The Impact of Quality Control Implementation on Productivity and Product Quality in Industry

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ABSTRACT
Furniture production is one of the activities that has the potential to generate income for educational institutions. The furniture production process is generally carried out by experienced students utilizing industry-standard facilities, namely the Wood Construction workshop along with its machinery equipment. Therefore, the implementation of Quality Control in the production process is necessary. This study aims to determine the impact of Quality Control implementation on improving the productivity and quality of furniture products. The method used is quantitative with 4 stages of Quality Control, including product design, process planning, Incoming Quality Control (IQC), and In-Process Quality Control (IPQC). Productivity measurement is divided into 3 parts: partial productivity, total factor productivity, and total productivity, which includes labor productivity, time, and production output. Meanwhile, product quality measurement is obtained from assessments by practitioners and product quality testing according to ISO 19682. Data is processed using the path analysis method with the help of a smart PLS application. The research results show that the productivity of production output is 87.5%, categorized as good, with labor productivity of 0.125 pieces/person/day and work hour productivity of 0.25 pieces/hour/day. Product quality based on production processes is categorized as good at 83%. Meanwhile, product quality testing, including visual aspects is good (82.3%), product stability (normal), strength (normal), durability (normal), stiffness (normal 34mm/m), and drop test (normal). Based on path analysis, it is known that quality control including product design, process planning, Incoming Quality Control (IQC), and In-Process Quality Control (IPQC) has an impact on improving the productivity and quality of furniture products. the quality control carried out to increase productivity and product quality can be said to be good with the validation of the final result of 0.188 including in the good category.

KEYWORDS: Quality control, Furniture industry, Product quality, Productivity

1. INTRODUCTION
Industry according to Law No.5 of 1984 concerning Industry, industry is an economic activity that carries out the processing of raw materials, raw materials, goods that are not fully finished to become goods that have high value for users, also includes an industrial engineering design and engineering. The development of time and technology has a huge impact on the development of improvements in the improvement of existing industries. At this time so many industries exist both in the retail and manufacturing industries. In the process of making a product produced by the industry, of course, it must have quality. In addition to quality, increasing productivity is also worth taking into account. Increasing work productivity is one way to enhance competition. However, raising productivity is not a simple task. Organizations require unique techniques to boost productivity, especially from their workforce (Salman Al-Shoura, et.al, 2023).

Quality is a general description of goods and services in promoting, designing, assembling, and maintaining that makes the goods and services used to meet the buyer’s assumptions (Oktavia, 2021). In addition to increasing the quality of the industry, it is also necessary to increase productivity, according to Riyanto (in Elbandiansyah, 2019: 250), technically productivity is a comparison between the results achieved (output) and the overall resources required (input). Productivity implies a comparison between the results achieved and the role of labor per unit time. These two things are important in the success of the planned or produced product. The improvement of both affects the future product after completion with a good product evaluation.
Product quality is the physical condition, function and nature of a good product or service based on the expected level of quality such as durability, reliability, accuracy, ease of operation, product repair and other product attributes with the aim of meeting and satisfying consumer or customer needs. Quality control is a system of verification and maintenance of a product quality level or method carried out in the form of proper planning, application of appropriate equipment, continuous inspection, and corrective action when needed (Islamiyani et al., 2022).

Product quality is one of the keys to competition among business actors offered to consumers. Consumers always want to get quality products according to the price they pay, although some argue that expensive products are quality products (Arinawati, 2021). Therefore, the quality of a product greatly affects consumers, special attention is needed for the product to be made during the process to maximize results. Performance is based on two aspects, namely the quantity and quality of the products produced. Good or bad performance based on these two aspects is considered unable to measure the intangible value of the QC inspector department and the level of satisfaction (Al Farisy et al., 2023). Weak implementation in business diversification can have a negative impact on the business, in the case of internalization diversification, for example, the strategy can make the business experience a ‘disaster’ or failure due to incorrect or inadequate market analysis (Kamarudin et al., 2024). It is from this that quality improvement is needed for improvement in a business.

Broadly speaking, quality can be classified into three, namely, the quality of raw materials, the quality of the production process, and the quality of finished products. The quality of raw materials is a material whose quality is controlled, starting from nature directly or obtained from suppliers and can be utilized to obtain the results of production operations that have high quality and efficient values. Furthermore, the quality of the production process is an activity carried out to plan and supervise everything that happens during the production process in order to produce finished products that are in accordance with company standards. The production process starts from raw materials that have not been processed at all until they become finished goods (Rahayu & Sori, 2022). Based on the classification of product quality, it is necessary to check each work step during production. From this, it can be concluded that quality control is needed in every product, one of which is furniture products.

