

TOYOTARITY

MANAGEMENT OF THE PRODUCTION VALUES

MONOGRAPHY

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ANALYSIS AND EVALUATION OF THE INTEGRATED IT SYSTEM, ASSISTING THE QUALITY MANAGEMENT IN THE PRODUCTION PROCESS OF FURNITURE INTENDED FOR GASTRONOMY

Abstract: Catering Market in Poland is developing dynamically, thanks to the ever-increasing eating out habits. Along with its prosperity, increases the demand for furniture designed specifically for restaurants, pubs, bars and cafes. Companies, that produce this type of furniture, have to cope with a lot of competition and for that reason they have to look for new solutions that will allow them to adjust to changes and requirements of the customers. The quality of the offered products and the time in which the orders are being executed may be the advantages over other companies in the same industry. The analyzed company pays special attention to the quality of manufactured products. In order to improve it the company implemented an IT system supporting, most importantly production processes, but also the management. The advantage of this system is the ability to introduce modifications into the system at any stage of it being used and most particularly in the instance of any inconsistencies occurring in the process.

The aim of the research is to analyze and evaluate the functioning of an integrated IT system in the spectrum of quality management of manufactured products, as well as to propose corrective and preventive action that will be a result of the Ishikawa diagram analysis.

Key words: Ishikawa diagram, production process, the quality of the product, IT system, quality management.

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1.1. Introduction

In the production companies the quality of the product is the main concern. An important component of that matter is the technical quality of the product. It depends primarily on the raw materials and technological production process. The quality of raw materials is determined mainly by their original chemical composition. Properties of the materials have a significant impact on the whole technological process. During the process there is a change in quality characteristics of a manufactured product (URBANIAK 2007).

Undesirable changes in the qualitative characteristics of the product may occur as a result of applying inadequate technologies or because of the unsuitable environment in which the product was produced, stored or transported. The quality characteristics of a product can thus be regarded as specific or distinctive elements characterizing manufactured goods, and determine their nature and purpose. During the analysis of the product's quality, the main focus is on their physical and chemical properties. Both the physical and chemical characteristics of the product are measurable, i.e. it is possible to determine their optimal values, ranges and acceptable tolerances, etc. Those values may be included in the technical standards (e.g., standards of the company, national standards, European and international technical standards), and the entire production process is usually supported by the IT system. As a rule it is suited to the size of the company and the nature of the manufactured product (SZYMCAK 1992, URBANIAK 2007).

The companies that manufacture products often experience problems related to product quality. They are usually caused by the human factor, which is the weakest link in the whole production process. To diagnose the problem both traditional and new quality tools can be used (STASIAK - BETLEJEWSKA R., SELEJDAK J. 2007, STASIAK - BETLEJEWSKA R., ROSAK - SZYROCKA J. 2009). One of the most popular and most effective methods to detect the causes of inconsistencies in the production process is the Ishikawa diagram, which was used in this study.

1.2. The aim and methodology of the research

The aim of this study was to analyze and evaluate functioning of the integrated IT system supporting quality management in the production process of furniture intended for catering, in one particular company. The study analyzes the technological process of production of the shelving unit with adjustable shelves. The cause and effect Ishikawa diagram was created to identify the causes of non-compliances occurring in the production process. Based on the analysis, corrective as well as preventative actions were proposed, which were aimed at improving the already functioning IT system. The study used: observation, induction and support methods.

1.3. Characteristics of the IT system supporting the quality management in the analyzed company

1.3.1. Description of the system's structure

The object of the analysis is the integrated IT system supporting the quality management in the production of furniture intended for catering. The system consists of nine modules, including strategic business areas, i.e. 1) production, 2) logistics, 3) finance and accounting, 4) human resources, 5) fixed assets 6) controlling and budgeting, 7) customer relationship management, 8) e-orders, 9) e-documents (Materials obtained from the analyzed company 2012).

PRODUCTION module - covers areas related to the individual production and mass production. It helps employees in developing the design related documentation of the product, on the basis of which the description of the technological process is created. It also provides information about the properties of the product, the workplace, tools, equipment, materials and operations necessary for producing it. It allows to plan the production process, on the basis of which the material demand and the workload on a specific work station is calculated. Thanks to combining it with the modules responsible for materials management it

can continually update and pass information to the purchasing department and other departments supporting production (Materials obtained from the studied company 2012).

