The Implementation of Supply Chain Management in Construction Industry

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Abstract. Supply Chain Management (SCM) of the construction is a management of resource activities and relationship between suppliers and consumers from upstream to downstream in the terms of construction services. This study focused on Small and Medium Classes of constructors in Blora. The purposes of this study were to determine the positive effect of the performance of company, to determine the positive factors of Supply Chain Management in increasing the competitiveness of the company and in the level of the customers’ satisfaction. The analysis was carried out through processing methods and path analysis was also used to analyze the data. The results show that the implementation of SCM can improve the performance and competitiveness of construction companies and it also affects the level of customers’ satisfaction.

1. Introduction

The advances of technology and global competition require companies to improve their quality in maintaining competitiveness. There are two main things to choose: first, involving in the competition by making improvements or second, getting out of the competition but creating something new to build an image of the company. Nowadays, one of the sectors that play an important role in the changes of economy is a construction service company. So it needs much attention and good ways to handle the management of construction projects. Some construction projects are often found with the unexpected quality and the delays in completing the projects. Thus, the performance of the construction company is very influential on the construction process.

The success of a construction company can be measured by performance, the better the performance, the more successful and developing it will be. Performance can be defined as the quantity and quality of work completed by individuals, groups, or organizations. The performance aspect consists of three components namely quality, quantity, and effectiveness. Basically, performance is the responsibility of every individual who works in the organization. The responsibility for construction performance actually does not come from the company manager but also from the cooperation of all parties in the construction process [1]. Good strategy, innovation, and activity planning will encourage the company to be competitive. So, companies must find solutions to increase their competitiveness and make some effective costs. One aspect of increasing competitiveness is managing the Supply Chain Management.

The SCM is a management of activities, resources, and relationships between suppliers and consumers from upstream to downstream in terms of construction services. If this theory is carried out properly, it will further increase the competitiveness of a company [2]. Some researchers acknowledge the effectiveness of SCM in reducing costs [3]. It needs to be convinced that SCM can improve the performance and increase the competitiveness.
2. Literature Review

Supply Chain Management is an effort to integrate the parties involved in the activities of making a product to give the efficiency of quality and service operations to the customers. In manufacturing companies that implement Supply Chain Management, there are 5 main developments, namely product development, procurement, planning, control, production, and delivery [4]. Supply Chain is a collaboration between companies that interact to deliver products (goods or services) to the last customers [5].

Supply Chain Management of the construction is an operational and strategic cycle that includes workers, materials, equipment, subcontracting, and project completion. These components are connected by technology, security and communication. Supply Chain Management of the construction is referred to a strategic management of the flow of information, activities, tasks, and processes involving various independent organizational networks and interaction relationships (upstream and downstream) that gives value in the form of project completion [6].

2.1. Performance

Performance is the result of work that has been compiled and it has a strong relationship with the strategic goals of an organization, customers’ satisfaction, and makes an economic contribution [7].

2.2. Competitiveness

The competitive advantage is the ability of a company to achieve economic benefits above the profits that can be achieved by competitors in the same market [8]. Companies that have a competitive advantage are always able to understand the changes in market structure and to choose effective marketing strategies. Competitive advantage is “the ability of a company to keep the stable position through the competition with the other companies [9]. In research this competitive advantage is measured by delivery dependability, innovative products and time to market.

2.3. Supply Chain Management Actors

Based on several models developed in Supply Chain Management of the construction, there are several main components including:

1. Owner (Downstream Actor)
   In the process of product construction based on the request from the owner, the owner also plays an important role. The Supply Chain Management process starts from the initiative from the owner to build a construction product and ends when the production is finished [5]. The owner takes important role in every stage, from the feasibility study, planning, procurement, implementation, operation, and maintenance stages. In the production process, the owner can directly appoint the parties for the implementation of nominated subcontractor / supplier.

2. Contractors (Main Actors)
   Contractors are the organization that provide construction work services based on predetermined technical planning and specifications. Currently, there is development of contractors from a very small companies to the biggest companies that have many workers.

