

Performance measurement of processes through Six Sigma method in furniture company

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Abstract: *Performance measurement of processes through Six Sigma method in furniture company.* Six Sigma is a set of tools and strategies for process improvement originally developed by Motorola in 1985. Six Sigma seeks to improve the quality of process outputs by identifying and removing the causes of defects (errors) and minimizing variability in manufacturing and business processes. The term Six Sigma originated from terminology associated with manufacturing, specifically terms associated with statistical modeling of manufacturing processes. The statistical representation of Six Sigma describes quantitatively how a process is performing. To achieve Six Sigma, a process must not produce more than 3.4 defects per million opportunities. A Six Sigma defect is defined as anything outside of customer specifications. A Six Sigma opportunity is then the total quantity of chances for a defect. The aim of this paper is through the method of Six Sigma evaluation of performance of manufacturing processes in production of white lacquered furniture from agglomerated materials (right hind leg of table - LIATORP Coffee table) in the selected furniture company, and thus to achieve quality improvement in the production process.

Keywords: process, performance measurement of processes, Six Sigma, capability of processes

INTRODUCTION

Quality of goods and services is a guarantee of customer satisfaction, a reliable business means of the company perspective, and thus an assumption of its future. According to EN ISO 9000:2008 - *quality is the standard with which a set of inherent characteristics (product, system or process) meets the requirements of customers and other stakeholders.* Under the term quality management system we understand the organizational structure, procedures, processes and resources necessary for the implementation of quality management (*Mateides, Strašik, 2004, Šatanová, 2001*). The above definition implies that the current concept of quality is based on the processes orientation. If an enterprise wants to regulate processes, it must measure their performance. Performance measurement of process includes activities, which shall provide objective and accurate information about individual processes; so that these processes can be continuously managed in order to fulfill all requirements imposed on them (*Nenadál, 1998*). *The instruments of performance measurement of processes include performance measurement indicators of manufacturing processes, non-production processes, models EFQM, TQM and Six Sigma method. The aim of this paper is through the method of Six Sigma evaluation of performance of manufacturing processes in production of white lacquered furniture from agglomerated materials (right hind leg of table - LIATORP Coffee table) in the selected furniture company, and thus to achieve quality improvement in the production process.*

MATERIAL AND METHODS

Method Six Sigma is a systematic approach to quality, using target searching reserves in business processes. It is a tool for improving the productivity, efficiency, and quality of products and services. It is based on understanding of the needs and expectations of customers and applies standard tools for removal of defects in processes of their satiation and development of new corporate culture (*Nenadá, 2001*).

Six Sigma is implemented by its own employees. Employees are the most important solution capacity of improvement.

It is primarily based on (Šatanová, 2002):

- systematic project management,
- understanding customer needs and expectations,
- improving and creating new business, production and service processes,
- sustain the improvement.

Basic principles of Six Sigma are (Šatanová, 2002):

1. Customer orientation

2. Focus on processes

3. Focus on employees

4. Management and improvement based on data, information, and knowledge

Causes of deviation:

85-95 % of all deviations are due to systematic effects.

5-15 % of all deviations are due to random effects.

5. The standard procedure of process improvement

The most commonly applied standard procedure is process improvement DMAIC:

D - Define,

M - Measurement,

A - Analysis,

I - Improve,

C - Control.

6. Proactive management

7. Organization to support Six Sigma

8. Perfection as a long-term target.

The methodology was selected according to the aim of this paper, which was evaluation of processes performance in selected furniture company through the method Six Sigma. At first it was necessary to select the monitored processes. *Based on the application DMAIC, we pay attention to the process - drilling.* It is a parameter **depth of drilling** for the rear leg of the product: **LIATORP Coffe table**. The project was implemented due to dissatisfaction and frequent complaints of workers, following immediately after the drilling process, because this representation of claims leads to a disproportionate increase in costs of removing errors. It was used capability index (c_{pk}) to determine the capability of the manufacturing process. The index describes the preliminary capability of the process and is based on a selective standard deviation. The formula is given by the following equation (Šatanová, 2002):

$$c_{pk} = \frac{\min[(USL - \bar{x}); (\bar{x} - LSL)]}{3 \times s} \quad [1]$$

- c_{pk} - capability of process for development contract
- USL (LSL) - upper (lower) tolerance limit
- \bar{x} - average
- s - selective standard deviation

The following description includes a classification of process based on c_{pk} by QS - 9000 series.

- $c_{pk} > 1,67$ - process is capable
 $1,33 \leq c_{pk} \leq 1,67$ - process is conditionally capable
 $c_{pk} < 1,33$ - process is incapable

RESULTS AND DISCUSSION

The analyzed furniture company has been established in 1998, produced lacquered white furniture from agglomerated materials and actually has 850 employees.

The measured values of qualitative parameter - *depth of drilling* are shown in the following table *to determine the capability of drilling process*. These are further evaluated to determine whether they meet the capability requirement.