Logistics Module - it enables to reduce the costs significantly, as it gives the ability to control, record and have easy access to information collected by the sales department as well as by the warehouse and supply departments (Materials obtained from the studied company 2012).

FINANCE AND ACCOUNTING Module - is equipped with tools necessary to effectively manage finances of the company. It provides up-to-date information on the subject of value of reserve, revenues, expenses and settlements. It gives the ability to keep track of the company's finances. This module relies on a regularly updated tax laws (Materials obtained from the analyzed company 2012).

HUMAN RESOURCES module - supports decisions related to managing the employees. In addition to payroll and keeping the standard HR files, the module evaluates and determines ways to motivate employees and promotes / supports recruitment processes. The analysis of collected data allows to properly planning the path of employees' development, which translates into increased productivity (Materials obtained from the analyzed company 2012).

FIXED ASSETS module - supports management of the assets belonging to the company, which are owned by the company as well as the leased assets. The system can file assets such as intangible assets, fixed assets, tools and equipment. This information are used by the FINANCE AND ACCOUNTS module which receives the readymade decrees with counted out depreciation, as well as to the services that are responsible for the repair and maintenance of machinery and equipment (Materials obtained from the analyzed company 2012).

CONTROLING AND BUDGETING module - through the analysis of the collected data it provides the ability to make decisions at all levels of management. Allows to create personal reports showing the degree to which the budget was implemented (Data obtained from the analyzed company 2012).

CUSTOMER RELATIONSHIP MANAGEMENT module - helps in keeping records of all customer inquiries, records of customer contacts, planning and reporting of activities that relate to individual customers as well as groups of customers and creation of calculations and offers. This module is also responsible for defining personalized tables containing pricing and discounts for individual and group customers (Data from the analyzed company 2012).

E-ORDERS modul - allows the definite customers to place orders directly in the system without sending e-mails, paper-work or calling the sales department to check availability and to order the necessary goods. By using the Web browser the customers can log on to the e-orders module, and then view the current stock and prices that are the results of the individual price lists, tables and discounts associated with the particular customer (Data obtained from the analyzed company 2012).

E-DOCUMENTS module - it generates documents and allows to send them in electronic form. They are created automatically based on the data collected by other modules of the system. Electronic documents can have a certified electronic signature (Materials obtained from the analyzed company 2012).

1.3.2. Compatibility of the Integrated IT system with the standard norm regarding the quality management system according to ISO 9001:2008

The integrated IT system functions based on the requirements of the ISO 9001:2008 norms, which is why there is the possibility of putting together the particular sections of the norm with particular modules of the system.

The first chapter of ISO 9001:2008 norms titled "The scope of the norm" "Scope" refers to the ability of the company to continually deliver the product, that is in accordance with the relevant regulations, to the customer.

The guidelines contained in the second and third section of the norm are not included in the company's system because of its specific organizational structure.

The fourth chapter of ISO 9001:2008 norm titled 'Quality Management System' consists of two sub-chapters. The first one is called "General requirements" and presents actions related to process management, which should be fulfilled by implementing organization (QMS - Quality Management System) (ROSAK J., MACHELSKI W., STASIAK-BETLEJEWSKA R. 2007, BORIS T., ROGALA P. 2012; GRUDOWSKI P., HAMROL A., ZYMONIK Z. 2013). The second sub-section titled: "Documentation Requirements" indicates that the introduction of the QMS is related to the preparation and maintenance of appropriate documentation (ROSAK J., MACHELSKI W. STASIAK-BETLEJEWSKA R. 2007, BORIS T., ROGALA P. 2012; GRUDOWSKI P., HAMROL A., ZYMONIK Z. 2013). This section of ISO 9001:2008 norm is compatible with "PRODUCTION" and "E-DOCUMENTS" modules.

Chapter Five of the ISO 9001:2008 norm titled 'Management's responsibilities' consists of six sub-sections. The first titled "The commitment of the management" refers to the direct involvement of management in the creation and continuous improvement of the quality management system as well as its propagation among employees (WISNIEWSKA 2002; ROSAK J., MACHELSKI W. STASIAK-BETLEJEWSKA R. 2007, BORIS T., P. ROGALA 2012; GRUDOWSKI P., HAMROL A., ZYMONIK Z. 2013). The second sub-section titled "Customer focus" indicates that one of the most important responsibilities of management is to ensure that customer needs and expectations are defined and fulfilled. This also applies to management, employees and suppliers (ROSAK J., MACHELSKI W. STASIAK-BETLEJEWSKA R. 2007, BORIS T., ROGALA P. 2012; GRUDOWSKI P., HAMROL A., ZYMONIK Z. 2013). The third section titled "Quality Policy" states that top management should ensure that the quality policy includes, among others, commitment to comply with requirements and continually improve the effectiveness of the QMS (ROSAK J., MACHELSKI W. STASIAK-BETLEJEWSKA R. 2007, BORIS T.,

