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Message of Editor in Chief

Journal entries this year at 44 year of regular publication, ranking it among the technical journals with the longest tradition of publishing in our country. Since the mid nineties, it began to publish their papers, scientists and experts from abroad, so that, after two thousand, as a rule, a number was in English. Since then (two thousand years), to date, came the forty numbers, published about 1635 papers (over 30% of the articles were in English), appeared around 3295 authors from over 63 countries.

The Journal publishes papers based on the new approach to quality, related to technical - technological, bio-technical and agricultural science, medical and pharmaceutical sciences and in interdisciplinary science related to engineering, information technology, management, etc.

This volume contents of selected papers (Plenary Sessions, Special Conferences and Introduction papers from Sessions) from the 11th International Convention of Quality, was held 31st May – 3rd June 2016, Belgrade, Serbia.

In Belgrade, 25th June 2016.

Prof. Dr. Vidosav D. Majstorović

Scope of the International Journal of Advanced Quality

The main objective of the Journal is to provide an *international forum for the exchange of knowledge, experience, research results and information* about various aspects of the state-of-the-art and the future development of quality and publishing only orginal articles.

The *scope* of the Journal covers *philosophical, scientific and practical concepts concerning research, development and application* of quality advanced approaches.

Topics of interest include, but are not limited to:

- *Advanced Quality approaches;*
- *Business excellence models (applications and development trends);*
- *TQM & manufacturing management;*
- *Quality Management and Integrated Management Systems*
- *World class performance;*
- *Attractive quality;*
- *Robust engineering;*
- *Six sigma model;*
- *Intelligent quality tools and methods;*
- *Virtual factory and virtual quality;*
- *Intelligent metrology in manufacturing;*
- *Intelligent and virtual CMM;*
- *Business process improvement;*
- *Breakthrough management;*
- *Organizational Excellence;*
- *Intelligent design for quality;*
- *Intelligent Business;*
- *Quality in Higher Education;*
- *Quality of the Public Services / health care;*
- *Digital engineerin / manufacturing / quality;*
- Manu*future* initiative *and Micro-nano manufacturing / Metrology.*

Peer Review Policy

All articles in this journal have undergone rigorous peer review, based on initial editor screening and anonymous double-blind review.

Instructions for Authors

Manuscripts should be sent both as a Word and a PDF document to jusk@eunet.rs. The PDF document must be review friendly so all figures and tables must be included in the text. Please visit www.jusk.org for instructions for author or ask jusk@eunet.rs for template of paper.

Preface of Editor Special Issue

This issue contents papers presented on the 9th Special Conference - ***Developing BE and concurency of domestic enterpraces,*** was held on 1st June 2016, as a part of UASQ ICQ 2O16, Belgrade, Serbia.

Over the past eight years during the Special Conference - Developing and BE and concurrency of domestic enterprises, 54 papers of theoretical, research character, and case studies associated with the claimed subject matter have been presented. In a broader sense, these papers included: models, concepts, methods and tools for quality improvement, IMS, TQM concepts, CSR, leadership, human resources, business, strategic and operational planning, characteristics and application of IT, innovation and entrepreneurship, marketing, CRM etc. The subject of analysis and display were various institutional and business activities such as: education, transport, textile industry, process industry, e-business, telecommunications and energetics. The focus was also to create the institutional framework and suitable environment to achieve business excellence and develop competitiveness of domestic enterprises, primarily in SME sector.

This year, within the Special Conference, eight papers are selected for presentation, and seven of them were published in this issue of International Journal of Advanced Quality. In addition to the above mentioned current issues, we are dealing with a business area to which we did not paid attention so far. It is, in fact, the development of the competitiveness of domestic hotel companies. Hotel industry is in expansion and research attention is turning to a broader subject: the realization and ensuring the quality of hotel services, the overall effect on the business operations of the hotel industry, the effects on consumers and society etc. Career and human resources in the hotel business are also the subject of analysis. We believe that this year's Special Conference realised within the International Convention will meet the high standards and expectations of the organizers, and possibly open some issues and directions of development.

