JARES, Vol. 8. No.1, Maret 2023; p-ISSN: 2502-826X; e-ISSN: 2503-1163
Copyrights@ Balitar Islamic University, Blitar, Indonesia;
https://ejournal.unisbablitar.ac.id/index.php/jares

JARES (Journal of Academic Research and Sciences), (8)1, page 13-24

SUPPLY CHAIN PERFORMANCE MEASUREMENT OF DOWNSTREAM WOODWORKING INDUSTRY

Natalia Hartanto [1], Muhammad Asrol[2], Muhammad Noor Badruddin[3]

[1-3]Industrial Engineering Department, BINUS Graduate Program – Master of Industrial Engineering, Bina Nusantara University, Jakarta, 11480, Indonesia
e-mail: muhammad.asrol@binus.edu

ABSTRACT

People's needs of wood toward increase. Along with the development of technology, the woodworking industry exists to balance the fulfilment of human needs of wood and to increase the value added of timber forest resources. The objective of this study is to identify the supply chain configuration and to measure the supply chain performance of the downstream woodworking industry. Metrics validation using the supply chain operation reference (SCOR) framework that is adjust to industry activities through discussions with stakeholders. Performance metrics are weighted using the Analytical Hierarchy Process (AHP). The result of the supply chain performance measurement of the downstream woodworking industry obtains a value 76.21 in the good category indicating that XYZ has achieved the target of 59%. 41% need to improve performance, namely 32% in the Average category, 5% in the Marginal category, and 4% in the Poor category.

Keywords: *Business strategy, Downstream wood industry, Merbau, Performance, Supply chain*

1. INTRODUCTION

People's needs of wood toward increase. People still use a lot of products derived from timber forest products because they have high aesthetic value and are environmentally friendly so they can be renewed (Mutaqin et al., 2022). The most important forest product and most often used for both community needs, and export needs are timber forest products (BES et al., 2021). From the international trade aspect, merbau is a forest commodity that has a wide market and high economic value (Tokede et al., 2013). Along with the development of technology, the woodworking industry exists to balance the fulfillment of human needs of wood and increase the value added of timber forest resources. Law No.5/1967 made the woodworking industry a support for the national economy.

XYZ is one of the downstream woodworking industries that process sawn timber into finished products in the form of wood flooring, decking, door jambs, and door panels. The downstream woodworking industry is an industry whose raw materials come from upstream industries. The upstream industry processes logs into various forms of wood sorties (Permenperin No. 119/M-IND/PER/10/2009). The main purpose of the supply chain is to balance supply and demand (Maizi et al., 2020). The supply of wood raw materials for the downstream woodworking industry is sustainable considering the large distribution of the upstream woodworking industry. Total primary woodworking industries in Indonesia currently is 1,575 units consist of 394 units in East Java, 244 units in Central Java, 105 units in Central Kalimantan, 104 units in South Kalimantan, 111 units in East Kalimantan, 39 units in Papua, 29 units in West Papua, and 549 units in other provinces (Mutaqin et al., 2022).

The success of an industry is not only measured by the profits generated, but also by how efficient, effective, duration and quality the production process is (Kulkarni et al., 2014). The quality of wood raw materials, saw quality, machine precision, machine operator expertise, and quality control are factors that affect the reliability of wood products. If one of the factors is not met, the quality of the product is not up to standard, or a defective product occurs. Human factors, machines, methods, environment, and raw materials affect product quality (Andiwibowo et al., 2018). Supply chain of an organization will not be successful, if they have not been able to increase the supply chain performance measures (Singh et al., 2019).

In general, the production of timber forest products continued to increase from 2014-2019. Timber forest product production is dominated by wood chips with production in 2019 reaching 31.28 million cubic meters. The very high production of wood chips is thought to be due to the high demand for products with wood chip raw materials such as pulp and furniture. Total export volume in 2014 to 2019 tends to decline. The volume of export of timber forest products in 2017 increased by 5.57 percent and reached 28.85 million cubic meters, then decreased until 2019 (Mutaqin et al., 2022).