ROGALA P. 2012; GRUDOWSKI P., HAMROL A., ZYMONIK Z. 2013). In the fourth section titled "Planning" it is described that the top management is responsible for the company's work planning (ROSAK J., MACHELSKI W. STASIAK-BETLEJEWSKA R. 2007, BORIS T., ROGALA P. 2012; GRUDOWSKI P., HAMROL A., ZYMONIK ISSUE 2013). The fifth section titled "Responsibility, qualifications, communication" states that management, among other things, must appoint from among themselves a representative responsible for the QMS (ROSAK J., MACHELSKI W. STASIAK-BETLEJEWSKA R. 2007, BORIS T., ROGALA P. 2012; GRUDOWSKI P., HAMROL A., ZYMONIK Z. 2013). The sixth section titled "Management review" requires top management to carry out the review of the quality management system at appropriate intervals to ensure its continuing suitability, adequacy and effectiveness (ROSAK J., MACHELSKI W. STASIAK-BETLEJEWSKA R. 2007, BORIS T., ROGALA P. 2012; GRUDOWSKI P., HAMROL A., ZYMONIK Z. 2013). This chapter is related to: "PRODUCTION", "MANAGING THE EMPLOYEES" and "MANAGING CUSTOMER-PRODUCER RELATIONS".

The sixth chapter of ISO 9001:2008 norm titled "Managing resources" consists of four sub-sections. The first titled "Providing resources," states that the organization should determine what resources are needed for the proper functioning and improvement of the quality management system and provide these resources (ROSAK J., MACHELSKI W. STASIAK-BETLEJEWSKA R. 2007, BORIS T., P. ROGALA 2012; GRUDOWSKI P., HAMROL A., ZYMONIK Z. 2013). The second section titled "Human resources" refers to the staff, which should be competent, as well as have the skills, education and experience. In addition, the employees should be trained in the scope of knowing the requirements of the QMS (WISNIEWSKA 2002; ROSAK J., MACHELSKI W. STASIAK-BETLEJEWSKA R. 2007, BORIS T., ROGALA P. 2012; GRUDOWSKI P., HAMROL A., ZYMONIK Z. 2013). Part three titled "Infrastructure" stresses the need to ensure adequate infrastructure, such as: hardware and software, buildings and work-space, which are necessary for the correct course of the processes and supporting services (ROSAK J., MACHELSKI

W. STASIAK-BETLEJEWSKA R. 2007, BORIS T., ROGALA P. 2012; GRUDOWSKI P., HAMROL A., ZYMONIK Z. 2013). The fourth section titled 'Work Environment' draws attention to the need to ensure a good working environment which will allow the company to function in accordance with the applicable provisions (ROSAK J., MACHELSKI W. STASIAK-BETLEJEWSKA R. 2007, BORIS T., ROGALA P. 2012; GRUDOWSKI P., HAMROL A., ZYMONIK Z. 2013). This part of the ISO 9001:2008 norm is compatible with : 'PRODUCTION', "HUMAN RESOURCES", "CUSTOMER RELATIONSHIP MANAGEMENT" and "LOGISTIC".

Chapter Seven of the ISO 9001:2008 norm titled "Product execution" refers to the manufacturing operations. It consists of six sub-sections (ROSAK J., MACHELSKI W. STASIAK-BETLEJEWSKA R. 2007, BORIS T., ROGALA P. 2012; GRUDOWSKI P., HAMROL A., ZYMONIK Z. 2013). The first is the "Planning of the product execution" section which includes a general statement that the organization shall plan and develop the processes that are needed for product realization. The second section titled "The processes associated with the product" emphasizes the particular importance of the customer in the quality management system (ROSAK J., MACHELSKI W. STASIAK-BETLEJEWSKA R. 2007, BORIS T., ROGALA P. 2012; GRUDOWSKI P., HAMROL A., ZYMONIK Z. 2013). The third section titled "Design and development" draws attention to the need for planning and supervising the activities that are associated with the development of the products (ROSAK J., MACHELSKI W. STASIAK-BETLEJEWSKA R. 2007, BORIS T., ROGALA P. 2012; GRUDOWSKI P., HAMROL A. ZYMONIK Z. 2013). The fourth section titled 'Purchasing' commits the organization to the proper conduct of activities related to buying. The fifth sub-section titled "Production and delivery of services" indicates that planning and execution of production processes should take place in supervised conditions (ROSAK J., MACHELSKI W. STASIAK-BETLEJEWSKA R. 2007, BORIS T., ROGALA P. 2012; GRUDOWSKI P., HAMROL A. ZYMONIK Z. 2013). The sixth section titled "Supervision over equipment intended for monitoring and measuring" refers to the security