Editor of Special Issue

Prof. Dr. Dragan Cockalo

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THE IMPORTANCE OF LEAN CONCEPT IN SUSTAINABLE DEVELOPMENT OF ENTERPRISES WITH SMALL SCALE PRODUCTION

UDC: 316.775.2; 510.5; 519.248;

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Abstract: *This paper presents an algorithm that makes it possible to improve manufacturing process in an enterprise with small scale production. Today, Lean concept is more and more used in the process of improving production. Also, on the case of transmitters' production, implementation of Lean concept is analyzed based on the known principles. Credibility of the algorithm is reflected in giving recommendations on how to eliminate the short comings in the production process through transmitters: regular movement of employees, regular sequence of operations, products design, and cooperation with customers, reducing inventory and control introduction in all stages of the process. The paper gives an example of how to save material and other resources in the company.*

Key Words: *Transmitter, Algorithm, Waste, Lean concept, Control.*

1. INTRODUCTION

Today's trends show that customers have become demanding, so producers have to offer more qualitative, functional, ergonomic products with short delivery terms. Moreover, customers have to send detailed specifications so that producers could design and make a product that will satisfy all requirements. Many producers ask the customers to determine a desired functionality resulting from the product. It is of high importance that an enterprise chooses an appropriate strategy in order to satisfy both their and market needs. On the example of manufacturing a pressure transmitter we can see the significance of Lean concept implementation in product realization. Accordingly, a reduction of waste in the process of new product manufacturing must become an imperative for small and middle enterprises in Serbia.

2. DIAGRAM OF MATERIAL FLOW

A manufacturing process represents a transformation process of input and output values. Generally speaking, there are three basic types of input values: material, energy and other factors (water, tools, consumable material, information). Otput values in the transformation process are: final product, material waste, energy loss and time waste.

Figure 1, presents a diagram of material flow in manufacturing process [1, 2]. It is about sustainable manufacturing process within the purview acceptable and sustainable development of small and middle enterprises (SMEs). In renewable manufacturing process it is necessary to pay attention to organization of the manufacturing process through [3]: reduction of energy and resources consumption, reduction of toxic materials usage, usage of materials with good characteristics and quality, possibility of additional building and repair.

Materials are bought from suppliers, then input materials control is performed and finally, materials are stored in warehouse. Manufacturing process follows, in other words, the process of transforming materials in final products. The final phase includes new product control and storing in warehouse of final products. In the diagram of flow a re-manufacturing is implemented as a strategy of renewable manufacturing system.

A system is satisfactory when there is a demand for manufacturing and re-manufacturing process (See Figure1). This system includes a possibility of buying products from buyers, then their storing and later using in re-manufacturing process. Flow diagram also gives room for Lean concept which includes manufacturing and re-manufacturing operations resulting in reduction of manufacturing time and considerable stock reduction.

Literature [4], distinguishes the following advantages of re-manufacturing: 1)the enterprises which use the used products will reduce their expenses, 2) a mere use of re-manufacturing represents a strategy for increasing profit in marketing sense, 3) special equipment is used in the process of re-manufacturing, 4) tools are optimized for the sake of disassembling and assembling, 5) re-manufacturing secures stability related to investments and enterprise business and 6) independence from suppliers is present.