3. Subcontractors, Suppliers, and Foremen (Upstream Actors)
   a. Subcontractors and Specialists
      Subcontractors are the construction company that have some contracts with the main contractor to carry out several parts of the work. In this contractual relationship, there are some terms used: main contractor, subcontractor, and sub-subcontractor.
   b. Subcontractors and Labors
      This group has a leader called the foreman who acts as a communicator between contractors and labors. The foreman provides services to contractors as a provider of labor with a variety of specific skills (for example, diggers, masons, carpenters, etc.) and also other different levels of expertise.
c. Suppliers and Construction Manufacturing

Based on the type of material required in a building construction project, there are two types of actors involved in the flow of materials:

• Construction manufacturers produce construction materials by processing natural materials to the certain building components.

• Suppliers distribute obtained materials to the customers. These suppliers can be divided into suppliers of natural materials and suppliers of building component materials.

3. Research Methodology

The data of the research were obtained through direct observation using a questionnaire in several small and middle contractors in Cepu - Blora Regency, Central Java. Direct observation provided an overview of each work at the location and the potential hazards that might arise.

Path analysis model was used to analyze the data. It was used to analyze the causal relationship that occurred in multiple regression if the independent variable affected the dependent variable directly and indirectly in the correct steps. After all the data was collected, the next step was to analyze the data and it was processed by computer with the SPSS version 16. Unvaried data was analyzed descriptively and presented in the form of a frequency distribution table. Secondary data was presented in a narrative manner and analyzed based on applicable regulations.

3.1. Variable Determination and Measurement Method

The variables in this study are divided into the independent variable = X and the dependent variable = Y.

1. Independent Variable (X)

Independent variables are the factors that support the successful implementation of Supply Chain Management which can affect performance and competitiveness with the following variables:

X1 = Role of company management
X2 = Implementation of the Supply Chain Management
X3 = Performance of the Company
X4 = Competitiveness of the Company

To determine the level of influence of these factors in the implementation of Supply Chain Management (SCM), a Likert Scale of 1-5 was used with criteria [10]:

- VL = Very Low Score = 1
- L = Low Score = 2
- H = High Score = 3
- RH = Rather High Score = 4
- VH = Very High Score = 5

2. Independent Variable (Y)

The dependent variable is influenced by the independent variables, namely the performance and competitiveness of the company.

Y = The level of customers’ satisfaction with the service

4. Result and Discussion

After conducting the research, the primary data was obtained to test the hypothesis. The questionnaire were distributed to 35 respondents.
Table 1. Characteristics based on Company Grade.

| No. | Class of the Company | Frequency | Percentage (100%) |
|-----|----------------------|-----------|------------------|
| 1.  | Grade S (Small)      | 24        | 68.6 %           |
| 2.  | Grade M (Middle)     | 11        | 31.4 %           |
|     | Amount               | 35        | 100 %            |

(Source: Primary data processed, 2020)

After the characteristics of the class, there are also some characteristics of the position. It shows that the lowest presentation is 2.9% for the drafter positions which is only 1 person and the largest presentation is 60.0% for the director position as many as 21 people. Furthermore, there are characteristics of the age of the company.

Table 2. Characteristics based on the Age of the Company.

| No. | Age of the Company | Frequency | Percentage (100%) |
|-----|--------------------|-----------|------------------|
| 1.  | < 5 year           | 9         | 25.7             |
| 2.  | 5 – 10 year        | 15        | 42.9             |
| 3.  | > 10 year          | 11        | 31.4             |
|     | Amount             | 35        | 100              |

(Source: Primary data processed, 2020)

It can be seen that the age of the companies was mostly between 5 - 10 years and it has 15 companies with the percentage of 42.9%. Furthermore, there is a validity test where all instrument variables have a significance level of 0.05 (α = 5%) and a reliability test with the Cronbach alpha value (0.60).

4.1. Validity Test

Based on the table 3, it can be seen that all variables of this research instrument have a significance level, smaller than 0.05 (α = 5%) except for the variables X2.1 and X3.6. So, the two variables are either dropped or not used.

