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Combination of SCOR-BSC and Regression Linear Programming to Assess the Performance of Construction SMEs in DIY and Central Java

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Abstract: Several metrics in the supply chain performance assessment system cannot be uncovered by merely putting a strategy into action. Meanwhile, the balanced scorecard strategy necessitates the incorporation of numerous measures derived from the implementation of strategies, ultimately guiding the business toward its long-term orientation. The same is true for evaluating the effectiveness of a supply chain. The Business Service Chain (BSC) takes three viewpoints of the Supply Chain Operations Reference (SCOR) and expands them into four: financial, customer, internal business, and innovation and learning. Both the SCOR and BSC methods can be utilized to implement a sustainable supply chain management system. These two methods were employed to solve supply chain issues in the construction industry. BSC aimed to compensate for SCOR's limited focus on performance by considering two angles—those of internal business operations and customers. When compared to SCOR, BSC's uniformity in the supply chain allowed for more adaptable metrics when resizing; more applicable models, encompassing all processes; and easier performance monitoring; all through the utilization of various metrics.

Keywords: Construction SMEs, SCOR method, BSC method, SCOR-BSC framework

1. Introduction

The construction industry, such as construction SMEs, has unique characteristics and constraints. Economic, legal, environmental, technical, and social restrictions contribute to the constraints faced by this industry (Rai, 2021). In addition, this industry is highly collaborative, bringing together experts from various disciplines and non-skilled workers. Unfortunately, the constraints impact construction projects; thus, developing awareness to effectively manage these constraints is crucial to actualizing better performance (Rai, 2021; Secher et al., 2018).

Researchers have examined the growth and decline of major corporations and small and medium-sized enterprises (SMEs) (Nguyen et al., 2021). There has been a recent uptick in studies on entrepreneurial behavior and how businesses attain high performance by implementing entrepreneurial actions and strategic decisions (Wales et al.,

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2013). The term "performance evaluation" refers to evaluating a company's efficacy in meeting its objectives, which can be broken down into two categories: financial and non-financial (Seo & Lee, 2019). A company's non-financial performance includes aspects such as brand reputation, customer satisfaction, internal performance, and innovation activities that cannot be directly translated into monetary value (Gan et al., 2020). While financial performance is often linked to a company's ability to stay in business in the short term, non-financial performance is commonly associated with the type of sustainable growth businesses can enjoy in the long run (Bhagwat & Sharma, 2007; Nguyen et al., 2021). Evaluation of development results is unlike financial performance assessment. Therefore, SMEs are more applicable to activities such as innovation.

The supply chain system of construction SMEs might be an area ripe for innovation. As it is known that construction SMEs are one of the most fragmented sectors globally due to their high level of specialization among professions, businesses, and processes, and most of the construction projects are carried out only once, involving the relationship of many parties (Turk & Klinc, 2017). Thus, it is necessary to assess the performance of supply chain innovation activities in construction SMEs. Construction SMEs consist of various aggregates, such as light steel roofs, brick, and others. However, the assessment can be performed equally from all aggregations. Supply chain system defects can originate from the absence of good quality data for coordinated functional modules, such as compliance checks, process control, and quality assurance, and can also be ascribed to low levels of information visibility and traceability (Lu et al., 2021).

1.1 BSC-SCOR Framework

The assessment model for construction SMEs concerning supply chain improvement can be formed using various methods, one of which is Supply Chain Operation Reference (SCOR). Business processes, best practices, performance indicators, people, and technology are all interconnected in the Supply Chain Council's proposed SCOR model (Chorfi et al., 2018). Practitioners can identify factors contributing to customer satisfaction through the SCOR model, enabling them to specify how processes interact along the supply chain from suppliers to customers (Lima-Junior & Carpinetti, 2020). The BSC model is another tool for internal performance evaluation alongside SCOR. The BSC-SC model is a hybrid of the BSC and the SC models. The BSC-SC's internal business perspective incorporates SCOR operation measurements of plan-source-make-deliver-return. Furthermore, the integration is conducted further by evaluating the regulator's contribution to supply chain actors in each BSC-SC viewpoint (Kusrini et al., 2016). From the application of BSC-SC, the SCOR-BSC framework emerged to solve the problem of increasing performance in the supply chain.

