GENERAL GUIDELINES FOR QUALITY MANAGEMENT AND TECHNOLOGY IN THE SUPPLY CHAIN FOR EXAMPLE OF METALLURGICAL INDUSTRY

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Abstract: The main objective of the study was to develop a model supporting the process of quality management and technology in the supply chain. This model will be enough general and universal in nature that the guidelines will be able to implement various production companies. Assumptions of the model have been developed during the four-month research internship author of one of the largest and most advanced foundry in Poland pressure, Meta-Zel Company. According to the author developed model should significantly improve the functioning of enterprises of the metallurgical industry through: the construction of effective forms of customer communication, the realization of the logistics processes based on customer requirements, ensuring customer service at a high level.

Key words: quality management, technology, supply chain

Introduction

Continuous development of the industry, competition and globalization make the issue of ensuring the optimum level of quality and development of new technologies increasingly determines the competitiveness of the whole supply chain. While in the case of individual organizations quality development can proceed on the basis of implementing some standardized quality management systems, across the entire supply chain issue is much more complex. Each of the subsystems of logistics has its own strictly assigned targets and is shaped differently in the quality of the end product (Malindžák et al., 2011). Supply subsystem is focused on minimizing inventory levels and costs of the raw materials while paying attention to highest standards of quality. The subsystem manufacturing logistics activities are aimed at improving the effectiveness and efficiency of production processes, while increasing quality standards and minimizing the number of non-compliance. In turn, the distribution subsystem integrates logistics processes, marketing and quality in order to improve comprehensive customer service. It is worth mentioning that the efficiently accomplished processes of transport and logistics in these subsystems are one of the most important growth factors of competitiveness (Ślusarczyk and Kot, 2015). In order to achieve the objectives assigned to individual logistics subsystems it is necessary to develop optimal quality standards and efficient management of technology (Brah and Ying Lim, 2006; Tabor, 2009) which requires a systematic approach to this issue.

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Organizations working in the supply chain should resort to instruments, methods and tools used to create joint comprehensive quality management systems and technology. The same opinion is shared by D. Malindžák (2012) who claims that the development of logistics processes based on the latest technologies and concepts of quality management is particularly important in enterprises of the metallurgical industry. According to many authors (Pacana et al., 2014; Budzik et al., 2013) in recent years have been developed a variety of methods, techniques and quality management systems to streamline operations and logistics processes and yield measurable benefits to organizations. Among them they stand out standardized quality management systems (Kafel and Sikora, 2014) and techniques to support the development of technology (Tabor, 2011). According to the author the use of these instruments will improve the effectiveness and efficiency of logistics processes, provided their full integration into the supply chain. The similar opinion has M. Nowicka-Skowron oraz R. Ulewicz (2015) who claims that quality management and logistics processes must interact with each other and mutually do not permeate. The very high quality of the product and the same logistics service effectively realized, will not affect the final success. Only the interaction of these elements will allow the organization to function effectively in the market and attract new customers. An important factor in determining the final quality is the cooperation and similar understanding of quality for all participants in the supply chain. Quality management should be understood as a sequence of actions, which result in the continuous improvement of internal processes based on the requirements of internal and external customers.

Research Methodology

The main objective of the study was to develop a model supporting the the process of quality management and technology in the supply chain. This model will be enough general and universal in nature that the guidelines will be able to implement various production companies. It should be emphasized that quality management in large enterprises making up the supply chain is extremely complex. Developed model does not simplify this process, but will order its elements and allow for more effective implementation of the objectives adopted in the entire supply chain. This model will be a combination of systems, methods and techniques of quality management in such a way that mutually complementing an impact on increasing the efficiency of logistics processes. Assumptions of the model have been developed during the four-month research internship author of one of the largest and most advanced foundry in Poland pressure, Meta-Zel. Moreover, it is a one of the largest and most advanced open pressure casting foundries in Poland. Their products include pressure castings of aluminum and zinc for household appliance OEMs, construction industry, consumer electronics sector, power machinery engineering and automotive industry. Meta-Zel also offers services in specialist CNC machining, research and laboratory testing. With over 40 years of experience, the company has thorough casting expertise and proprietary

know-how based on their own processes and patents. Years of tradition and experience allow the company to meet the requirements and exceed the expectations of its customers. Proper preparation and performance of manufacturing processes are guaranteed by design engineer specialists, process engineers and the Quality Control Department.
In order to achieve the objectives pursued, during the internship was performed the following tasks:

- an analysis of the functioning of the different quality management systems implemented in Meta-Zel and the supply chain of the company were made,
- in detail familiarized with the ways of integration of quality management systems,
- the system procedures was analyzed and proposed improvement actions,
- a comprehensive model of the structure of quality management was developed,
- the barriers and limitations of the model were determined.