XYZ still often have the problems related to delays in receiving raw materials and delays in delivery of finished products to consumers. According to the results of interviews with stakeholders, delays in raw materials generally occur in rainy season which vehicles not being able to pass the road to/from the location of raw materials. Another factor is the changing schedule of the vessel and machine damage of the supplier's industry. The reduction in order cycle time leads to reduction in supply chain response time, and as such is an important performance measure and source of competitive advantage it directly interacts with customer service in determining competitiveness (Gunasekaran et al., 2004).

The measurement of supply chain performance has been carried out using SCOR model and fuzzy-AHP (Asrol et al., 2017), the simulation techniques are more suitable than other performance techniques and approaches for the supply chain performance measurement in a volatile environment (Reddy et al., 2019). According to Delipinar & Kocaoglu (2016) process modelling and performance measurement are the crucial subjects in SCOR model that need to be integrated with information technology. Bukhori et al. (2015) argues that the SCOR method is very appropriate and superior to improve supply chain management satisfaction services. Ntabe et al. (2015) argue that the SCOR model is suitable for the evaluation of supply chain environmental performance.

Performance requires measurement to study and identify the management strategy; to predict future internal and external situations; to monitor state and behaviors relative to its aims; and to make decisions in the needed periods (Taouab & Issor, 2019). Performance measurement is essential enabling and control of strategies and regulating the coordination in order to fulfill consumer demands on the supply chain (Asrol et al., 2021). The objective of this study is to identify the supply chain configuration of the downstream woodworking industry and to measure the supply chain performance of the downstream woodworking industry.

2. METHODOLOGY

The research stages start from field observations until obtain a performance improvement strategy which is illustrated in Figure 1.

Problem identification is done by describing in detail the supply chain flow, making models, and doing brainstorming by identifying problems in the downstream woodworking industry to identify influencing factors. In ascertaining the problem, it is necessary to conduct field study and literature study.

Data collection was carried out by direct observation and through interviews with stakeholders regarding the industrial supply chain, data from the industry and distributing questionnaires to experts for metric validation and metric weighting. The supply chain performance measurement is carried out using the SCOR model approach.

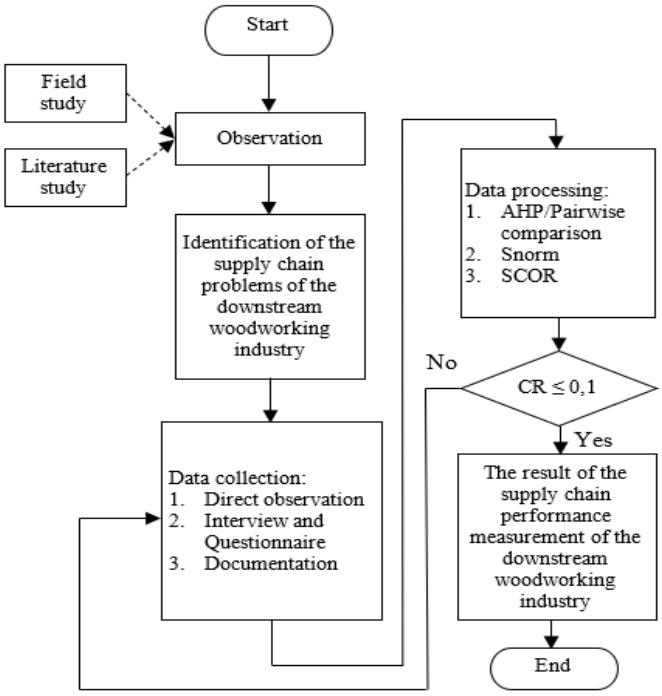

Figure 1. Research stages

Level 1 Business process	Level 2 Performance attributes	Level 3 Performance metrics
Plan	Responsiveness	Finished product delivery planning cycle time
	Agility	Procurement volume
Source	Reliability	Raw material delivery performance on time
		Delivery raw materials accuracy
		Raw materials quality
		Raw materials delivery documentation accuracy
Make	Responsiveness	Production cycle time
	Agility	Production volume
		Productivity with available working hours
		Availability of skilled worker
		Total additional worker