and proper handling of all the tools used to take measurements (ROSAK J., MACHELSKI W. STASIAK-BETLEJEWSKA R. 2007, BORIS T., ROGALA P. 2012; GRUDOWSKI P., HAMROL A. ZYMONIK Z. 2013). This chapter of ISO 9001:2008 norm is associated with the "PRODUCTION", "LOGISTIC", "FINANCE AND ACCOUNTING", "CUSTOMER RELATIONSHIP MANAGEMENT" and "E-CONTRACT".

Chapter Eight titled "Measurements, analysis and improvement" consists of five sub-sections. The first titled 'General resolutions' refers to the fact that the organization should plan and implement the measurements, monitoring and improvement analysis processes in such a way that would among other things: show the compliance of their QMS with the relevant requirements. The second section titled "Monitoring and Measurements" presents the most important areas and forms of monitoring (ROSAK J., MACHELSKI W. STASIAK-BETLEJEWSKA R. 2007, BORIS T., ROGALA P. 2012; GRUDOWSKI P., HAMROL A., ZYMONIK Z. 2013). The third section titled "Supervision over the incompatible product" requires the organization to use solutions that will guarantee that the incompatible product will be identified and supervised in such a way that will not allow for it to be used in an unplanned way (ROSAK J., MACHELSKI W. STASIAK-BETLEJEWSKA R. 2007, BORIS T., ROGALA P. 2012; GRUDOWSKI P., HAMROL A., ZYMONIK Z. 2013). Fourth sub-section titled "Data Analysis" focuses on the necessity to identify as well as collect and analyze all of the information necessary to assess the relevance and effectiveness of the QMS (ROSAK J., MACHELSKI W. STASIAK-BETLEJEWSKA R. 2007, BORIS T., ROGALA P. 2012; GRUDOWSKI P., HAMROL A., ZYMONIK Z. 2013). The fifth section titled "Improvement" states that the organization should constantly try to improve the effectiveness of the QMS through the use of quality goals, quality policy, data analysis, results of audits, reviews of management and corrective as well as preventive actions (ROSAK J., MACHELSKI W. R. STASIAK-BETLEJEWSKA 2007, BORIS T., ROGALA P. 2012; GRUDOWSKI P., HAMROL A., ZYMONIK Z. 2013). This part of ISO 9001:2008 is compatible with: "PRODUCTION", "CONTROLLING AND

BUDGETING", "FINANCE AND ACCOUNTING", "CUSTOMER RELATIONSHIP MANAGEMENT".

1.4. Characteristics of the study object

The object of the following research is a shelving unit with adjustable perforated shelves, which is pictured in (Figure 1). It is an unusual piece of furniture as it has perforations which are located on the shelves, and it is essentially the main difference between this piece and other shelving units that can be found on the market.

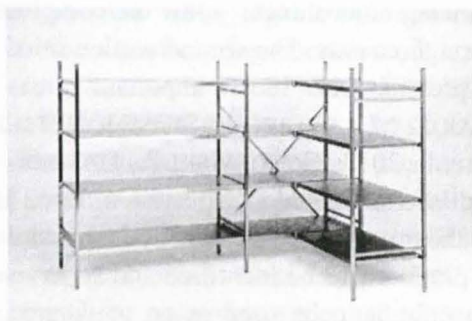


Fig. 1. Corner shelving unit with adjustable, perforated shelves.

Source: Materials obtained from the researched company.