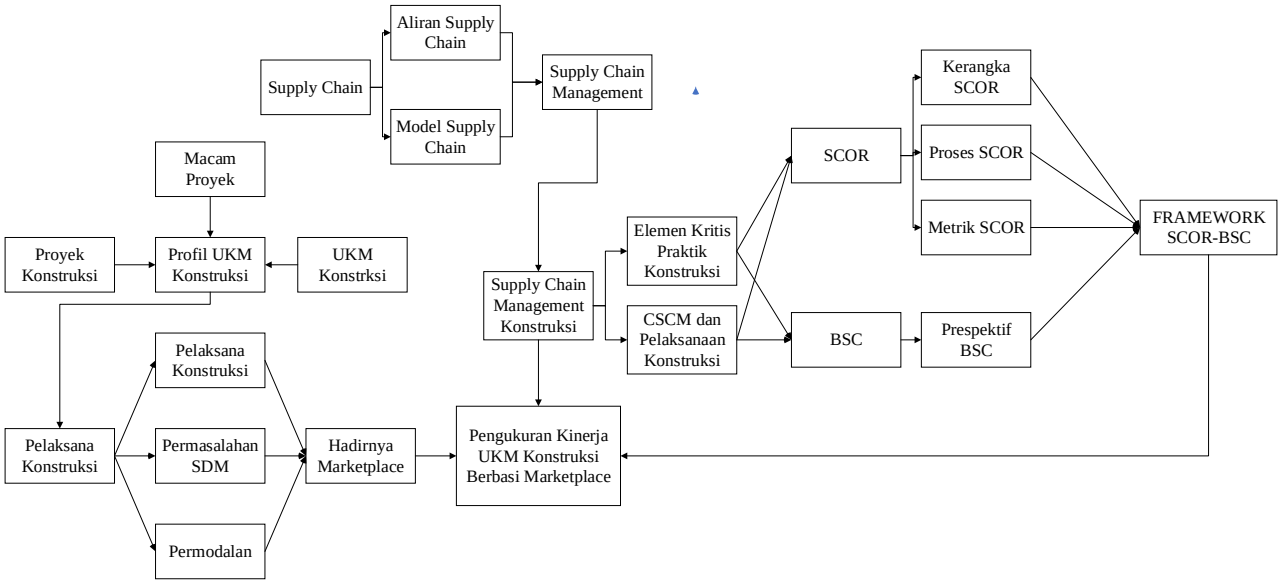
Several metrics in the supply chain performance assessment system cannot be unveiled by solely implementing a strategy. Moreover, the balanced scorecard strategy requires combining various measures from strategies that will direct the business toward its long-term goals. Evaluating the effectiveness of a supply chain is similar. The BSC takes the SCOR's three perspectives and broadens them into four: financial, customer, internal business, and innovation and learning (Bhagwat & Sharma, 2007).

Previous research was conducted by Singh et al., (2019) to pinpoint and examine critical elements of ICT implementation for the long-term success of small and medium-sized Indian food businesses. Government restrictions, public and private cooperation, and information technology usage were considered the three most problematic elements for food SMEs in India. Nevertheless, these issues impacted IT, departmental cooperation, and supply chain partnerships. Therefore, this study suggested new measures to strengthen existing laws and policies.

Research by Chun et al., (2015) defined a green supply chain as an initiative to assist SMEs in the construction industry in addressing environmental challenges and their effects on cost, response time, reporting, technology, and communication. This research looked at green management practices from the supply chain management perspective of SMEs. Sorting green SCM review of green SCM knowledge and green management action refers to many phases of SCM, such as purchasing. Green SCM operations, such as green purchasing, green production, green logistics, and reuse, were the subject of a factor analysis yielding the desired results. A p-value of 0.855 indicated no statistically significant difference between environmentally friendly purchasing and manufacturing techniques. For example, green logistics and green reuse revealed p-values of 0.003 and 0.001, respectively, significantly different from green purchasing. Thus, the findings implied, at the 0.05 level of significance, that SMEs engaged in varying degrees of green business activities at various stages of the supply chain process and that enterprises were more likely to engage in green business when located downstream.

Research related to SME development was carried out by Daxhammer et al., (2019), examining critical challenges in deploying multifaceted platforms through SMEs. The findings demonstrated how a flexible platform could foster ongoing innovation in SMEs. This research built on past findings to outline a business model framework for implementing multi-sided platforms within SMEs. The most crucial factors for building a multi-sided platform were deduced from the statements of the expert group with five members. The five primary characteristics discussed partially depended on one another and could be placed in distinct stages of managed service provider (MSP) evolution. As a result, the experts' testimonies were split into three periods: before, during, and after the MSP. Aspects of planning, implementation and subsequent market expansion were all discussed by experts. There was no longer any discernible time progression to the information provided. However, both factors must be considered simultaneously because of the

impact one had on the structural design of the other. With no clear beginning or conclusion, describing the model's components and their interconnections in ascending order has become more natural.



(Data processing, 2023)

Fig. 1 – Research framework

2. Method

A combination of the SCOR and BSC methods was employed in measuring the performance of marketplace-based construction SMEs. The two methods are different measurements (Sarvari et al., 2020). SCOR is commonly utilized as a measure of the supply chain performance with an analysis carried out including considerations on delivery and completion capabilities upon request, asset management and data collection, flexible production, guarantees, process budgets, and other indicators influencing the overall performance assessment (Ntabe et al., 2015). In contrast, BSC refers to a technique applied to assess the performance of a company with comprehensive aspects, both financial and non-financial (Balaji et al., 2021).

These two methods could be combined into one framework by creating indicators at the SCOR process level, consisting of reliability, responsiveness, agility, cost, and assets (Bhagwat & Sharma, 2007). These indicators were obtained from a literature study on construction measurements using SCOR. Subsequently, it proceeded to the construction level, describing and conceptualizing all the mechanisms at the first level, signifying that the indicators were formed from the process level. At the next level, the elaboration of various elements was carried out, outlining various processes. This step included describing the process components, the input and output, the equipment and the amount, and the definition of the best process.