Furniture or furniture is furniture that is needed, useful or preferred, such as goods or objects that can be moved, used to equip homes, offices and so on (Putra et al., 2019). The context of product innovation will also be related to the process of creating new furniture products, because the product innovation process is a way of conveying new ideas for the creation of a new furniture product (Anshory, 2021).

Furniture production is one of the activities that has the potential to generate income for educational institutions. The furniture production process is generally carried out by experienced students by utilizing industry-standard facilities, namely the Wood Construction workshop and its machine tools. Although the equipment is industry standard and the production personnel are experienced, two problems are still found, namely the long production time and the absence of product quality testing. Quality control is needed in every production process, quality control in furniture is very important because if there is a slight defect, it will be taken into consideration by consumers and the selling price will also decrease. Quality control on furniture must be carried out throughout the manufacturing process, this is an alternative to be able to reduce any errors that occur in the products made.

This study aims to determine the impact of implementing Quality Control on improving productivity and quality of furniture products. This is to identify product defects using 4 Stage Quality Control. The application of quality control will be carried out during the product manufacturing process, this is done to maximize the product manufacturing process. This application will be carried out in accordance with the quality control in the industry, product analysis will be carried out to see existing defects so that they can be evaluated. From this examination, we will get a result to solve the problem and become an improvement proposal to improve product quality and productivity of furniture products.

2. METHODOLOGY

The method used is quantitative with 4 Stages of Quality Control, including product design, process planning, Incoming Quality Control (IQC), and In-Process Quality Control (IPQC). Productivity measurement is divided into 3 parts: partial productivity, total factor productivity, and total productivity, which includes labor productivity, time, and production output. Meanwhile, product quality measurements are obtained from assessments by practitioners and product quality testing in accordance with ISO 19682. The findings of this study will highlight the impact of the implementation of quality control (Abdullah et al., 2023).

2.1 Stages Quality Control

According to Dinata et al. (2022), there are 4 steps in performing quality control.

2.1.1 Product Design

Product design to determine the properties of raw materials, production processes, and other service requirements to produce products to the desired...
standard. Standards become the basis for quality control.

### 2.1.2 Process Plan

The first step of the quality control process mostly involves planning. Manufacturing production spends time formulating goals and establishing what the quality standards will be for the product being made. This involves understanding what is required to achieve the targets that have been set and ensuring certain criteria are met.

#### 2.1.3 Incoming Quality Control (IQC)

IQC stands for Incoming Quality Control, which refers to the quality confirmation and inspection of raw materials, components, or purchased products. IQC is the first quality control point before product production. If unqualified products are put into the manufacturing process, it will cause the process or final product to be unqualified, causing huge losses. The 2-step process in conducting IQC includes: Incoming Material Inspection. Involves confirming the inspection standards required for incoming materials, and that the materials meet those inspection standards. Handling of Identified Quality Issues. During the inspection process, quality issues will be tracked, promptly addressed and communicated back to the relevant departments.

In the manufacturing industry, there are usually four main items that have a direct impact on product quality design, incoming raw materials, manufacturing processes, and storage and transportation.

#### 2.1.4 In-Process Quality Control (IPQC)

IPQC refers to the quality control applied in the process from the production of raw materials to the packaging and storage of products (Hence the name In-Process Quality Control). In this step, quality inspectors will conduct random inspections of the product quality of each process, check the operation methods and handling of operators in each process, and check the contents of the control plan. The inspector will analyze the problems found in the inspection, propose corrective actions, and implement the improvement strategy. The quality control of the process is mainly to make the production of the process fully meet the product quality requirements. IPQC, as one that has many inputs, consists of a 6-step process involving: 1) staff handling procedures, 2) machine and tool safety checks, 3) material placement, 4) tool handling, 5) testing methodology and 6) environmental control. At this stage, the productivity of the work process will be measured, including partial productivity measurement and total productivity measurement.