	Cost	Production cost
Deliver	Reliability	Finished product delivery performance on time
		Delivery finished products accuracy
		Finished products delivery documentation accuracy
	Responsiveness	Finished product delivery cycle time
	Agility	Finished product delivery volume
	Cost	Delivery cost
Return	Asset	Days payable outstanding
		Days sales outstanding
Enable	Agility	Waste handling
	Asset	Turnover remaining stock

Table 1. Metrics level 1, level 2, level 3

The measurement of the supply chain performance of the downstream woodworking industry in this study uses the SCOR 12.0 model approach to map and evaluate the activities that occur in the supply chain system and to determine supply chain performance that needs to be improved based on the scoring system, and provide recommendations for improvement on performance indicators that are low and require immediate improvement. Processes related to level 1, level 2, and level 3 metrics are shown in Table 1.

3. RESULT AND DISCUSSION

A. Supply chain configuration of the downstream woodworking industry

Supply chain in the downstream woodworking industry from upstream to downstream starting from the forest (through the holder of the Business Permit for Utilization of Timber Forest Products in Natural Forests (IUPHHK-HA) and Perhutani), followed by upstream industry/Primary or Timber Forest Products Primary Industry Business Permits (IUIPHHK), are forwarded to downstream woodworking industry, distributors/consumers, and final consumers. The downstream woodworking industry supply chain can be seen in Figure 2.

The following are described the main actors and activities in the downstream woodworking industry supply chain.

IUPHHK-HA

Timber Forest Product Utilization Business Permit in Natural Forest, hereinafter abbreviated as IUPHHK-HA, is a permit to utilize production forest whose activities consist of harvesting or logging, enrichment, maintenance and marketing of timber forest products (Permen LHK No. P.9/Menlhk-II/2015).