At this stage, key indicators were determined by measuring construction performance using SCOR. Furthermore, the indicators were transformed in BSC, comprising four main perspectives. The balanced scorecard utilized the financial perspective because financial considerations are economic risks carried out by the company. The consumer's perspective was critical, and a product was considered to have value for consumers if they received benefits higher than the sacrifices made to obtain a product or service. The internal business perspective became the basic principle of innovation, operations, and after-sales service. The perspective of development and coaching was conducted by developing measures and goals for learning and company growth. The indicators in SCOR were classified according to each perspective in BSC. Finally, the assessment was carried out using a structured questionnaire.

3. KPI SCOR-BSC

Apart from the determined indicators, attribute performance indicators also existed, encompassing larger is better and lower is better. Carrying out normalization required these indicators, affecting the formula. The determination of attribute indicators can be seen as follows.

A. Financial Perspective

a) Growth in Monthly Sales

To improve a variable, it is necessary to understand the field conditions in advance. The following formula was applied to discover the growth rate of a company, especially sales growth.

$$G = \frac{S1 - S0}{profit\ X1} x100\% \quad (1)$$

(Hoque and James. 2000; Maiga and Jacobs. 2003;Wu, 2014; Rodríguez, 2020)

Description:
G = Growth in monthly sales
S1 = Total sales during the current period
S0 = Total sales for the previous period

b) Decrease in Product Development Cost (DPDC)
A product must undergo development to have good relevance in every market trend constantly rolling. The company's efforts to develop a more efficient product were analyzed through the following formula.

$$DPDC = \frac{DC1 - DC0}{DC0} x100\% \quad (2)$$

(Rodríguez, 2020)

Description:
DC1 = Costs incurred for developing new products in the recent period
DC0 = Costs incurred for developing new products in the previous period

c) Marketplace Operating Cost (MOC)
A company incurs marketplace operating costs when marketplaces are common. The following formula was utilized to examine the significance of the costs incurred by the company in operating the marketplace.

$$MOC = \frac{MC}{TOC} x100\% \quad (3)$$

(Hoque and James, 2000; Maiga and Jacobs, 2003;Solano et al., 2003; Yeniyurt, 2003; Wu, 2014)

Description:
MC = Costs incurred to manage the marketplace
TOC = Overall operating costs

d) Marketplace Storage Cost (MSC)
The storage in question refers to a warehouse for storing goods belonging to the company, useful for storing special products from marketplace orders ready to be distributed. The significance of the costs incurred for storage was determined using the following formula.

$$MSC = \frac{MSC}{TSC} x100\% \quad (4)$$

(Hoque and James, 2000; Gunasekaran et al., 2001; Maiga and Jacobs, 2003;Solano et al., 2003; Neri, 2020; Rodríguez, 2020)

Description:
MSC = Costs incurred to manage the warehouse for orders from the marketplace
TSC = Overall storage management costs

B. Customer Perspective
e) Monthly New Customer (MNC)
One of the aspects determining a company's development is the increase in the number of new customers. It was analyzed using the following formula.

$$MNC = \frac{NC}{TCust} x100\% \quad (5)$$

(Rodríguez, 2020)

Description:
NC = Number of new customers in the last month
TCust = Total number of customers in the last month

f) Customer Satisfaction Index (CSI)
The targeting strategy in measuring customer satisfaction aims to enhance customer satisfaction. The Customer Satisfaction Index (CSI) was obtained by distributing questionnaires to several respondents being consumers of construction SMEs.

g) Number of Variety Products (NVP)
With the existing limitations of a marketplace, the company has its policy in deciding what products to sell. However, the percentage of goods sold through the marketplace should also be determined using the following formula.

$$NVP = \frac{NV}{TVP} x100\% \quad (6)$$

(Aramyan et al., 2007;Wu, 2014; Rodríguez, 2020; Neri, 2020)

Description:
NV = The number of product types in the marketplace (Number of Variety)
TVP = Total number of product types (Total Variety of Products)

h) Capacity to Receive Orders (CRO)
The readiness of the company to fulfill orders can describe its capacity. The following formula was employed to analyze it.

$$CRO = \frac{OF}{TOrder} x100\% \quad (7)$$

(Gong and Yan, 2015; Neri, 2020)

Description:
OF = Order fulfilled
TOrder = Total orders

C. Internal Process
i) New Product Monthly Revenue
This analysis could present the percentage of profits obtained from the sales of newly launched products. It aims to determine the significance derived from the new products. The analysis was performed with the following formula.

$$New\ Product\ Monthly\ Revenue = \frac{NPP}{TP} x100\% \quad (8)$$

(Beamon, 1998; Charkha and Jaju, 2014; Ahi and Searcy, 2015; Neri, 2020)

Description:
NPP = Profits from selling new products (New Product Profit)
TP = Total profit

j) Decrease in Defective Product (DDP)
Knowing how many items are defective during and after delivery is necessary for more effective production. It was examined using the following formula.