Table 3. Validity test results.

| No. | Variable                          | Indicator | r table | r count | Information |
|-----|-----------------------------------|-----------|---------|---------|-------------|
| 1.  | The Role of Company Management    | X1.1      | 0.334   | 0.678   | Valid       |
|     |                                   | X1.2      | 0.334   | 0.801   | Valid       |
|     |                                   | X1.3      | 0.334   | 0.427   | Valid       |
|     |                                   | X1.4      | 0.334   | 0.689   | Valid       |
|     |                                   | X1.5      | 0.334   | 0.427   | Valid       |
| 2.  | The Implementation of Supply Chain Management | X2.2 | 0.334 | 0.780 | Valid |
|     |                                   | X2.3 | 0.334 | 0.619 | Valid |
|     |                                   | X2.4 | 0.334 | 0.707 | Valid |
|     |                                   | X2.5 | 0.334 | 0.395 | Valid |
|     |                                   | X2.6 | 0.334 | 0.675 | Valid |
|     |                                   | X2.7 | 0.334 | 0.712 | Valid |
| 3.  | The Performance and Competitiveness of the company | X3.1 | 0.334 | 0.544 | Valid |
|     |                                   | X3.2 | 0.334 | 0.538 | Valid |
|     |                                   | X3.3 | 0.334 | 0.680 | Valid |
4.2. Reliability Test

Based on the table 4, it can be seen that all research variables have a Cronbach alpha value that is greater than 0.60. So that, it can be said that this research instrument is reliable.

Table 4. Reliability test results.

| No. | Variable                                    | Cronbach Alpha | Information |
|-----|---------------------------------------------|----------------|-------------|
| 1.  | The role of company management              | 0.737          | Reliable    |
| 2.  | The Implementation of Supply Chain Management | 0.756          | Reliable    |
| 3.  | The Performance and Competitiveness of the Company | 0.728          | Reliable    |
| 4.  | The level of customers’ satisfaction of the service | 0.722          | Reliable    |

(Source: Primary data processed, 2020)

4.3. Analysis Phase

There are some steps in this analysis stage:

4.3.1 Model

To examine the influence of variables on the Role of Company Management, Implementation of Supply Chain Management (SCM), Performance and Competitiveness of the Company, this study was analyzed by using path analysis. The model below was used based on the concepts and theory:

![Figure 1. Path analysis model](image-url)
Information:
X1 = The Role of company management
X2 = The Implementation of supply chain management (SCM)
X3 = The Performance and competitiveness of the company
Y = The level of customers’ satisfaction of the service

The model can also be expressed in equation form:

\[ X2 = P_1 X1 + e1 \]
\[ X3 = P_2 X1 + P_3 X2 + e2 \]
\[ Y = P_4 X1 + P_5 X2 + P_6 X3 + e3 \]

4.3.2 Calculation of the Path Coefficient

a. The Role of Company Management on the Implementation of Company Supply Chain Management (SCM). Based on the data, the result will be shown in the following table:

**Table 5.** Estimation Results of the Influence of the Role of Company Management (X1) on the Implementation of Company Supply Chain Management (SCM) (X2)

| Model | R   | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-----|----------|-------------------|---------------------------|
| 1     | .665* | .442     | .425              | 1.98538                   |

*Predictors: (Constant), x1

| Coefficients * |
|----------------|

| Model | Unstandardized Coefficients | Standardized Coefficients |
|-------|-----------------------------|---------------------------|
|       | B                           | Std. Error               | Beta         | t   | Sig.  |
|       |                             |                           |              |     |       |
| (Constant) | 6.307                     | 2.929                     | 2.154        | .039|       |
| x1 | .861                           | .169                      | .665         | 5.109| .000  |

*Dependent Variable x2

(Source: Primary data processed, 2020)

\[ e1 = \sqrt{1 - 0.442} = 0.747 \] So it can be obtained the new formula: \[ X2 = 0.665 X1 + 0.747 \]

b. The Coefficient of the Role of Company Management and the Implementation of Supply Chain Management to the Performance and Competitiveness of the Company.