**a) Partial productivity measurement.** In the partial productivity measurement required, it is measured based on ratios, among others (based on the inputs used):

- **i) Labor Productivity**

\[
\text{Productivity} = \frac{\text{Output Result}}{\text{Input Total Labor}}
\]

- **ii) Time Productivity**

\[
\text{Productivity} = \frac{\text{Output Result}}{\text{Input Total Labor Hours}}
\]

- **iii. Measurement of total yield productivity**

Measurement of total productivity is applied to the American Productivity Center (APC) model, this mode states that the quantity of output and input each year is multiplied by base year prices to produce a productivity index (Manulung, 2020). The formula used refers to the formula previously described in the theoretical basis, specifically using the APC Model.

\[
\text{Productivity} = \frac{\text{Input}}{\text{Output}} \times 100\%
\]

From the results obtained, productivity is categorized based on the percentage score as shown in **Table 1**.

<table>
<thead>
<tr>
<th>Interval Skor</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>85-100</td>
<td>Very High</td>
</tr>
<tr>
<td>68-84</td>
<td>High</td>
</tr>
<tr>
<td>51-67</td>
<td>Medium</td>
</tr>
<tr>
<td>34-50</td>
<td>Low</td>
</tr>
<tr>
<td>17-33</td>
<td>Very Low</td>
</tr>
</tbody>
</table>

Source: (Rahman et al., 2019)

**b) Product Quality Based on Practitioner Assessment**

Product quality was assessed from several aspects, namely, visual aspects, product stability, strength, durability, stiffness and drop test. This assessment was assessed based on ISO 19682 by comparing the results of the practitioner’s assessment.

#### 2.1 Sample Preparation

The sample used in this study is labour, which will make products that have been planned and designed. A sampling method is a statistical method used in research to select a subset of people from a larger population for observation, measurement, and analysis to understand the population’s nature (Xie, et al., 2024).

**2.2.1 Sample Testing**

This study will collect data by conducting assessments during the process by practitioners. The assessment is conducted periodically. Product quality and productivity measurements will be taken into account.
3. RESULTS AND DISCUSSION

3.1 Product Design
In this study, product design will be carried out first or rather a design before product manufacturing is carried out. Product design is carried out by taking into account the determination of the nature of raw materials, the selection of raw materials will be adjusted to the product design that has been designed. The selected raw material will determine the success of the product that has been designed. The material used is wood.

After completing the design and preparing raw materials, then designing the production process, in the production process is carried out by preparing raw materials clean from dust and other impurities by washing, followed by the drying process, after drying, product manufacturing will be carried out until finally finishing.

3.2 Process Plan
The first step is to check the product design, starting from the inspection of raw materials and planning the production process. The second step is continued with the inspection of the production process carried out during the product manufacturing process; the inspection is carried out at each stage of the product manufacturing process. The inspection of the product process is monitored by the practitioner. The third step is to check the quality of the product, which is also carried out by practitioners with quality testing in accordance with ISO 19682.

3.3 Income Quality Control (IQC)
IQC testing of raw materials is the first control point for quality control of enterprise products before production. Putting non-conforming products into the manufacturing process will cause non-conformity in the process or final product and result in huge losses. IQC impacts not only the quality of the company’s final product but also a wide range of direct or indirect costs. This incoming quality control is in the form of checking the quality of incoming materials. Receipt of a number of materials is checked by practitioners and researchers related to quality. The incoming raw materials for product manufacturing have met the inspection standards.

After the inspection of incoming raw materials, followed by handling the identified quality problems, discussions were held with researchers and practitioners. This check has an impact on four items that have a direct influence on quality including 25% design, 50% incoming raw materials, 20% production process, and 1 - 5% storage and transportation.

3.4 In-Process Quality Control (IPQC)
Quality control is carried out during the production process, this aims to control accuracy in the execution of production.

3.4.1 Partial Productivity Measurement
a) Labor Productivity
This labor productivity is calculated based on the ability of labor to work on products and complete work according to a predetermined volume, the calculation is done by equation. This data processing is assisted by the SmartPls application. Calculations are carried out by taking into account the results of the production produced and how much labor in completing the product from this, the results of measuring labor productivity are obtained with the equation [1]. Based on the above calculations, it can be concluded that the measurement of labor productivity per month can complete 0.5 pcs / person/month.

\[ \text{Productivity} = \frac{45}{9} \]
\[ \text{Productivity} = 5 \text{ Pcs/person/month} \]

b) Labor Hours Productivity
Working hour productivity is calculated based on the amount of time required to complete a product. The calculation of working hour measurement uses the help of equation [2]. The calculation results can be seen below. Based on the above calculations, it can be concluded that the measurement of labor productivity per month can complete 0.2 pcs/hour/day.