$$DDP = \frac{D}{TOI} x100\% \quad (9)$$

(Rodríguez, 2020)

Description:
D = Damaged product (Defect)
TOI = Total ordered items

k) Time to Launch New Product
The longer it takes to develop a new product, the more resources are required. It was analyzed using the following formula.

$$Time\ to\ Launch\ New\ Product\ = \frac{LT}{DT} x100\% \quad (10)$$

(Rodríguez, 2020)

Description:
LT = Time used to introduce the product (Launch Time)
DT = Time required to develop a new product (Develop Time)

l) Certified Supplier
The materials' quality should be examined by establishing a classification system for suppliers who play a role. It was conducted using the following formula.

$$Certified\ Supplier\ = \frac{CS}{TS} x100\% \quad (11)$$

(Kaplan and Norton, 2004; Wu, 2014; Rodríguez, 2020)

Description:
CS = Number of certified suppliers
TS = Total suppliers

D. Learning and Growth
m) Training Hours on Development
The company's commitment is highly challenged in product development. Hence, employee training must align with the company's product development. It was analyzed using the following formula.

$$Training\ Hours\ on\ Development\ = \frac{THD}{WHM} x100\% \quad (12)$$

(Kaplan and Norton, 2004; Wu, 2014; Neri, 2020; Rodríguez, 2020)

Description:
THD = Total time allocated by the company for training (Training Hours on Development)
WHM = Total working hours in a month

n) Training Hours on Work Culture Training
In addition to development training, the company's commitment is also challenged regarding work culture. Thus, employee training must be coordinated with the company's product development, examined using the following formula.

$$Training\ Hours\ on\ Work\ Culture\ Training\ = \frac{THWC}{Working\ hours\ in\ a\ month} x100\% \quad (13)$$

(Kaplan and Norton, 2004; Wu, 2014; Rodríguez, 2020)
Description:
THWC = Total time allocated by the company for training (Training Hours on work culture)
WHM = Total working hours in a month

o) R&D Investment in Marketplace Development
The company's commitment can also be identified in how much financial resources are spent on the marketplace strategy development. It was determined using the following formula.

$$RnD\ Investment\ on\ Marketplace\ Development\ = \frac{RDI}{TMO} x100\% \quad (14)$$

(Kaplan and Norton, 2004; Wu, 2014)

Description:
RDI = Total costs incurred for training (R&D Investment)
TMO = Total monthly operational cost

4. Results

The digital marketplace performance measurement system for construction SMEs began with determining indicators. Each indicator was obtained from various validated research references. The selected indicators were suitable for construction SME businesses. These indicators were applied in determining the performance of digital marketplaces using the SCOR method in the business sector.

Table 1 - Performance metrics of SCOR

Level	Performance Metric	Reference
Reliability	Reducing operating efficiency	Hoque & James, 2000; Maiga & Jacobs, 2003; Solano et al., 2003; Yeniyurt, 2003; Wu & Chen, 2014
	Improving product development knowledge	Rodríguez-Rodríguez et al., 2020
	Enhancing material or asset utilization	Hoque and James, 2000; Maiga and Jacobs, 2003;Solano et al., 2003; Yeniyurt, 2003; Wu & Chen, 2014
	Increasing the marketing mix related to new products	Rodríguez-Rodríguez et al., 2020
	Analyzing and improving the new products' launch	Kaplan & Norton, 2004; Rodríguez-Rodríguez et al., 2020; Wu & Chen, 2014
	Examining and enhancing the management of the new products	Kaplan and Norton, 2004; Rodríguez-Rodríguez et al., 2020; Wu & Chen, 2014
	Detecting the main areas requiring training	Kaplan and Norton, 2004; Rodríguez-Rodríguez et al., 2020; Wu & Chen, 2014
	Improving sharing of worker knowledge	Kaplan and Norton, 2004; Wu & Chen, 2014
Responsiveness	Hiring some local commercial representatives	Rodríguez-Rodríguez et al., 2020
	Selecting sources of customer input information	Rodríguez-Rodríguez et al., 2020
	Accounting for the capability of the marketplace to fulfill an order	Beamon, 1998; Charkha & Jaju, 2014; Ahi & Searcy, 2015; Neri et al., 2021
	Designing and conducting training	Kaplan and Norton, 2004; Rodríguez-Rodríguez et al., 2020; Wu & Chen, 2014
Agility	Transforming the identified customers' needs into concrete projects	Rodríguez-Rodríguez et al., 2020
	Applying the six-sigma method	Rodríguez-Rodríguez et al., 2020
	Carrying out a business process analysis	Hoque and James, 2000; Maiga and Jacobs, 2003; Rodríguez-Rodríguez et al., 2020; Wu & Chen, 2014
Cost	Increasing revenue actions	Hoque and James, 2000; Maiga and Jacobs, 2003; Rodríguez-Rodríguez et al., 2020; Wu & Chen, 2014