The Model of Quality Management and Technology in the Supply Chain - Assumptions

There is no doubt that a properly organized and managed logistics subsystems backed up with quality management concepts and technology have a significant influence on the process of production and distribution of products (Zimon, 2015). In Figure 1 presents the concepts of Total Quality Management model and technology addressed to organizations cooperating in the supply chain.

The model presented is general in nature and leaves a lot of flexibility in choosing optimal management concepts specific to a particular supply chain. Its proper implementation should include the following principles:

- Quality management model and technology is subordinated to the mission and the strategy adopted in the supply chain (shall be ancillary).
- The mission, objectives and tasks of logistic should be established prior to the implementation of the model. This will determine the place of quality management departments throughout the supply chain (Malindžák and Zimon, 2014).
- Before the implementation of the model it should also be developed a strategy for the development of technologies and periodically examine its effectiveness.
- Design, control and quality management is created based on customer and market needs and supported by selected instruments, concepts and quality management systems (Czajkowska and Kadłubek, 2015; Fonseca, 2015). The idea is to develop a model of the philosophy of total quality management throughout the logistics chain.
- Improving logistics processes and technology development should be initiated by external and internal customers needs.

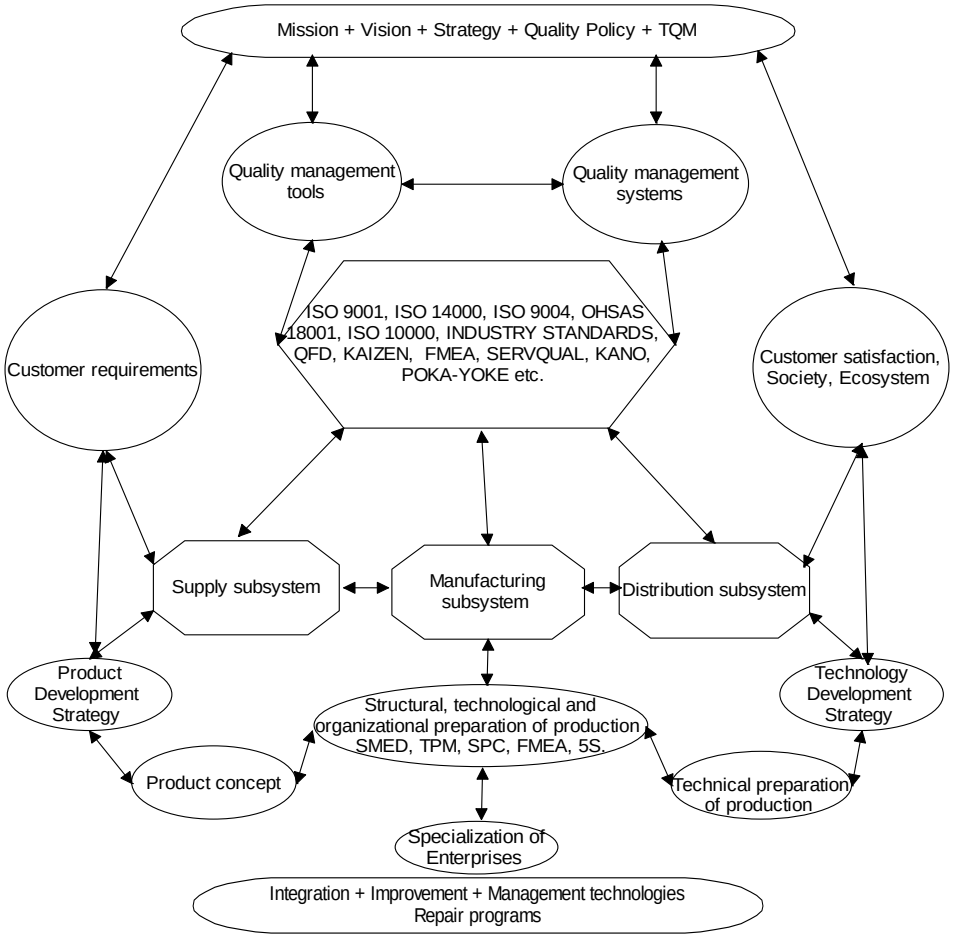

Figure 1.The model of quality management and technology in the supply chain

- The cooperation and realization of common objectives in the supply chain should be supported by transfer of technology (knowledge transfer projects, joint ventures, sale of infrastructure).
- To better meet the needs of the organization, increasing productivity, improving the quality, integrating processes, reducing negative impacts on the environment it is necessary to improve the technology. These activities should be aimed at taking into account the development of technology in the overall strategy, an analysis of its life cycle, the introduction of continuity of supervision and to initiate processes which enhance the competence of personnel.
- The premise of the model is to go outside (to customers) and consolidate the relationship between the supply chains. Implementation of standardized quality management systems emphasize the guiding role of the client in business management (Kadłubek and Grabara, 2015).