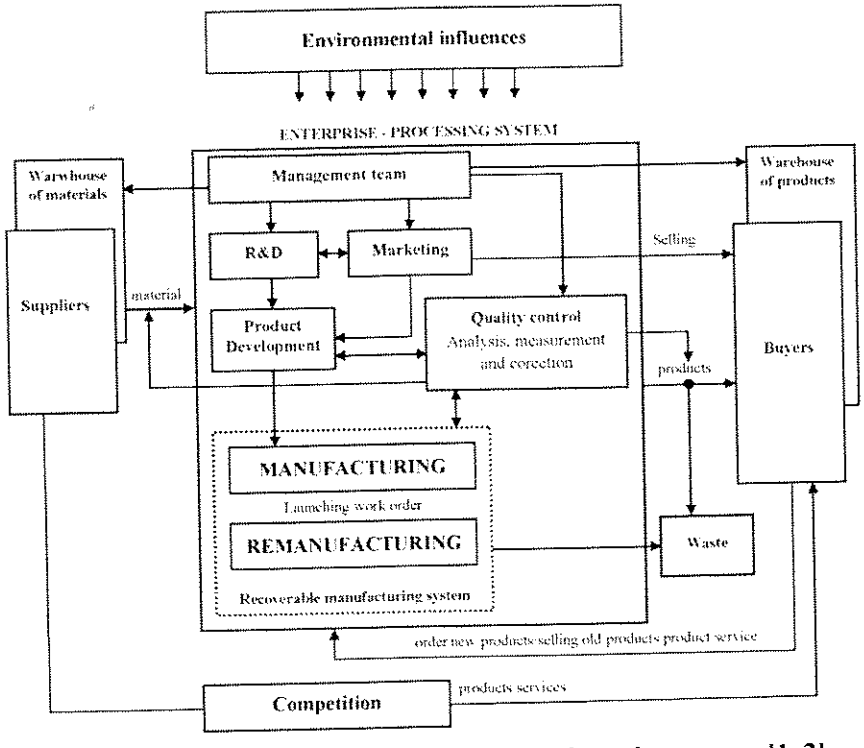

Figure 1. Diagram of materials flow in manufacturing process [1, 2]

3. LEAN CONCEPT

Lean concept (LC) represents a system in which the main idea is optimization of manufacturing process and making an inexpensive, best quality product in time. The principle assumes manufacturing products for the next phase or operation only. Development of new product is defined by methodology which implements LC principles in traditional way of manufacturing. The basic principles of LC are [5]:

1. Recognition of waste;
2. Standardization of the process;
3. Continuity;
4. Pull system;
5. Quality at the entrance /source;
6. Non-stop improvement.

In LC employees are learning continually which means that if they achieve their maximum at one work position, they will be moved to another, etc. In this way, they are motivated for work and the manufacturing process is permanently improved.

4. LEAN CONCEPT IN SMEs

LC has been implemented successfully in a lot of big enterprises. However, there is still weak and insufficient documented evidence about its usage in SMEs. SMEs have to change a complete organization of enterprises by means of tools and techniques in order to reach a higher level of quality and productivity and also to perform better planning before the beginning of manufacturing process. According to the source [6], mid enterprises (ME) tend more to implement LC (over 50%) unlike small enterprises (SE). The problems related to LC implementation in SE can be justified by: lack of qualified workers, lack of financial means and the presence of a great number of products.

In the literature [7] some guidelines are given which should eliminate failures in SMEs business and could be useful for Serbian enterprises:

1. Stoppage in manufacturing process – it is caused by work delay, poor planning of manufacturing process, lack of work procedure, lack of appropriate equipment or materials as well as lack of capacity.
2. Transport of the subject of work - Transport in the enterprise represents an integral part of manufacturing process. The following reasons cause this type of waste: unnecessary transport of workers and raw materials, weak organization of work and more storage locations.
3. Employee flow/movement – in SMEs, especially in the process of individual and small scale production, a work place does not let workers have frequent pauses in work. Unnecessary pauses during work time appear because employees have to leave their place in order to bring materials, tools or documents.
4. Stocks – Stocks include raw materials, unfinished products or final products. Unfortunately, stocks assume additional handling, additional documents, space and expenses. The main reasons for the emergence of stocks in SMEs are inadequite relations with suppliers, unbalanced flow of business operations or bad predictions of consumers' needs.
5. Damaged parts making - Making damaged parts or waste represents inappropriate realization of business processes, inadequite training of employees or lack of standardized procedure. In manufacturing SMEs, beside final products, certain waste products can appear, such as broken tools, damaged pieces, etc.