Level	Performance Metric	Reference
	Highly relevant inventory costs along the entire marketplace	Hoque and James, 2000; Gunasekaran et al., 2001; Maiga and Jacobs, 2003; Solano et al., 2003; Neri et al., 2021; Rodríguez-Rodríguez et al., 2020
	Reducing operating efficiency	Hoque and James, 2000; Maiga and Jacobs, 2003; Solano et al., 2003; Yeniyurt, 2003; Wu & Chen, 2014
	Enhancing material or asset utilization	Hoque and James, 2000; Maiga and Jacobs, 2003; Solano et al., 2003; Yeniyurt, 2003; Wu & Chen, 2014
Assets	Allocating resources to apply the marketing mix	Rodríguez-Rodríguez et al., 2020
	Improving sharing of worker knowledge	Kaplan and Norton, 2004; Wu & Chen, 2014
	Enhancing awareness of share vision, objectives, and value	Kaplan and Norton, 2004; Wu & Chen, 2014
	Improving capabilities of knowledge management	Kaplan and Norton, 2004; Hadiguna et al., 2011; Wu & Chen, 2014
	Increasing the accessibility of various information	Kaplan and Norton, 2004; Hadiguna et al., 2011; Wu & Chen, 2014

(Data processing, 2023)

Structure-wise, the BSC framework for SCM provided in this study is comparable to that for enterprise management proposed by Bhagwat & Sharma (2007); defining metrics for the supply chain and putting out a model for measuring the effectiveness of SCM are the main focuses here. This article applied BSC for the analysis to provide a more thorough assessment of the SCM performance. Different metrics were employed to accommodate each of the four BSC views. A set of metrics and measures accurately reflecting the strategic objectives should be developed for each perspective. At regular intervals, perspectives should be examined and revised as necessary. The activities in a specific BSC should be monitored and recorded throughout time and formally incorporated into the strategic SCM procedure. The following sections discuss building using BSC to assess SCM key performance indicators.

Table 2 - Scoring metrics of SCOR-BSC

No.	Perspective	Strategic Objective	Action Plan	KPI	Reference
1	Financial	Revenue growth	Increasing revenue actions	Product sales growth percentage	Hoque and James, 2000; Maiga and Jacobs, 2003;Wu, 2014; Rodríguez, 2020
		Product development costs	Improving product development knowledge	Percentage reduction in product development costs	Rodríguez, 2020
		Cost structure	Reducing operating efficiency Enhancing material or asset utilization	Percentage of marketplace operating costs	Hoque and James, 2000; Maiga and Jacobs, 2003; Solano et al., 2003; Yeniyurt, 2003; Wu, 2014

No.	Perspective	Strategic Objective	Action Plan	KPI	Reference
		Inventory costs	Highly relevant inventory costs along the entire marketplace	Percentage of marketplace capacity storage costs	Hoque and James, 2000; Gunasekaran et al., 2001; Maiga and Jacobs, 2003; Solano et al., 2003; Neri, 2020; Rodríguez, 2020
2	Customer	Securing at least three new customers in nasional markets	Hiring some local commercial representatives Selecting sources of customer input information	Number of new customers in national markets per month	Rodríguez, 2020
		Anticipating customers' needs	Transforming the identified customers' needs into concrete projects	Customer satisfaction level	Aramyan et al., 2007; Wu, 2014; Rodríguez, 2020; Neri, 2020
		Product variety	Identifying products listed in the marketplace	Number of variety product	Gong and Yan, 2015; Neri, 2020
		Order fulfillment	Accounting for the capability of the marketplace to fulfill an order	System capacity to receive orders	Beamon, 1998; Charkha and Jaju, 2014; Ahi and Searcy, 2015; Neri, 2020
3	Internal Process	Improving the marketing Mix related to new products	Improving the marketing mix related to new products Defining the marketing mix of new products Allocating resources to apply the marketing mix	Monthly revenues from new products as a percentage of the total monthly revenues	Rodríguez, 2020
		Improving quality of products and services	Conducting a business process analysis Applying the six-sigma method	Decrease in defective products	Rodríguez, 2020
		Enhancing the portfolio management	Analyzing and improving the new products' launch Examining and enhancing the management of the new products	Time required to launch a new product	Kaplan and Norton, 2004; Wu, 2014; Rodríguez, 2020

No.	Perspective	Strategic Objective	Action Plan	KPI	Reference
		Certifications	It indicates if and to what extent the supplier is certified.	Percentage of certified suppliers/ total suppliers	Kaplan and Norton, 2004; Wu, 2014; Neri, 2020; Rodríguez, 2020
4	Learning and growth	Improving training hours on product development	Detecting the main areas requiring training Designing and conducting training	Percentage of training hours on product development	Kaplan and Norton, 2004; Wu, 2014; Rodríguez, 2020
		Organization capital	Improving sharing of worker knowledge Enhancing awareness of share visions, objectives, and values	Percentage of training work culture	Kaplan and Norton, 2004; Wu, 2014
		Information capital	Improving capabilities of knowledge management Increasing the accessibility of various information	Representing the number of investments allocated to R&D concerning the marketplace operations	Kaplan and Norton, 2004; Hadiguna et al., 2011; Wu, 2014

(Data processing, 2023)

In carrying out the performance measurement, key performance indicators (KPIs) were required to determine the success of the company's performance, depicting how far the company has achieved the strategy per its vision and mission.