\[ \text{Productivity} = \frac{45}{20} = \frac{9}{5} \]
\[ \text{Productivity} = 0.23 \text{ pcs/hour/day} \]

c) Total Yield Productivity Measurement
Measurement of total productivity results obtained from the output and input of product results. From the data that has been obtained, the measurement of product productivity is calculated by equation (Manulung, 2020). The calculation results can be seen below.

\[ \text{Productivity} = \frac{\text{Output}}{\text{Input}} \times 100\% \]
\[ \text{Productivity} = \frac{4}{4.5} \times 100\% \]
\[ \text{Productivity} = 0.888 \times 100\% = 88.8\% \]

Based on the above calculations, it can be concluded that the percentage of total productivity measurement results obtained a score of 88.8%, including in the very high category.

d) Product Quality
Product quality is based on several aspects, namely, visual aspects, product stability, strength, durability, stiffness and drop test. The assessment was conducted by practitioners with the assessment results categorized based on ISO 19682. The assessment results can be seen in Table 2.
Based on the processing carried out using SmartPLS assistance in accordance with the indicators in seeing the final results for overall quality control. SmartPLS, an acronym for Smart Partial Least Squares, serves as a statistical analysis method employed in empirical research to examine and assess the relationships between variables within a structural model (Wuisan et al., 2023). The results obtained are seen in Figure 1.

From the data processing above, it can be concluded that the results of the calculation using SmartPLS by entering existing data, where two indicators in the quality control check are Productivity Measurement and Product Quality. Total productivity measurement obtained a result of 0.981 which was included in the very high category, while the value of product quality was carried out based on practitioner assessment by obtaining a percentage value of 83% including in the high category. Judging from the SmartPLS results, the path coefficient value between the two indicators called product quality on quality control is +0.375, while the productivity measurement value is -0.076. The final results obtained from these two indicators that Quality Control carried out to improve productivity and product quality can be said to be good with the validation of the final results of 0.188 including in the good category.

3.5 Discussion
The results of this study reveal that quality control is important in increasing productivity and product quality, this can be seen from the results obtained. The results of this study are in line with the results of research conducted by Zacharias (2022) with the research title “The Importance of Quality Control for The Success of a Company”, which has the same research objectives to determine the importance of implementing quality control. The research results obtained from his research include, among others, quality control is an important aspect of production. In connection with this, the results of research by Putra (2023) with the title “Analysis of the Effect of Product Quality Research and Production Process Control on Increasing Product Productivity” which has a research objective to analyze the effect of product quality control and production process control on increasing product productivity with the results of his research the variables of product quality control and production process control have an effect on increasing product productivity.

<table>
<thead>
<tr>
<th>No</th>
<th>Aspect Indicator</th>
<th>Category ISO 19682</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Visual Aspect</td>
<td>82.3 % (Baik)</td>
</tr>
<tr>
<td>2</td>
<td>Product Stability</td>
<td>Normal</td>
</tr>
<tr>
<td>3</td>
<td>Strength</td>
<td>Normal</td>
</tr>
<tr>
<td>4</td>
<td>Durability</td>
<td>Normal</td>
</tr>
<tr>
<td>5</td>
<td>Stiffness</td>
<td>Normal 34 mm/m</td>
</tr>
<tr>
<td>6</td>
<td>Drop test</td>
<td>Normal</td>
</tr>
</tbody>
</table>

Table 2: Product quality result

Figure 1: Quality control processing results
4. CONCLUSION

Through various stages in the implementation of the research, the results of this study reveal that quality control is important in improving productivity and product quality, this can be seen from the results obtained. The results of the measurement of labor productivity obtained a productivity value of 0.5 pcs/people/month, while the results of the calculation of labor hour productivity measurements obtained a value of 0.23 pcs/hour/day. Production output obtained a percentage with a total score of 88.8%, including in the very high category. Product quality is assessed based on several indicators of assessment by practitioners, the results of the assessment are based on ISO 19682, including the visual aspect which obtained a score of 82.3% is included in the good category. Stability obtained a category including normal, followed by strength assessment including normal. While durability is also included in the normal category, with product stiffness included in the normal category with a value of 34 mm / m, and product drop testing is normal. From this research is only to find out the impact of implementing quality control on the quality and productivity of a product. It is hoped that in the future other researchers can continue research by applying this quality control to industries that produce a product.

REFERENCES