6. Poor design of products – It assumes unnecessary steps which complicates construction and uses more resources.
7. Human potential – There is unused human potential which represents new and significant category. It is caused by insufficient or incomplete use of intellectual potential of all employees or because of lack of appropriate intellectual capital within an enterprise.
8. Control – It is difficult to take time for qualitative and complete control in today's fast working enterprises. Therefore, self-control which every employee has to carry out is of high significance. The control of parts, assemblies and final products is essential.

5. LC IN REALIZATION OF PRESSURE TRANSMITTERS

As an example for improvement of manufacturing process by means of LC a domestic enterprise with small scale production of transmitters - IHTM-CMT is given. The Figure 2 presents a photo of a pressure transmitter realized by analysis and implementation of LC.

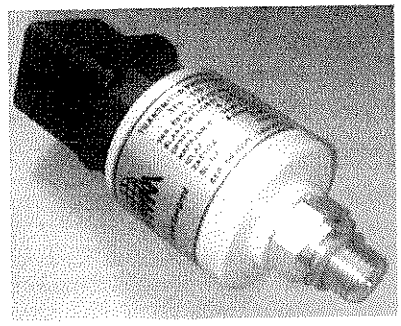

Figure 2. Pressure transmitter, TPa/r-110

A pressure transmitter was designed to be modulated. Modulation represents a general concept which describes a degree to which system components can be independent and recombined. In that way the system enables linking up of components and forbids mixing and adjustment [8]. Modules in the assembly can give a new product. Based on this standpoint, the modules on the transmitter enable application of a renewable manufacturing process through LC implementation.

We can find a lot of waste in the manufacturing process of pressure transmitters. An algorithm for improving production is presented in this work (See Figure 3). The following types of waste are analyzed by this algorithm:

1. Employee movement/flow – it is important to define a correct employee flow here. There is an open work place, in other words, employee flow is caused by searching for some tools or materials which have not been left at proper place. Improvement or reduction of the observed losses assumes the introduction of the closed type of work place. LC enables actively led and controlled manufacturing process, in other words, it makes possible a continual flow of materials and output at the work place.
2. Sequence of operations – It is necessary to perform optimization of operations and acts in the process of manufacturing transmitters in order to reduce waste. A previous making of a lid for electronic box was carried out from a full cylindar piece (Ø50x50mm), which asked for additional planer acts. The processing implied the manufacturing of a lid in the form of tube (See Figure 2), a great engagement of resources and a lot of irretrievable waste. LC saves the materials because now a round tube (Ø50x2x50mm) is used instead of a full round bar profile.
3. Product design – Product design is important –this can be seen on the example of a pressure transmitter – which results in success of the enterprise. The objective of design is to redesign a product by means of elimination of certain components and modules. Accordingly, elimination is the simplest process. By analysis of LC elements a good design must include material savings and reducing time for mechanical processing of elements along with keeping the current overall dimensions and purpose.
4. Buyers/customers – their role is very important because they help with their ideas the process of improvement and development of a new product. In relation to this, a cooperation with buyers improved the old model of the pressure transmitter - standardized connectors were inbuilt so the access to electronics was made easier. The old version of the pressure transmitter had an axis connector which was twice more expensive than this one, while the use of LC enabled the use of angle connector Hirschmann GDM (See Figure 2).
5. Stocks – before manufacturing process the types and dimensions of the material which will be used for making a pressure transmitter should be standardized. A precise specification makes free alternative dimensions of the material (purchase of a bigger diameter in order to get a desired diameter during manufacturing), warehouse space is reduced as well as material waste and energy consumption.
6. Control – in order to improve the manufacturing process of a transmitter it is necessary to perform permanent self-control at a work place, permanent control of all parameters after every operation, control of final products after the manufacturing process, control of measuring tools and instruments. It is also significant to monitor issuing and control of input – output documents. The surplus (waste) of activities should be minimized, in other words, a complete standardization of all procedures at the work place should be standardized.