Tab. 1 The measured values for the detection of process capability - drilling (mm)

Výberové hodnoty Selection values	Poradie výberu Order of selection									
	1	2	3	4	5	6	7	8	9	10
1	13,3	14,3	13,8	14	14	17,2	13,7	13,4	13,8	13,2
2	13,1	13,5	13	13,5	13,7	16,8	13,4	13	13,3	13
3	13	13,1	9	13,2	13,4	16	13,1	9	13	12,9
4	12,7	13	8,7	12,7	12,5	13,4	13	8,8	12,5	12,7
5	12,5	12,5	8,5	12,5	12	13	12,7	8,7	11,7	12,4
Priemer Average \bar{x}	12,92	13,28	10,6	13,18	13,12	15,28	13,18	10,58	9,86	12,84
Rozpätie R	0,8	1,8	5,3	1,5	2	4,2	1	4,7	2,1	0,8
Max	13,3	14,3	13,8	14	14	17,2	13,7	13,4	13,8	13,2
Min	12,5	12,5	8,5	12,5	12	13	12,7	8,7	11,7	12,4
USL	13,381	16,318	13,568	14,045	17,274	17,7034	13,757	13,2919	14,0717	13,3016
LSL	12,4584	12,2414	7,5419	12,3145	11,966	12,8566	12,603	7,8681	11,6483	12,3784
Smer. odchýlka Standard devision s	0,319374	0,672309	2,57779	0,605805	0,840833	1,952434	0,383406	2,398333	0,801873	0,304959
c_{pk}	0,481	1,515	0,384	0,477	1,677	0,413	0,344	0,377	1,70	0,204

It can be seen from the figure 1 that *the requirement of process capability was fulfilled in two selections [5, 9] of the given process and the process was conditionally capable in one [2]. The condition of process capability was not fulfilled in the other selections, so the process was therefore incapable. Therefore we can conclude that the drilling process is incapable for the production of component, so the company should think about the factors that enhance and increase efficiency of the given process.*

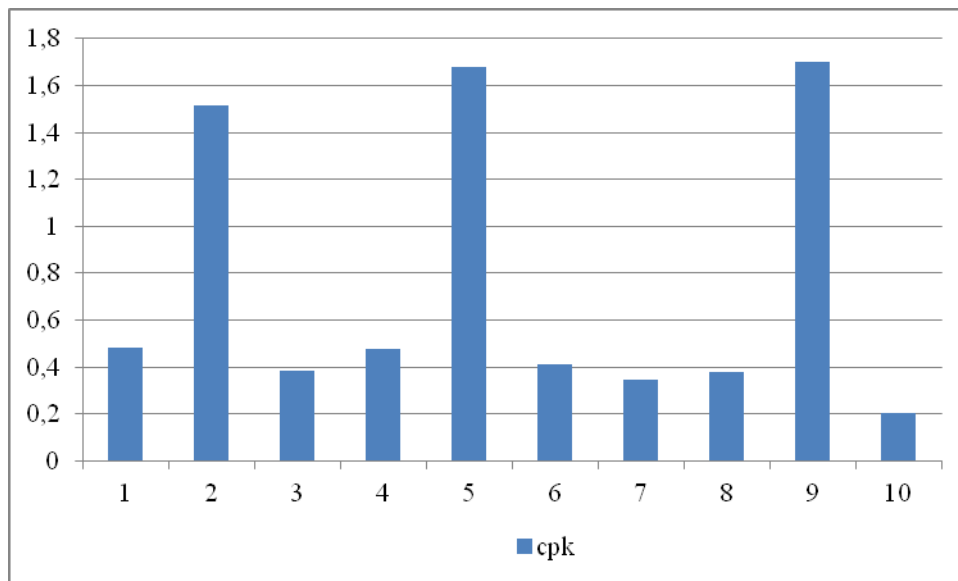


Fig. 1 Capability of process - drilling

CONCLUSION

The basic philosophy of Six Sigma is based on the fact that all processes, from design through production to services provided to customers, show some variations, which can result defects of product and cost time and money.

These deviations in processes can be reduced by various methods, for example through method DOE (design of experiments), by identifying and removing the causes of defects (errors). The number of non-conforming products and repairs will be decreased thought reduction of process variability. It will be ensured standardization of the process to return the process to its primary condition. Six Sigma is the management tool through which companies can solve their economic problems focused on individual business processes or outputs. This methodology is based on the principle of continuous improvement, which means that business processes and procedures is necessary to monitor, quantify, assess and control after its successful implementation.

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Streszczenie: *Ocena efektywności przedsiębiorstwa meblarskiego za pomocą metody Six Sigma.* Six Sigma jest zestawem narzędzi oraz strategii opracowanych przez firmę Motorola w 1985. Six Sigma ma na celu poprawę jakości procesu poprzez identyfikację i eliminację błędów, minimalizację zmienności w produkcji oraz procesach biznesowych. Określenie Six Sigma jest derywatyw¹ terminologii statystycznej związanej z procesem produkcyjnym. Statystyczna reprezentacja Six Sigma opisuje ilościową zdolność procesu, żeby osiągnąć stan docelowy, proces nie może produkować więcej niż 3.4 braku na milion produktów. Celem pracy jest ocena wydajności procesu produkcji lakierowanych mebli z materiałów drewnopochodnych w wybranym zakładzie przemysłu drzewnego, sporządzona w celu poprawy tego procesu.

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