Sugiono (2011) defined population as a broad category of subjects or objects with certain quantities and characteristics established by researchers, allowing studies to be conducted and conclusions to be drawn. As a result, the population is not only limited to the number of subjects or objects being studied, but also includes all the features and characteristics of the subject or object and is not restricted to people but includes various other natural objects.

As described by Margono (2004), population refers to all data becoming the focus of scope and timing. It deals with data, not humans. If humans contribute data, the population size and type will be equivalent to the number of people. Moreover, a population is also defined as the subject of thorough research (Arikunto, 2002), referring to a group of events, people, or objects formulated in detail. It can also be described as a combination of all individuals with fixed qualities and characteristics. In short, a population is a group of large-scale objects in an area with qualitative or quantitative measurements related to research. The population of this study was construction SMEs in Central Java and D.I. Yogyakarta.

Table 3 - Final score of the SCOR-BSC framework

No.	Perspective	KPI	Weight	Target	Achievement	Achievement Level	Score
1	Financial	Product sales growth percentage	1	70%	61.66%	88.09%	88.09%
		Percentage reduction in product development costs	1	8%	6.07%	75.90%	75.90%
		Percentage of marketplace operating costs	1	1%	0.68%	68.41%	68.41%
		Percentage of marketplace	1	5%	2.88%	57.55%	57.55%

No.	Perspective	KPI	Weight	Target	Achievement	Achievement Level	Score	
		capacity storage cost						
		Average			17.82%	72.49%	72.49%	72.49%
2	Customer	Number of new customers in national markets per month	1	25%	9.21%	36.83%	36.83%	
		Customer satisfaction level	1	85%	55.57%	65.37%	65.37%	
		Number of variety product	1	80%	81.74%	102.18%	102.18%	
		System capacity to receive orders	1	90%	63.82%	70.91%	70.91%	
		Average			52.58%	68.82%	68.82%	68.82%
3	Internal Process	Monthly revenues from new products as a percentage of the total monthly revenues	1	15%	9.71%	64.73%	64.73%	
		Decrease in defective products	1	5%	4.08%	81.59%	81.59%	
		Time required to launch a new product	1	5%	1.67%	33.32%	33.32%	
		Percentage of certified suppliers/ total suppliers	1	100%	79.06%	79.06%	79.06%	
		Average			23.63%	64.67%	64.67%	64.67%
4	Learning and growth	Percentage of training hours on product development	1	30%	21.17%	70.56%	70.56%	
		Percentage of training work culture	1	30%	21.06%	70.19%	70.19%	
		Representing the number of investments allocated to R&D concerning the marketplace operations	1	5%	4.10%	82.06%	82.06%	
		Average			15.44%	74.27%	74.27%	74.27%
		TOTAL					1,046.74%	280.25%
		AVERAGE					69.78%	70.06%

(Data processing, 2023)

Regarding the SCOR-BSC matric results for construction SMEs in DIY and Central Java, the weighting revealed the equally crucial indicators; thus, given a weight of 1. From a financial perspective, four indicators served as benchmarks for company performance. The growth sales achieved 61.66%, with the target to be achieved by the

company at 70%. Hence, the achievement level reached 88.09% of the target and a score of 88.09%. The decrease in product development cost acquired 6.073%, with a company target of 8%. Thus, the reduction in product development costs attained 75.90%, with a score of 75.90%. In the operating marketplace costs, the achievement obtained 0.68%, with a target of 1%, thereby acquiring an achievement level of 68.41% and a score of 68.41%. Of the four indicators, the average achievement in the financial perspective of construction SMEs was 17.82%. Moreover, the achievement level reached 72.49%, with a score of 72.49%.

Data were collected to create new factors for the 15 independent variables. From the factors revealed, the path was analyzed for the dependent variable—the digital market performance of construction SMEs in DIY and Central Java. Factor analysis refers to determining the structure of data metrics and analyzing the correlation between several variables by defining a set of similar variables or dimensions, often called factors. With factor analysis, the dimensions of a structure can be identified and then determined to what extent each dimension can explain each variable. Once the dimension and explanation of each variable are identified, the two main objectives of factor analysis can be carried out: data summarization and data reduction. The main principle of factor analysis is a correlation; hence, the assumptions related to correlation must be employed.

- The magnitude of the correlation between independent variables must be significant, for example, > 0.5 or marked (*) or (**) in the SPSS output.
- A large partial correlation is a correlation between two variables; one must be smaller. In SPSS, partial correlation is given through the anti-image correlation option.
- In certain cases, the assumption of normality of the variables should be met.

Table 4 - KMO and Bartlett's tests

Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO)		0.706
Bartlett's Test of Sphericity	**Approx. Chi-Square**	141.213
	df	36
	Sig.	0.000

(Data processing, 2023)

The KMO and Bartlett's tests examined the correlation between variables. Table 4 portrays the test result of 0.706 > 0.5, with a significance of 0.000 < 0.05. In short, the factor analysis could be continued.