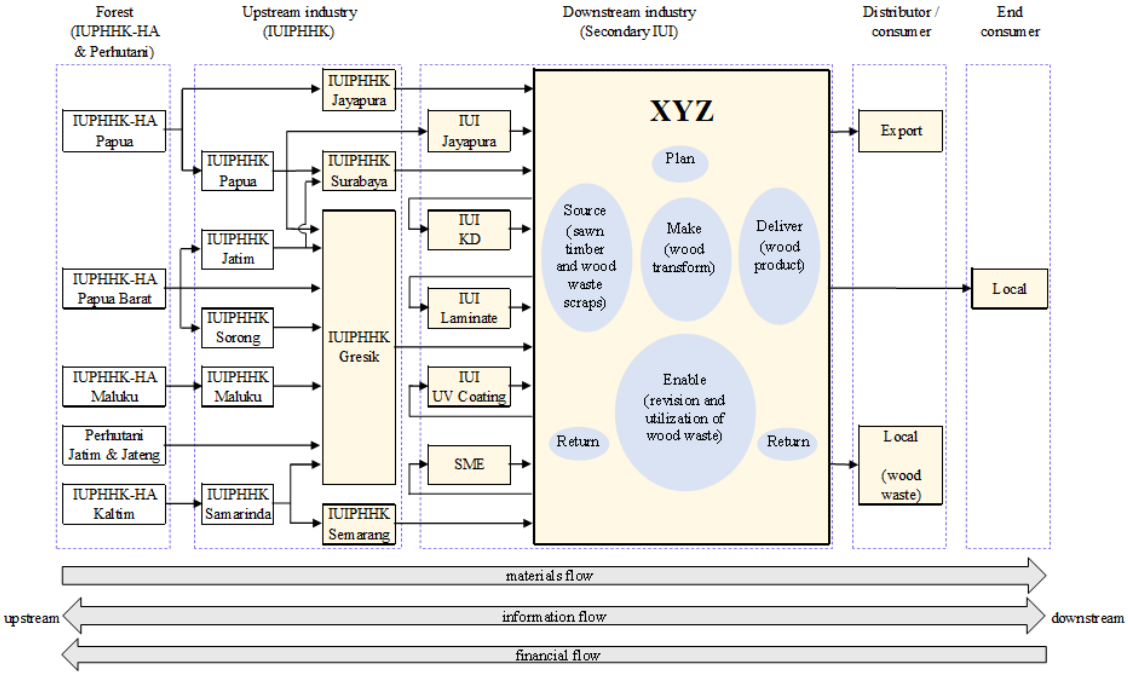

Figure 2. The downstream woodworking industry supply chain

Perhutani

Perhutani is a state-owned enterprise which assigned by the government to manage production forests and protected forests in Java Island. The forest management budget obtained by the results of the utilization of forest areas in the form of the sale of timber and non-timber (Syafii et al., 2015).

IUPHHK-HA and Perhutani are the first producer of timber forest products in the form of logs.

Upstream industry

The upstream woodworking industry is the primary woodworking industry (Permenperin No. 119/M-IND/PER/10/2009). Timber Forest Products Primary Industry Business Permit, hereinafter abbreviated as IUIPHHK, is a permit to process logs and/or wood chip raw materials into one or several types of products at one particular location which is granted to a permit holder by an authorized official (Permen LHK No. P.13/Menlhk-II/2015).

East Java Province as a place to integrate wood raw materials from various provinces including Papua, West Papua (merbau and kuku), Maluku (lingua), and Samarinda (bangkirai and ironwood). XYZ receives raw materials of sawn timber ironwood, linggua, and kuku from IUIPHHK Gresik. Bangkirai wood from IUIPHHK Gresik and Semarang. Teak logs from Perhutani. Merbau sawn timber from IUIPHHK Jayapura, Gresik, and Surabaya. Merbau processed wood from IUI Jayapura.

The journey of merbau wood raw material from Jayapura until arrived at XYZ takes

about 14 days without any problems. XYZ's production system is Make to Order (MTO), but to anticipate delays in raw materials, XYZ also uses the Make to Stock (MTS) system. MTS is used to stock finger joint raw materials because it requires a long production time. Raw materials come in, finished products are ready to be shipped, wood waste that can be used for derivative products, and finger joint semi-finished products are stored in warehouses. The main discrepancy between MTS and MTO is the timing of the receipt of the customer order relative to the final assembly of the finished product. In an MTS environment, the product is assembled in anticipation of future orders and stored in the finished goods inventory, whereas in an MTO system the customer order is received before assembly of the final product (Jalali et al., 2020).

According to the rules, XYZ cannot receive and process logs, for that reason XYZ collaborates with IUIPHHK in Gresik to process teak logs into sawn timber. Merbau logs can be found in East Java. This facilitates the acquisition of sawn timber in East Java at a higher price than the acquisition of sawn timber from Jayapura.

The production process at XYZ uses machines, namely double planner, multi ripsaw, moulding, single ripsaw, and crosscut. Sawn timber, after being processed into raw material for decking and/or flooring and door panels, is then put into a kiln dry for 14 days to reduce the moisture content in the wood. According to Usman (2010) wood drying is a process of removing water from the wood, either in the form of free water or bound water with the aim of stabilizing the dimensions of the wood, so that it can be used more efficiently and effectively. Wood used for interior (indoor) components is recommended to have a moisture content not exceeding 12%. The wood drying process, door panel laminating, and UV coating are processed at IUI partners. After returning from IUI partner, production continued at XYZ into products in the form of decking or flooring with smooth four sides without the addition of other materials, and door panels. Door engraving is not only done manually but also using a Computer Numerical Control (CNC) router.

Before the product is delivery, a revision process is carried out on products that have defects, this is aimed at maximizing the use of wood forest product resources for the sustainability of the woodworking industry, increasing production yields, and increasing company profits.

