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# Using Six Sigma Methodology to Improve the Assembly Process in an Automotive Company

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**Abstract**

The exigencies of the permanently evolving markets require continuous adaptation of company offers. The development and continuous improvement of the quality and environment management systems would be to anticipate these developments and therefore fully satisfy the needs and expectations of each partner (customers, staff and other stakeholders) and also maintain competitive advantage. One of the possibilities of gaining operational excellence is implementing different quality improvement initiatives like Total Quality Management, ISO certification, Agile & Lean manufacturing etc. Real life demonstrated that these initiatives are neither time efficient nor profitable in terms of quality. Therefore introducing and implementing the Six Sigma methodology was proven to provide breakthrough quality improvements in a reasonable short time. This paper presents a creative solution for improving an assembly process in an automotive company in Romania by using Statistical Thinking and DMAIC Six Sigma methodology.


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*Keywords:* Six Sigma; DMAIC; Xbar & R charts; AHP; Poka Yoke

## 1. Introduction

The desire to achieve business excellence in the Automotive Industry assumes the management commitment to develop and deliver perfect solutions, products or services, to promote the "Zero Defects" and first time right production philosophy, the integration of environmental protection in all its activities (design and production), as well as training, motivating and involving all staff in the effort towards excellence.

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Usualy, for an Automotive Company, policy is conducted mainly along the following lines: increase the quality of staff, steady decrease in non-quality costs, react better to meet customers requirements and to solve problems, regulatory compliance for the environment, optimizing natural resource consumption, better waste management, prevent any type of pollution, chronic or accidental.

In this context, it is considered that Six Sigma methodology is the best way for improving quality / reducing waste by helping organizations produce products and services better, faster, and cheaper (Pyzdek & Keller 2010). Tomkins (1997) defines Six Sigma to be "a program aimed at the near-elimination of defects from every product, process and transaction". Harry (1998) define Six Sigma to be "a strategic initiative to boost profitability, increase market share and improve customer satisfaction through statistical tools that can lead to breakthrough quantum gains in quality". Park, Lee & Chung (1999) believe that Six Sigma is a "new strategic paradigm of management innovation for company survival in this 21st century, which implies three things: statistical measurement, management strategy and quality culture". Pyzdek and Keller (2010) believe that Six Sigma is a "rigorous, focused, and highly effective implementation of proven quality principles and techniques. .. Six Sigma aims for virtually error-free business".

Six Sigma methodology has two approaches: DMAIC (D-Define, M-Measure, A-Analyze, I-Improve, C-Control).), which is applicable to an existing product or process to be improved, and DMADV (D-Define, M-Measure, A-Analyze, D-Design, V-Verify) which is applicable to new products or processes, to be designed and / or implemented in a manner that will provide a Six Sigma performance.

Statistical thinking is a method used as part of Six Sigma methodology. Statistical thinking relates processes and statistics, and is based on the following ideas: action occurs in a system of interconnected processes, variation exists in all processes and is very important to understand and deal with it (reducing variation is the key to success), understand and use the appropriate statistical tools for a systematic approach to process improvement.

## 2. The DMAIC Six Sigma methodology applied to an assembly process

### *2.1. Define Phase*

The analysis was focused on the production line providing a semi-finished product in "Horn Assembly" product, i.e. "Upper wire horn assembly".

On the production line, for this semi-product, are performed the following operations:

- Cutting and stripping cables
- Cables stripping and crimping terminal on the stripped cables
- Crimping terminal cables stripped from previous operations
- Riveting rivet

It was performed a SIPOC analysis and then a Flow Chart was drawn for the process. A Pareto analysis was performed on 10,000 semi-finished products from which 801 were defective, revealing that incorrect height of the rivet (319 defects) as the major defect (Fig. 1.).

### *2.2. Measure Phase*

It has been decided to concentrate improvement efforts on riveting process which causes the highest number of defects. This process is done manually by inserting the horn upper plate and the cables in a holding device than applying a riveting force using a special hand operated tool. (Fig. 2.).

The measured characteristic (CTQ - Critical To Quality) is the "Rivet Height" which is very important for the next operation in the final assembly of the finished product "horn assembly". According to the technical drawing (Fig. 3.), the rivet height (assembled) dimension is 10.3 ± 0.035 mm. It has been decided to measure 20 samples of 5 semi-finished products each, during an 8 hour shift.