracja systemów zarządzania. *Trendy, zastosowania, kierunki doskonalenia [Integration of management systems. Trends, applications, directions of improvement]*. Place: Wydawnictwo Uniwersytetu Ekonomicznego w Krakowie, pp. 84-91.
12. Kafel, P., Nowicki, P., Sikora, T. (2013). Planowanie w integrowaniu systemów zarządzania w przedsiębiorstwach w branży spożywczej [Planning in integrating management systems in enterprises in the food industry]. *Żywność. Nauka. Technologia. Jakość*, 2(87), pp. 173-184. Retrieved from: <https://bibliotekanauki.pl/articles/826579.pdf>
13. Karapetrovic, S. (2002). Strategies for the integration of management systems and standards. *The TGM Magazine*, 14(1), pp. 61-67, doi: 10.1108/09544780210414254.
14. Labodová, A. (2004). Implementing integrated management systems using a risk analysis based approach. *Journal of Cleaner Production*, 12(6), pp. 571-580, doi: 10.1016/j.jclepro.2003.08.008.
15. Luchian, I., Luchian, CE. (2017). *Literature review on integrated management system*. Basiq International Conference New trends in Sustainable Business and Consumption, pp. 388-394. Retrieved from: https://basiq.ro/papers/2017/Luchian_I.pdf.
16. Maier, D., Olaru, M., Floricel, T., Marin, G. (2014). *Innovative Integrated Management Systems for the Business Continuity Management*. Proceeding of the 10th European conference on management leadership and governance (ECMLG 2014). Retrieved from: https://www.researchgate.net/publication/317901957_Innovative_integrated_management_systems_for_the_business_continuity_management

17. Matuszak-Flejszman, A. (2010). Integracja systemów zarządzania [*Integration of management system*]. Poznań: Wyd. Uniwersytetu Ekonomicznego, pp. 199-210.
18. Molenda, M. (2015). *The intelligent integrated system management*. Environmental economics, education & accreditation in geosciences, pp. 681-688. Doi: 10.5593/SGEM2015/B53/S21.088.
19. Niculae, E., Ionescu, SC., Dima, D. (2019). *The impact of the integrated management system on the performance of organizations*. International Conference on Management and Industrial Engineering, pp. 549-554.
20. Nowosielski, R. (1999). Ogólne problemy integracji systemów zarządzania [General problem of integration of management systems]. *Czystsza Produkcja w Polsce, no. 1*.
21. Olaru, M., Maier, D., Nicoară, D., Maier, A. (2014). Establishing the basis for development of an organization by adopting the integrated management systems: comparative study of various models and concepts of integration. *Procedia Social and Behavioral Sciences, vol. 109*, pp. 693-697. Doi: 10.1016/j.sbspro.2013.12.531
22. *PAS 99:2012 Integrated Management System*. British Standards Institution (2012).
23. Popescu, D., Dragomir, M., Popescu, S. (2006). *A possible structured approach to integrated management systems*. Conference: ICBE – International Conference on Business Excellence, pp. 376-381. Retrieved from: https://www.researchgate.net/publication/306097309_A_possible_structured_approach_to_integrated_management_systems.
24. Rajkiewicz, M., Mikulski, R. (2016). Tendencje zmian w systemach zarządzania. Problemy w integracji oraz wdrożenia [Trends in changes in management systems. Problem of integration and implementation]. Wydawnictwo Politechniki Łódzkiej, pp. 25-33.
25. Roszak, M.T. (2016). Integracja wymagań systemowych w ujęciu procesowym [The Integration of System Requirements in Terms of Process]. *Problems of Quality, vol. 12*, pp. 12-17.
26. Velmakina, Y.V., Aleksandrova, S.V., Vasiliev, V.A. (2018). *Basics of Forming an Integrated Management System*. IEEE International Conference "Quality Management, Transport and Information Security, Information Technologies" (IT&QM&IS), pp. 77-78. Doi: 10.1109/ITMQIS.2018.8524955.
27. Węgrzyn, B. (2007). Zintegrowany System Zarządzania etapem kształtowania w przedsiębiorstwie Zarządzania przez Jakość (TQM) [Integrated of Management System for the development stage in the enterprise of Quality Management (TQM)]. *Przegląd Organizacji, vol. 6(809)*, pp. 37-40. Doi: 10.33141/po.2007.06.09.
28. Zeng, S.X., Shi, J.J., Lou, A.X. (2006). A synergetic model for implementing an integrated management system: an empirical study in China. *Journal of Cleaner Production, vol. 15*, pp. 1760-1767. Doi: 10.1016/j.jclepro.2006.03.007.