Production of this type of shelving units takes place in one production hall, in which all of the technological equipment necessary to produce them, is located. Presence of all the necessary machines in the same production hall allows shortening the time required to produce a particular component of the shelving unit. The essential elements of the unit are made of stainless steel 1.4301 that has the following parameters: thickness of the standing shelving unit shelves, which were produced using metal sheet is 1.5 mm, crossheads of the flat 20 x 4, square cross-section of the tube of crossbeams and legs of the shelving ladders is 25 x

25 x 1.2 mm, the thickness of the reinforcing bars of the shelves made of metal sheet is 0.8 mm, 1.5 mm or 1.0 mm.

The production process of the shelving units with perforated, adjustable shelves consists of the following steps: 1) laser etching of the metal sheet (cutting it using laser), 2) cutting the metal sheet using the frame saw, 3) assembling the pegs, 4) bending the metal sheet using the cornice break, 5) de-burring (removing the remaining sharp pieces of material), 6) removing the protective film, 7) welding, 8) grinding, 9) assembly, 10) cleaning, 11) packing.

The elements of the final product should have the following characteristic features:

- **Metal sheet** - External surfaces should be smooth, with no scratches, deformations and/or bending, and the edges should be blunt and burr-free. All of the visible parts of the metal sheet must be ground lengthwise using 320 grain
- **Square sections** - visible endings of the sections should be welded and polished or sealed with plugs made of plastic.
- **Welded joints** - joints should be free from scales and discoloration. All welded joints must be smooth, and if necessary they should be polished to make the jointing invisible.

1.5. Identification of the occurring inconsistencies

The shelving unit purchased by the customer does not meet his technical requirements. Based on the complaint logged by the customer, the non-compliance of the product was identified as incorrect size of the perforations in the shelves of the shelving unit. It should be noted that the diameter of the perforations located on the shelves has to be equal to the thickness of the metal sheet, as shown in (Fig. 2).

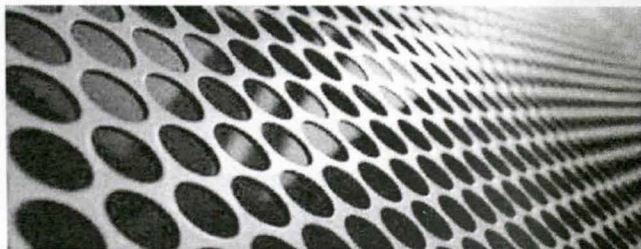


Fig. 2. View of the, hundred times magnified perforated shelf.

Source: personal study based on the data from [Www.cromostal.pl (taken 23.05.2013r.)]

1.6. Ishikawa diagram used for the non-compliance: “lack of the perforated shelves of the shelving unit”

To analyze the detected non-compliance Ishikawa diagram was used (Fig. 3). Causes of the non-compliance are organized according to the principle of 5M, that is the principle of five main categories of reasons that cause or may cause the occurrence of the quality problem, e.g.(man, machine, material, method and management) (DZIUBA S.T., PIEKARA A. MALAS W., KOZIOL P. 2013)