**Table 6.** Estimation Results of the Influence of the Role of Company Management (X1) and Implementation of Supply Chain Management (SCM) (X2) on the Performance and Competitiveness of the company (X3)

| Model | R   | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-----|----------|-------------------|---------------------------|
| 1     | .749* | .561     | .533              | 1.41928                   |

*Predictors: (Constant), Implementation of SCM, Role of Management

| Coefficients * |
|----------------|

| Model | Unstandardized Coefficients | Standardized Coefficients |
|-------|-----------------------------|---------------------------|
|       | B                           | Std. Error               | Beta | t   | Sig.  |
|       |                             |                           |      |     |       |
| 1     | (Constant) | 9.456                   | 2.236          | 4.229| .000  |

(Source: Primary data processed, 2020)
The Role of Company Management  
\[ .075 \quad .161 \quad .073 \quad .466 \quad .644 \]

The Implementation of SCM  
\[ .554 \quad .124 \quad .698 \quad 4.453 \quad .000 \]

### a. Dependent Variable: performance and competitiveness
(Source: Primary data processed, 2020)

\[ e2 = \sqrt{(1 - 0.561)} = 0.662 \] 
So that, it is obtained the new form: \[ X3 = 0.73X1 + 0.698X2 + 0.662 \]

### c. The Coefficient of Role of Company Management, the Implementation of Supply Chain Management, the Performance and Competitiveness on customers’ satisfaction.

#### Table 7. Estimation Results of the Influence of the Role of Company Management (X1), Implementation of Company SCM (X2), Company Performance and Competitiveness (X3) on Customers’ Satisfaction (Y)

| Model Summary |
|----------------|
| **Model** | **R** | **R Square** | **Adjusted R Square** | **Std. Error of the Estimate** |
| 1 | .576* | .332 | .268 | .870 |

a. Predictors: (Constant), Performance and Competitiveness, Management Role, Implementation SCM

| Coefficients * |
|----------------|
| **Model** | **Unstandardized Coefficients** | **Standardized Coefficients** | **t** | **Sig.** |
| 1 (Constant) | 6.088 | 1.711 | 3.557 | .001 |

Management Role  
\[ -.019 \quad .099 \quad -.038 \quad -.194 \quad .847 \]

Application of SCM  
\[ -.024 \quad .097 \quad -.063 \quad -.252 \quad .803 \]

Performance and Competitiveness  
\[ .313 \quad .108 \quad .640 \quad 2.892 \quad .007 \]

a. Dependent Variable: Y
(Source: Primary data processed, 2020)

\[ e3 = \sqrt{(1 - 0.334)} = 0.816 \] 
so it can be obtained the formula: 
\[ Y = 0.99X1 + 0.97X2 + 0.108X3 + 0.816 \]

#### 4.3.3. Validity Model

There is an indicator of validity model in path analysis, namely the total coefficient of determination which is the diversity of data that can be explained by the model. The total coefficient of determination for the consumers’ satisfaction level is: 

\[ R2m = 1 - (0.747)^2 (0.662)^2 (0.816)^2 \]

\[ R2m = 0.837 \]

Thus, the diversity of data can be explained by the model with the percentage of 83.7%. In other words, the information contained in the data can be explained by the path analysis model. Meanwhile, 16.3% is explained by other variables (which are not included in the model and error).
4.3.4. Interpretation
a. Based on the results of validity model, it is obtained the result that explains the information contained in the data with the percentage 83.7%. This figure is large enough to allow further interpretation.
b. The effect of each variable
   The direct effects of exogenous variables to endogenous variables are:
   • The direct effect of X1 on X2 = P1
     The direct effect of the Role of Company Management on the Implementation of SCM is 0.665
   • The direct effect of X1 on X3 = P2
     The direct effect of the Role of Company Management on the Performance and Competitiveness is 0.73
   • The direct effect of X2 on X3 = P3
     The direct effect of the Implementation of SCM on the Performance and Competitiveness is 0.689
   • The direct effect of X1 on Y = P4
     The direct effect of the Role of Company Management on Customers’ satisfaction of the Service is -0.38
   • The direct effect of X2 on Y = P5
     The direct effect of the Implementation of SCM on Customers’ Satisfaction of the Service is -0.63
   • The direct effect of X3 on Y = P6
     The direct effect of Performance and Competitiveness on Customers’ Satisfaction of the Service users is 0.64