Moreover, the overall correlation matrix was analyzed with sampling measure adequacy (MSA), ranging from 0 to 1, with the following criteria.

• MSA = 1, indicating that other variables can predict the variable without error
• MSA > 0.5, implying that variables can still be predicted and analyzed further
• MSA < 0.5, signifying that the variable cannot be predicted, analyzed further, or excluded from other variables

MSA was measured from the output of the anti-image matrix to the correlation results of nine variables. Table 5 displays the output of the anti-image matrix, demonstrating that all variables had a correlation value of > 0.5. Hence, these variables could be factor analyzed.

Table 5 - Output of the anti-image matrix

		F2	F4	C1	C2	C3	I1	I3	L1	L2
Anti-image Correlation	F2	.642[a]	0.019	0.275	-0.276	0.036	-0.348	0.204	-0.445	-0.019
	F4	0.019	.646[a]	-0.163	0.074	-0.438	0.358	0.136	0.104	0.136
	C1	0.275	-0.163	.676[a]	-0.630	-0.200	-0.534	0.402	0.109	-0.136
	C2	-0.276	0.074	-0.630	.757[a]	-0.310	0.252	-0.377	0.046	-0.034
	C3	0.036	-0.438	-0.200	-0.310	.800[a]	-0.099	-0.211	-0.498	-0.137
	I1	-0.348	0.358	-0.534	0.252	-0.099	.603[a]	-0.150	-0.036	0.218
	I3	0.204	0.136	0.402	-0.377	-0.211	-0.150	.553[a]	0.078	-0.356
	L1	-0.445	0.104	0.109	0.046	-0.498	-0.036	0.078	.747[a]	0.084
	L2	-0.019	0.136	-0.136	-0.034	-0.137	0.218	-0.356	0.084	.773[a]

(Data processing, 2023)

Subsequently, factor analysis was carried out by extracting variables to form one or more new factors. This process was called factoring.

Table 6 - Output of the total variance explained

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	Variance Percentage	Cumulative Percentage	Total	Variance Percentage	Cumulative Percentage	Total	Variance Percentage	Cumulative Percentage
1	4.882	32.544	32.544	4.882	32.544	32.544	3.015	20.101	20.101
2	2.098	13.988	46.533	2.098	13.988	46.533	2.814	18.761	38.862
3	1.937	12.912	59.444	1.937	12.912	59.444	2.617	17.446	56.308
4	1.189	7.930	67.374	1.189	7.930	67.374	1.387	9.244	65.552
5	1.087	7.246	74.620	1.087	7.246	74.620	1.360	9.067	74.620
6	1.000	6.664	81.283						
7	.734	4.895	86.179						
8	.610	4.067	90.246						
9	.503	3.350	93.596						
10	.318	2.120	95.716						
11	.240	1.601	97.317						
12	.185	1.235	98.553						
13	.101	.671	99.224						
14	.077	.515	99.738						
15	.039	.262	100.000						

Extraction Method: Principal Component Analysis.

(Data processing, 2023)

The extraction results of the nine variables became three new dimensions (where the eigenvalue >1 is a factor). The first dimension could explain 45.528% of the variation, the second could explain 18.090%, and the third could explain 12.303%. Accordingly, these three factors could explain 75.921% of the variation.

Table 7 - Output of rotated component matrix

	Component		
	1	2	3
F2	0.842	0.016	-0.058
F4	-0.113	0.912	-0.065
C1	0.439	0.693	0.288
C2	0.431	0.632	0.510
C3	0.479	0.708	0.397
I1	0.792	0.070	0.064
I3	0.034	0.024	0.875
L1	0.752	0.300	0.065
L2	-0.029	0.190	0.825

(Data processing, 2023)

- Dimension 1 (X.A) consisted of a collection of variables, such as the percentage reduction in product development costs (F2), monthly revenues from new products as a percentage of the total monthly revenues (I1), and the percentage of training hours on product development (L1). Henceforth, it was named time product development as an improvement for SMEs.

- Dimension 2 (X.B) comprised a collection of variables covering the percentage of marketplace capacity storage costs (F4), number of new customers in national markets per month (C1), customer satisfaction level (C2), and number of product varieties (C3). Therefore, it was named the level of customer satisfaction and loyalty.
- Dimension 3 (X.C) encompassed a collection of the variables of time required to launch a new product (I3) and the percentage of training work culture (L2). Hence, it was named work culture as employee motivation.

A regression analysis aims to quantify the degree of linearity (closeness) between the two factors. In regression analysis, the direction of the correlation between the dependent and independent variables is also displayed, in addition to the strength of the relationship between two or more variables, as in correlation analysis. The probability distribution of the dependent variable is considered to be random or stochastic, whereas the value of the independent or free variable is treated as a constant.

The regression analysis in this study aims to collect data to create a statistical model. This model contained the variable dimensions gleaned from the factor analysis, representing the assessment factors influencing the performance of marketplace-based construction SMEs. A regression analysis was conducted considering the dimensions and factor clustering.