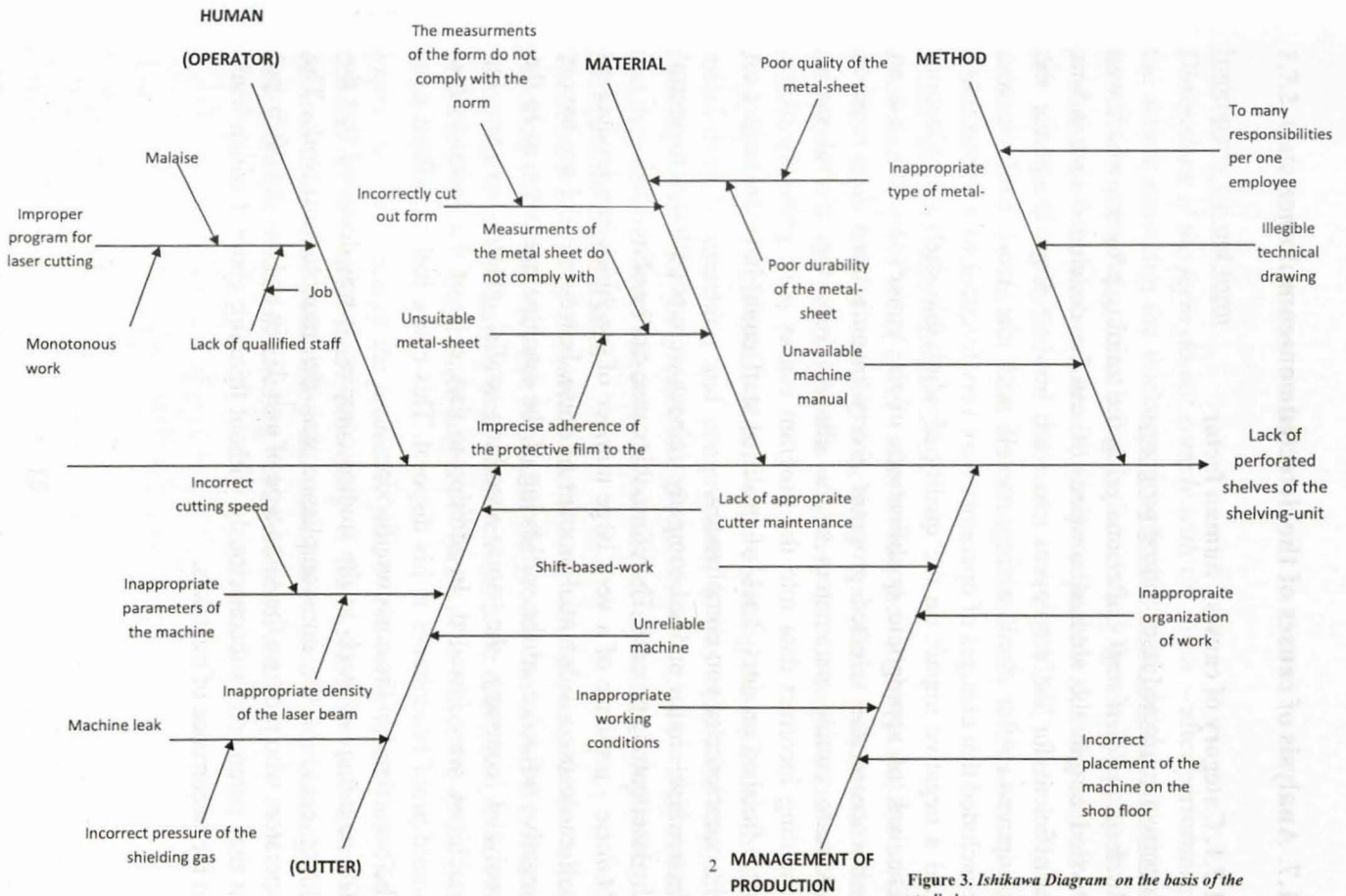


Figure 3. Ishikawa Diagram on the basis of the studied company.
 Source: personal study.

1.7. Analysis of causes of the detected non-compliance

1.7.1. Category of causes: human factor

Incorrectly selected laser cutting program

Lack of qualified staff - after analyzing the training program which was carried out in the studied company it can be concluded that it was insufficient for the employees to learn how to properly operate the equipment. After familiarizing oneself with the work cards it was concluded that changes of operators were very frequent which could have had a negative impact on the quality of adjustable shelves production. The lack of appropriate qualifications of the cutter's operator has an influence on the selected program. Every manufactured item requires adequate cutting parameters to be chosen from the control panel. Imputing incorrect data into the program causes poor geometry of the semi-finished product. Lack of qualified staff could have an impact on the occurrence of non-compliances.

Internships - in the audited company trainees were not allowed to control the laser cutting process. Therefore, this cause can be eliminated.

Malaise - presence of a very large number of machines in a production hall can cause a substantial amount of noise, however it did not have a negative influence on the well-being of the machine operators, as in the analyzed company the noise-absorbing walls, placed between the machines, were installed. In addition to that, each of the operators had sound-proof headphones at his disposal. This cause had no influence on the occurrence of the non-compliance.

The monotony of work - in the studied company it was deduced that the direct cause of the non-compliance was the monotonous work. The operators who produce the same type of unit day in and day out often put in the parameters subconsciously without thinking about it which leads to the occurrence of mistakes.

1.7.2. Category of causes: material

Improperly cut out form

Dimensions of the form do not comply with the norm - after performing the action (measuring the thickness, length and width) in order to check the dimensions of the form it can be concluded that in the process of production of the shelves intended for the adjustable shelving unit all of the parameters specified in the norm were fulfilled. The external dimensions of the cut out form are correct that is why this cause can be eliminated.

The wrong kind of metal-sheet used

Poor quality of the metal-sheet - after testing the roughness and hardness of the metal-sheet it can be concluded that these parameters were consistent with the norm, which is why they cannot be the cause of the inconsistency.