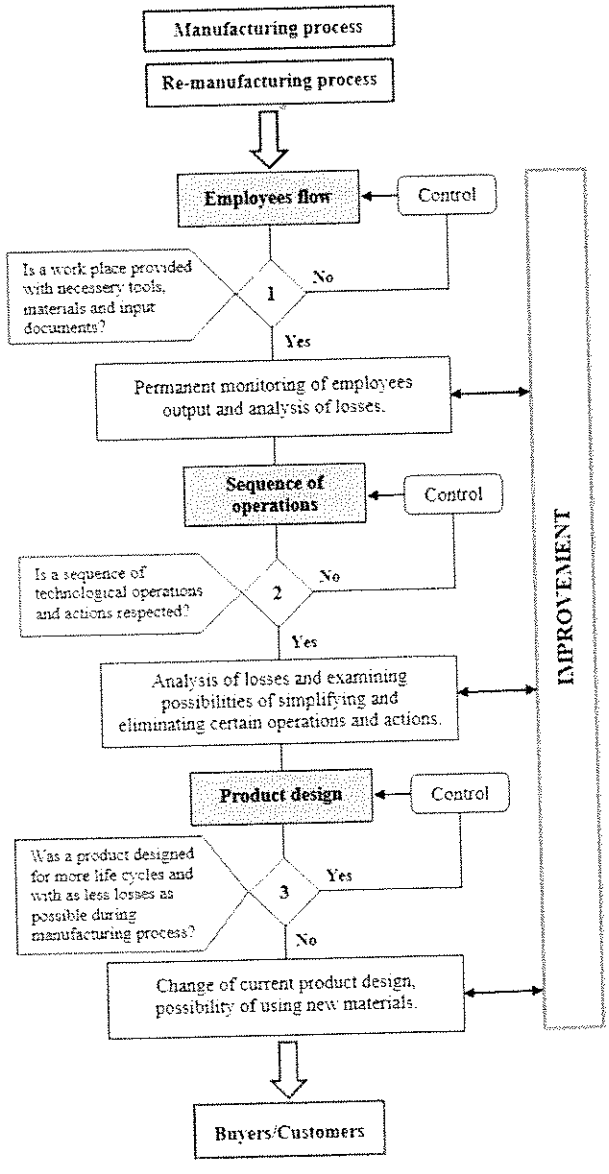

Figure 3. Algorithm for improving manufacturing of a transmitter by LC implementation

6. CONCLUSION

A customer is given a role of the main initiator of innovative activities of the enterprise. The enterprise, or the members of its management, are in permanent search for new ways of reducing costs, improving quality, increasing a product reliability, improving delivery and developing new products. In this way, along with a change of rules and conditions of business environment a need for a new business philosophy is imposed.

Implementation of LC in renewable manufacturing process helps in realizing the conditions in enterprises with small scale type of production. LC offers a model to domestic enterprises for improving the manufacturing process, better communication with customers and providing better business performance on the market with reduced losses or waste.

Transformation process in renewable manufacturing process is given a feedback when customers find themselves in the role of suppliers. In this way, a new business philosophy in designing a product for more life cycles is introduced in order to reduce losses or waste in manufacturing.

The algorithm has been created at the level of production but it can be implemented in other sectors of enterprises as well. Further researches should be focused on quality control and more agressive marketing activities in order to give the whole LC a real form.

We can conclude that if LC is implemented and used in enterprises correctly, it might result in reducing stocks and processing time, improving product quality, increasing efficiency of employees and better usability of machines and space.

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