The method can be implemented in various ways by forming latent variables, which can be conducted following the total sum; average, taking the variable with the strongest correlation, and utilizing extraction using a fixed number of factors in factor analysis. Hence, an expected factor value represents all the variables making up the variable dimensions.

The summary table exhibits model confidence and the potential number of models to be adjusted. The confidence, as measured by the adjusted R^2 value, can be considered the model's quality assurance. An adjusted R^2 of 81.2% implies that the functions of the XA, XB, and XC dimensions accounted for 81.2% of the variance in the performance assessment of construction SMEs, while the remaining 18.8% were attributed to factors other than those modeled.

Table 8 - Coefficient values

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.992	1.010		2.961	0.006
	XA	-0.555	0.242	-0.405	-2.293	0.030
	XB	0.856	0.232	0.709	3.686	0.001
	XC	0.016	0.119	-0.023	-0.134	0.895

(Data processing, 2023)

The coefficient values in Table 8 generated the following regression equation.

$$Y=2.992-0.555\ XA+0.856\ XB+\ 0.016\ XC \quad (15)$$

(Data processing, 2023)

Description:
Y : Marketplace-based construction SME performance assessment
XA : Time product development as an improvement for SMEs
XB : Level of customer satisfaction and loyalty
XC : Work culture as employee motivation

5. Critical Discussion

A study by Shi et al., (2021) looked into the issue by modeling and assessing quantitatively four possible channel architectures selected by the manufacturer, retailer, and producer to boost sales. It unveiled that establishing a marketplace platform only benefited supply chain members when competition among the various channels was low.

Research from Jia & Li (2020) on the charge and the order fulfillment cost affected chain decisions depending on the channel mode. The research also discovered that selling new products through e-retailers and remanufactured products in online markets was preferred concerning environmental considerations and that the preferred channel mode changed with two criteria from the producer or e-retailer perspective.

Therefore, it is evident that the overall metrics must be considered when setting measurement targets for effective supply chain management. These should be categorized at strategic, tactical, and operational levels and be financial and non-financial to represent a well-rounded method. With this context in mind, Gunasekaran et al., (2001) provided a framework to depict supply chain management as performance measurements and metrics, presenting a holistic picture of what has to be measured and how it should be handled.

This paradigm divides the metrics into three distinct categories: strategic, tactical, and operational. It is crucial to categorize the measurements as financial or non-financial to apply an appropriate costing strategy based on activity analysis. Such classifications have become useful for clarifying which metrics should be applied in certain situations and how well they could collectively represent the issues in various relationships. These measurements were drawn from both established works on supply chain management and the latest works exploring similar but distinct areas of the field. The high-performance metrics aim at those broad-scope supply chain functional domains.

As such, the subsequent part proposed using a balanced scorecard to assess the measurements and indicators of supply chain management. These metrics were considered general since they were necessary to evaluate each company's purpose, success, and strategic goals (Bhagwat & Sharma, 2007). To put the BSC to use, companies should establish objectives related to delivery time, product quality, productivity, and customer satisfaction and then transform those objectives into measurable KPIs. Companies should not rely on financial metrics alone but utilize a mix of financial and operational ones to guide their operations.

Before generating a balanced supply chain management scorecard, it is essential to have a clear knowledge of the supply chain management-related tasks in the business and well-defined specific objectives. Three conditions must be met by the metrics contained in the balanced supply chain management scorecard. They must be quantitative, easy to grasp, and ones for which data can be acquired and analyzed efficiently and affordably. It is understood that not all characteristics can be measured quantitatively. Connecting to other traits that could be quantified is crucial in such a scenario. Three principles have been emphasized as crucial to successful development (Kaplan and Norton, 1996), more than just a hodgepodge of disjointed BSCs, often at odds with one another. Therefore, it is vital to establish clear causation, incorporating relevant performance factors and related outcomes to monetary indicators to ensure financial success.

6. Conclusion

Attribute frameworks based on SCOR and BSC were beneficial in evaluating the effectiveness of SMEs in the Indonesian construction industry. Although supply chains have become more common in manufacturing, they could easily be implemented in the construction industry. The construction supply chain required some tweaking before being applied in the construction industry. Human resources and financial constraints were two major challenges in implementing the construction supply chain. The shortage of available human resources was caused by the insufficient preparation of prospective construction employees concerning education and training and the absence of relevant certifications.

SCOR and BSC were advantageous in creating a more environmentally friendly construction of the supply chain management system. These two methods have addressed supply chain problems in the construction industry. Considering that SCOR only looked at performance from two perspectives—those of internal business operations and customers—the BSC has been meant to make up the difference. Unlike the SCOR model, only employing a single metric for performance evaluation, BSC has made it possible to scale measurements when resizing, provided models relevant to all processes, employed various metrics, and simplified performance measurement. In addition to SCOR, BSC could be deployed to measure performance. SCOR focused on the perspective of internal business. Nevertheless, BSC considered the money, the client, and future growth.

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