Poor durability of the metal-sheet - after checking the resistance of the metal-sheet to stretching and compression, it was concluded that the parameters used for the production of shelves are correct, which means that they have no direct effect on the occurrence of the non-compliance.

Improper metal-sheet used

The measurements of the metal-sheet do not meet the standards - after checking the metal-sheet that is used in the production of shelves, it was found that their dimensions were consistent with the order, and so it was possible to cut out the planned amount of forms. Therefore, this cause has to be ruled out.

Imprecise adherence of the protective film to the metal-sheet - the film adheres to the metal-sheet protecting it from scratches and external environment. After controlling the metal-sheet used for producing the faulty units no inconsistencies e.g. rust were observed.

1.7.3. Category of causes: method

Unavailable machine manual

Inspection revealed that there was an availability of at least one manual in the vicinity of each machine, and thus it can be concluded that it was available to the machine operator. This cause can also be eliminated.

Too many responsibilities per one employee

In the studied company every employee was assigned to operate one machine, so it can be concluded that the operator's responsibilities did not exceed the daily norm. This cause can be considered to be eliminated.

Unclear technical drawing

After analyzing the technological documentation of the produced shelving-unit, that should be available at every work-station, it was detected that it contained drawings of individual components, that were illegible for operators (they were small in size and had indistinct markings). This cause could have had an effect on the occurrence of non-compliance.

1.7.4. Category of causes: machine

Improper parameters of the device

Incorrect cutting speed - it melts the edges that are being cut, which considerably decreases the quality of the process. Speed that is too high contributes to the accumulation of gatherings of metal and slag on the lower edge, and this in turn leads to the metal-sheet not being cut all the way through. The analysis carried out in the establishment; on the date of the complaint provided the information that the shelf had correct measurements. Research proved that this cause has no effect on the analyzed problem.

Incorrect density of the laser beam power - while checking the documentation from the date of the non-compliant product production it was found that the density of the laser beam power amounted to 1500 W/mm². It is a correct parameter of the process.

Machine leakage

Incorrect pressure of shielding gas - in the analyzed company, during the process of adjustable shelves production, liquid nitrogen is used to remove material from the crevices of the cuts, its pressure amounts to 12 bars. This parameter is normal and has no adverse effect on the cutting process.

Lack of cutter maintenance

In the analyzed company the machine operator, that operates the laser, conducted periodical maintenance (greasing, cleaning). Furthermore, the device was subjected to planned maintenance. All activities that were conducted to upkeep the machine were logged and used for subsequent maintenance work. Failures of the cutter were documented. Having access to this type of information made it possible to check that the maintenance was carried out as planned, and therefore it is not the cause of the non-compliance.

Reliability of the machine

On the basis of the performed analysis, it was concluded that the device does not work properly despite regular maintenance. Documentation concerning utilization of the machine proves that the control panel was already replaced twice, that is why this cause must be taken into account.

1.7.5. Category of causes: management

Inadequate organization of work - even the smallest changes in the organization of work can have a significant impact on weakening its effectiveness. Poor organization of work in the company results in the employee:

- not being able to find the necessary documents or information,
- filling the documentation in, in a wrong way,
- omitting certain tasks, in order to meet the deadlines,
- being unprepared and late for work,
- working in messy environment,
- having no clear priorities,
- having problems with interpersonal communication.

As a result, the employee puts double effort into his work, does not meet the deadlines, loses time, subsequently, his work becomes ineffective. Poor performance is visible to other employees and has an impact on their work. An employee who does not fulfill his duties entirely according to the orders and requirements of his supervisor often causes the production process to become abnormal. Lack of regular inspections at each stage of production can lead to errors. After conducting an analysis in the researched company it was concluded that there were no indications to claim that the organization of work was in any way inadequate, which is why this cause has no effect on the resulting non-compliance.

Shift-work

The organization of work in the company was based on the two-shift-work system. This type of system may lead to the situation when the cutter operator changes the parameters of the process without communicating it to his successor. Despite having the appropriate list of elements and parameters present at the work-station some information may be overlooked. As a result of the research it was noted that on the day of the non-compliant shelving-unit production, this particular project was implemented during two shifts of work, which could lead to the occurrence of non-compliances.