Production activities at XYZ cannot avoid the formation of waste in the form of sawdust, wood chips, wood ends, and wood scraps. What is meant by waste is the remains or parts of wood which are considered uneconomical in a certain process, time and place, but may still be used in a different process, place and time (Purwanto, 2009). XYZ has the responsibility to preserve the environment in accordance with the environmental permit that has been approved. To preserve the environment, waste in the form of sawdust, wood chips, and wood ends that cannot be reused by XYZ are sold locally. Waste sawdust, wood chips, and wood ends can be used to make pellets and charcoal briquettes. Wood scraps can be used by XYZ for derivative products such as FJ decking. That are processed into finger joint decking raw materials. That are also used by SMEs to make wall decorations, decorative lights, and garden tiles. The results of processed wood waste can be in the form of furniture consisting of: dining tables, cupboards, and sofas/chairs, as well as art work in the form of: wall decorations, decorative lights, and other knick-knacks (Sutarman, 2016). The field of

wood waste has many potential directions towards future development, and if the immense treasure represented by the forests, and implicitly the wood, is used efficiently, it can be a good solution to the problem of sustainable development of society (Maier, 2021).

B. Supply chain performance measurement of downstream woodworking industry

Determination of performance metrics adopted from SCOR through interviews with XYZ stakeholders as well as adjustments to the availability of existing data, set supply chain performance attributes to measure supply chain performance of the downstream woodworking industry. The definition and performance metrics unit for the downstream woodworking industry can be seen in Table 2.

According to Asrol et al. (2017) each industry has a level of importance of performance metrics depending on the business processes being carried out. In this case, the determination of the importance of each performance metric is determined through the Analytical Hierarchy Process (AHP) weighting technique. The hierarchy for calculating weights of attribute and performance metrics can be seen in Figure 3.

The result of the supply chain performance measurement of the downstream woodworking industry, in this study carried out in XYZ from January 2021 to May 2022 can be seen in Table 3.

No.	Code	Performance metrics	Definition	Unit
1	RL1	Raw material delivery performance on time	On time delivery of raw materials from suppliers against the time that has been committed upon.	%
2	RL2	Delivery raw materials accuracy	Orders delivered from suppliers according to the order quantity against the volume and/or size within the committed tolerance.	%
3	RL3	Raw materials quality	Presentation of raw materials that meet the quality of incoming raw materials.	%
4	RL4	Raw materials delivery documentation accuracy	Completeness of raw materials shipping documentations are complete, correct, and readily available when and how expected by customer, government, and others supply chain regulatory entities.	%
5	RL5	Finished product delivery performance on time	On time delivery of finished products to customers against the time that has been committed upon.	%
6	RL6	Delivery finished products accuracy	Finished products delivered to customers according to the order quantity against the volume and/or size within the committed tolerance.	%
7	RL7	Finished products delivery documentation accuracy	Completeness of finished products shipping documentations are complete, correct, and readily available when and how expected by customer, government, and others supply chain regulatory entities.	%
8	RS1	Finished product delivery planning cycle time	The planned time from confirmation of receiving the order to the planned delivery of the finished product to the customer.	day
9	RS2	Production cycle time	Days during the production process of raw materials to finished products.	day
10	RS3	Finished product	Days from the customer's order until the finished	day

		delivery cycle time	product is delivered to the customer.	
11	AG1	Procurement volume	Average procurement volume of raw materials per order.	m^3
12	AG2	Production volume	Average production volume per order.	m^3
13	AG3	Productivity with available working hours	Production volume per order against effective working days.	m^3/day
14	AG4	Availability of skilled worker	Number of skilled workers available to operate machines, graders and quality control per order.	man
15	AG5	Total additional worker	Number of additional workers required to assist the production process per order.	man
16	AG6	Finished product delivery volume	Average volume of finished product shipments per order.	m^3
17	AG7	Waste handling	Percentage of the volume of wood waste used to the total wood waste produced.	%
18	CO1	Production cost	The cost of converting raw materials into finished products, including the cost of replacing spare parts, does not include the cost of raw materials per order.	IDR
19	CO2	Delivery cost	Costs associated with the cost of shipping the finished product.	IDR
20	AS1	Days payable outstanding	The time it takes from the receipt of raw materials until payment is made.	day
21	AS2	Days sales outstanding	The time it takes from the delivery of finished products until payment is received.	day
22	AS3	Turnover remaining stock	The time required to start processing the remaining production that can be reused for the derivative production process from the time the remaining production is generated.	day