4.4. Hypothesis Test Results
4.4.1. First Hypothesis Test
H1: The role of company management has a positive influence on the level of the implementation of SCM.
   Based on the data in the illustration model, the validity test of the path analysis can be seen that the influence of the role of company management on the implementation of SCM is 0.665 with a significant level of 0.000 which is less than 0.05 or significant. So, the higher the role of company management, the better the implementation of SCM in construction companies. Thus, the first hypothesis which states that the role of company management has a positive influence on the application of SCM is accepted or proven.

4.4.2. Second Hypothesis Test
H2: The role of management has an influence on performance and competitiveness.
   Based on the data in the illustration model, the validity test of the path analysis can be seen that the influence of the role of company management on performance and competitiveness is 0.073 with a significant level of 0.644 which is greater than 0.05 or not significant. Thus, the second hypothesis which states that it is suspected that the role of company management has a positive effect on company performance and competitiveness is not accepted or proven.

4.4.3. Third Hypothesis Test
H3: The implementation of SCM has a positive influence on performance and competitiveness
   Based on the data in the illustration model, the validity test in the path analysis can be seen that the effect of implementing SCM on the performance and competitiveness is 0.689 with a significance level of 0.000 which is less than 0.05 or significant. So the higher the value of implementing SCM, the higher the performance and competitiveness of construction companies. Thus, the third hypothesis which states that it is suspected that the implementation of the SCM has a positive effect on the performance and competitiveness of the company.
4.4.4. Fourth Hypothesis Test
H4: The role of company management has a positive influence on level of customer satisfaction service users.

Based on the illustration model, the validity test of the path analysis shows that the influence of the role of company management on the level of customer satisfaction of service users is -0.038 with a significance level of 0.847 which is greater than 0.05 or not significant. Thus, the fourth hypothesis which states that it is suspected that the role of company management has a positive influence on customer satisfaction is not accepted or proven.

4.4.5. Fifth Hypothesis Test
H5: The implementation of SCM has a positive effect on the level of customers’ satisfaction of the service.

Based on the data in the illustration model, the validity test on the path can be seen that the effect of implementing SCM on the level of customers’ satisfaction of service users is -0.063 with a significance level of 0.803 or not significant. Thus the fifth hypothesis states that it is suspected that the implementation of SCM has a positive effect on the level of customer satisfaction of service users is not accepted or proven.

4.4.6. Sixth Hypothesis Test
H6: The performance and competitiveness of company have a positive effect on the level of customers’ satisfaction of the service.

Based on the data in the illustration model, the validity test of the path analysis can be seen that the effect of performance and competitiveness on the level of customers’ satisfaction of service is 0.640 with a significance level of 0.007 which is smaller than 0.05 or significant. So the higher the performance and competitiveness of the company, the higher the level of customer satisfaction with the construction company. Thus the sixth hypothesis which states that it is suspected that company performance and competitiveness have a positive influence on the level of customer satisfaction is accepted or proven.

The results of previous research which are in the higher level of Supply Chain Management can increase the performance with the percentage of 68% and competitiveness with the percentage of 28% and also the performance has a direct positive impact on the competitiveness of the company with the percentage 32% by developing three dimensions of Supply Chain Management in Banten and Jakarta using AMOS V21 software [11].

5. Conclusion
Based on the results of research and discussion, it can be concluded that the application of SCM can improve the performance and competitiveness of construction companies. Improved performance and competitiveness of construction companies affect the level of customer satisfaction.

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