Improper location of the machine on the shop floor

This cause does not influence the analyzed problem, as on the basis of the analysis it was concluded that all the machines on the shop floor were placed at an appropriate distance from each other. Every workstation had an adequate access to the control panel as well as to the working part of the machine. The cutter was located on a stable base in a place where there was no possibility of sunlight to be reflected off the control panel. If the situation was different the operator would have had a problem with entering the relevant parameters into the machine. This cause does not affect the occurring non-compliance.

Inadequate conditions of work

Comfortable working conditions have an influence on the more thorough performance of the employees as well as on their wellbeing. The study indicates that work in the company was based on the eight-hour-shift system, and each of the employees was entitled to half an hour break. The conditions of work in the production hall have also a significant impact on the work of the cutter operator. The company provided its employees with adequate work-space, temperature and lighting. Noise present on the shop floor was being minimized. After conducting the above analysis it can be concluded that the working conditions were adequate, and therefore this cause had no effect on the non-compliance that occurred in the company.

1.8. Summary

Based on the analysis conducted with the use of the Ishikawa diagram, four causes that led to the described non-compliance ('incorrect size of the perforations in the shelves of the shelving unit') were distinguished. The reasons for the non-compliance are as follows:

- lack of qualified staff,
- monotonous work,
- unclear technical drawing,
- device not being durable.

After identifying the causes of the non-compliance corrective and preventative actions were proposed in order to eliminate the possibility of their re-appearance in the shelving-units production process. The research identified the need to modify the already functioning integrated IT system that supports the management of quality. System modification will be based on the introduction of changes in the 'PRODUCTION' and 'HR' modules. Changes that were introduced into the IT system that will influence the 'PRODUCTION' module will consist of: introduction of tablets on each of the work-stations, tablets will be equipped with current

and legible technical drawings, replacing the current control panel with a new generation one that is more durable.

Introduction of the checklist that is consistent with the requirements of the customers.

The changes that were introduced in the "HR" module consisted of:

- providing training and making sure about its effectiveness,
- employing people with technical education,
- employing people with experience in the industry,
- allocation of work in order to prevent the monotony of performing the same activities over and over again,
- increasing the discipline of work.

Bibliography

1. BORYS T., ROGALA P. [Red.], *Systemy zarządzania jakością i środowiskiem*, Wyd. Uniwersytetu Ekonomicznego we Wrocławiu, Wrocław 2012.
2. DZIUBA S.T., PIEKARA A., MALAS W., KOZIOL P.: *Traditional tools of quality improvement used to improve furniture production process*. Monografia: S. BORKOWSKI, P. SYGUT, *Control Meaning in Products and Processes Improvement*, chapter 6, 2013.
3. GRUDOWSKI P., HAMROL A., ZYMONIK Z., *Zarządzanie jakością i bezpieczeństwem*, Wyd. Polskie Wydawnictwo Ekonomiczne, Warszawa 2013.
4. *Materialy z badanej firmy. Dokumentacja wewnętrzna* 2012.
5. ROSAK J., MACHELSKI W., STASIAK-BETLEJEWSKA R.: *The Accreditation and the ISO 9001:2000 System as Quality Determinants of Medical Services in Poland*. W: *TRANSCOM 2007. 7-th European Conference of Young Research and Scientific Workers. Proceedings. Section 2. Economics and Management. Part 2 (L-Z)*. Žilina, Slovak Republic 2007.
6. STASIAK-BETLEJEWSKA R., ROSAK-SZYROCKA J.: *Polityka motywacyjna w kontekście zarządzania jakością w ujęciu współczesnych przedsiębiorstw*. W: *Psychologiczne i socjologiczne*

aspekty zarządzania zasobami ludzkimi. Red. Felicjan Bylok, Mirosław Harciarek. Częstochowa, Wyd. P. Częst. 2009.

7. STASIAK-BETLEJEWSKA R., SELEJDAK J.: *Contemporary Portrait of the Manager in the Context of Managing the Quality in the Enterprise*. Human Resources Management and Ergonomics nr 1, 2007.
8. SZYMCZAK J., *Wyróżniki jakościowe dóbr konsumpcyjnych*, Wyd. Akademia Ekonomiczna w Krakowie, Kraków 1992.
9. URBANIAK M., *Zarządzanie jakością, środowiskiem oraz bezpieczeństwem w praktyce gospodarczej*, Wyd. Difin, Warszawa 2007.
10. WIŚNIEWSKA M., *Normy ISO serii 9000:2000-wymagania, analiza, wdrażanie*, Wyd. ODDK, Gdańsk 2002.