- The model highlights the importance of efficient communication systems within the organization and across the supply chain.
- The model is based on the integration of type IV (integration of core systems with systems industry). For organizations that do not have standardized quality management systems it is recommended its implementation. Research conducted by M. Bernardo and co-authors (Bernardo et al., 2012) suggest that doing so increases the efficiency and the level of integration.
- Equally essential it is to improve technology manufacturing processes and logistics infrastructure. Modern concepts of quality management must take into account the technological development.
- Logistical Subsystems and organizations participating in them must be included in the implementation of quality management outlined philosophy. Each link is important because it carries out the tasks that affect the improvement of the customer service process.
- Joint development of recovery plans and procedures (Wolniak and Skotnicka-Zasadzien, 2014; Rokke et al., 2015).
- Full commitment of top management (Lubimov, 2014) is essential in the implementation, adapt to the specifics of the company and improvement of the system.

Limitations of the Model

The author after talks with employees and managers Meta-Zel and detailed knowledge of the functioning of the company, described some of the barriers and limitations of the model. Knowledge of these barriers will allow companies to appropriately prepare for the implementation of the model. To the most important limitations of the model can be included the following areas:

- Development and implementation of the model is relatively expensive. Companies have to make substantial investments into the so-called external quality assurance costs, which include costs of designing and implementing different quality management systems, staff training costs, external audits, etc. Therefore, this model is primarily targeted at medium and large enterprises with a strong economic position and presenting innovative solutions.
- Smaller companies can also implement certain assumptions of the model, but in their case it is not recommended its implementation globally.
- The proper functioning of the model is not possible without the full involvement of representatives of top management. Unfortunately, the author's observation shows that not all representatives of the top management are able to set aside sufficient time to actively engage in the process of implementing and improving the model.
- The basis of the model is a comprehensive approach to the issues related to the development of new technologies, according to an observation of businesses do not have a appropriately developed strategy in this area.

Despite the limitations signaled, according to the author implementation of the model is desirable and will allow companies in the long term significantly improve the competitive position.

Summary

Comprehensive quality management and technology development are two areas that are mutually supporting enhance the efficiency and effectiveness of the supply chain. Implementation of the proposed model of total quality management in the supply chain supports and develops the potential of technological innovation in enterprises and enables to produce products strictly subordinated to the demands of the customer. According to the author developed model should significantly improve the functioning of enterprises of the metallurgical industry throughthe

- construction of effective forms of customer communication,
- the realization of the logistics processes based on customer requirements,
- ensuring customer service at a high level,
- improving production and technological processes that promote minimization of non-compliance,
- establishing effective ways of inspecting,
- establishing lasting relationships with cooperators,
- the construction of efficient and effective organization management system,
- mobilizing the organization's top management to become more involved in management processes,
- optimal technological preparation of the production process,
- improving technologies and manufacturing processes.

These considerations are confirmed by the results of tests conducted by Yusr M. and coauthors (2014) claiming that comprehensive quality management models support the development of technology, which translates into improving the entire supply chain. In a similar vein claims B. Skowron-Grabowska (2015) recognizing that comprehensive quality management models implemented in enterprises and supply chains improve their functioning and bring in the longer term economic benefits.

In conclusion, it is worth noting that the development of an optimal strategy for quality management and technology in the supply chain is a very personal issue and must take into account the specificities of the functioning of specific supply chain. For this reason, the model presented is general and universal so that it allows its implementation by companies representing various industries, after the adjustments resulting from their specifics and conditions of the external environment.

References

Bernardo M., Casadesus M., Karapetrovic S., Heras I., 2012, *Integration of standardized management systems: does the implementation order matter?, "*International Journal of Operations & Production Management", 32(3).

Brah S.A., Ying Lim H., 2006, *The effects of technology and TQM on the performance of logistics companies,* "International Journal of Physical Distribution & Logistics Management", 36(3).

Budzik G., Kozik B., Pacana J., 2013, *Defining influence of load conditions on distribution and value of stresses in dual-power-path gear wheels applying FEM,* "Aircraft Engineering and Aerospace Technology" ,85(6).

Czajkowska A., Kadłubek M., 2015, *Management of factors affecting quality of processes in construction enterprises,* "Polish Journal of Management Studies", 11(1).

Fonseca L., 2015, *Relationship between ISO 9001 certification maturity and EFQM business excellence model results,*"QUALITY, INNOVATION, PROSPERITY", 19(1).

Kadłubek M., Grabara J., 2015, *Customers' expectations and experiences within chosen aspects of logistic customer service quality,* "International Journal for Quality Research", 9(2).

Lubimow J., 2014, *Manager's qualifications in municipal partnerships,* "Polish Journal of Management Studies", 9 (1).

Kafel P., Sikora T., 2014, *The level of management maturity in the Polish food sector and its relation to financial performance,* "Total Quality Management & Business Excellence", 25(5-6).

Malindžák D., 2012, *Application of logistic principles in metallurgical production*, "Metalurgija", 51(3).

Malindžák D., Mervart J., Lenort R., 2011, *The logistic principles for fast flexible strategy design of the company in crisis time,* "Managing Global Transitions", 9(2).

Malindžák D., Zimon D., 2014, *The basic principles of the analyse for heuristic model creation in metalurgy,* [in:] "METAL 2014", 23rd International Conference on Metallurgy and Materials, May 21-23, Brno, Czech Republic.

Nowicka-Skowron M., Ulewicz R., 2015, *Quality management in logistics processes in metal branch,* [in:] "METAL 2015", 24th International Conference on Metallurgy and Materials, June 3-5, Brno, Czech Republic.

Pacana J., Pacana A., Bednárová L., 2014, *Strength calculations of dual-power path gearing with FEM,* "Acta Mechanica Slovakia", 18(2).

Rokke C., Yadav O.P., Singh B.N., 2015, *Impact of challenges and barriers on the success of TQM: an empirical study,* "International Journal of Productivity and Quality Management", 15(4).

Ślusarczyk B., Kot S., 2015, *Transport Effectiveness in Distribution of Steel Products,* "Applied Mechanics and Materials", 718.

Skowron-Grabowska B., 2015, *Qualitative Problems in Enterprises*, "Applied Mechanics and Materials", 718.

Tabor J., 2009, *Small- and Medium – Size Enterprises' Technological Development Policies in the Conditions when they use their Quality Management Systems,* [In:] Evaluation of Production Process, Ed. And Scientific Elaboration S. Borkowski, A. Novak, Novosibirsk State Techn. Univ., Novosibirsk.

Tabor J., 2011, *Technological Changes in the Conditions of Quality Management System being used. Chapter 8* [In:] Quality Improvement. Monograph. Editing and Scientific Elaboration: S. Borkowski, J. Rosak-Szyrocka, Publish. TRIPSOFT.

Wolniak R., Skotnicka-Zasadzien B., 2014, *The use of value stream mapping to introduction of organizational innovation in industry*, "Metalurgija", 53(4).

Yusr M.M., Mohd Mokhtar S.S., Othman A.R., 2014, *The effect of TQM practices on technological innovation capabilities: Applying on Malaysian manufacturing sector*, "International Journal for Quality Research", 8(2).

Zimon D., 2015, *Impact of the implementation of quality management system on operating cost for small and medium-sized business organizations affiliated to a purchasing group*, "International Journal for Quality Research", 9(4).

GŁÓWNE WYTYCZNE ZARZĄDZANIA JAKOŚCIĄ I TECHNOLOGIĄ W ŁAŃCUCHU DOSTAW NA PRZYKŁADZIE BRANŻY METALURGICZNEJ

Streszczenie: Głównym celem pracy było opracowanie modelu wspierającego proces zarządzania jakością i technologią w łańcuchu dostaw. Model ten będzie miał na tyle ogólny i uniwersalny charakter, że jego wytyczne będą mogły implementować różne przedsiębiorstwa prowadzące działalność produkcyjną. Założenia modelu zostały opracowane podczas czteromiesięcznego stażu naukowego autora w jednej z największych i najnowocześniejszych odlewni ciśnieniowych w Polsce, frimie Meta-Zel. Zdaniem autora opracowany model powinien znacząco usprawnić funkcjonowanie przedsiębiorstw z branży metalurgicznej poprzez: budowę skutecznych form komunikacji z klientem, realizację procesów logistycznych w oparciu o wymagania klienta, zagwarantowanie obsługi klienta na wysokim poziomie, itp.
Słowa kluczowe: zarządzanie jakością, technologia, łańcuch dostaw

質量管理體系和技術在供應鏈的一般準則，例如冶金工業

摘要：本研究的主要目的是建立一個模型，支持質量管理和技術的過程中，在供應鏈。這種式將是足夠的一般性和普遍性，該準則將能夠實現各類生產企業。在波蘭的壓力，元ZEL公司最大，最先進的鑄造車間之一四個月科研實習筆者在已建立的模型假設。據筆者開發的模型應該顯著通過提高冶金行業企業的運作：有效實現形式的客戶溝通，實現根據客戶要求的物流流程的建設，確保客戶在一個較高的水平。
關鍵詞：質量管理，技術，供應鏈。