Table 2. Definition and metrics unit for downstream woodworking industry

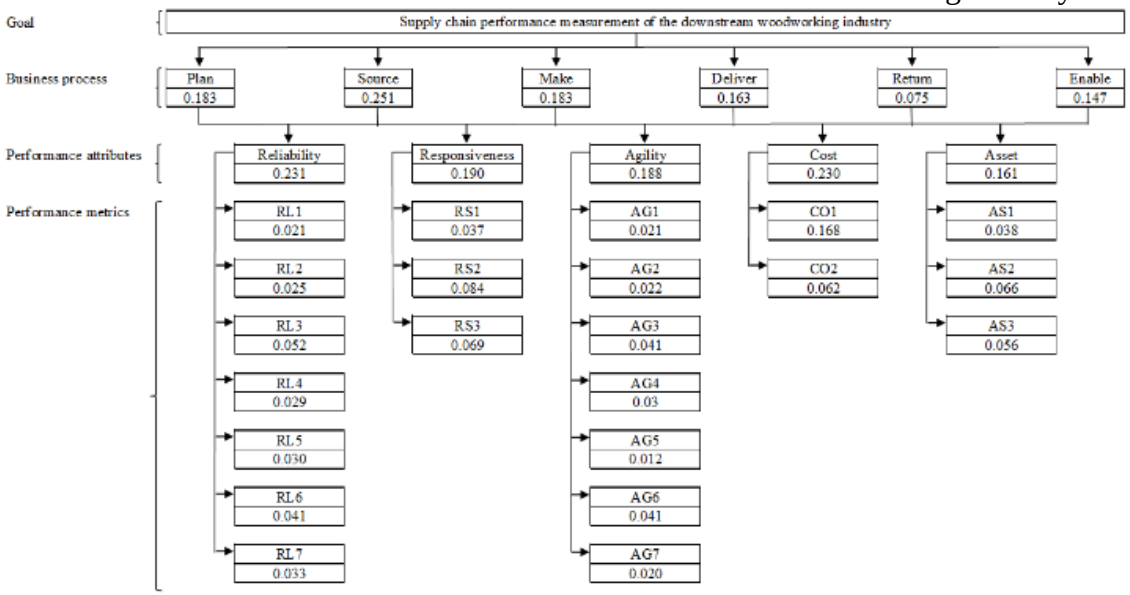

Figure 3. Hierarchy and metrics weighting of the downstream woodworking industry supply chain

Code	Target achievement indicators	Weight	Score	Performance
RL1	-	0.021	42.42	0.88
RL2	-	0.025	98.71	2.43
RL3	+	0.052	99.09	5.20
RL4	+	0.029	100.00	2.91
RL5	-	0.030	58.16	1.72
RL6	-	0.041	100.00	4.10
RL7	+	0.033	100.00	3.33
RS1	-	0.037	64.16	2.37
RS2	-	0.084	78.12	6.57
RS3	-	0.069	62.95	4.37
AG1	+	0.021	100.00	2.12
AG2	+	0.022	99.46	2.20
AG3	+	0.041	61.02	2.51
AG4	+	0.029	89.10	2.61
AG5	+	0.011	56.60	0.64
AG6	+	0.043	100.00	4.27
AG7	+	0.020	65.61	1.31
CO1	-	0.168	68.01	11.42
CO2	-	0.062	92.95	5.80
AS1	-	0.038	79.84	3.05
AS2	-	0.066	33.26	2.21
AS3	-	0.056	74.73	4.21
		Total performance		76.21
			Category	Good

Table 3. Result of supply chain performance

The result of the supply chain performance measurement of the downstream woodworking industry obtains a value 76.21 in the good category. XYZ has achieved the target of 59% (13 performance metrics), namely in the Excellent category by 41% and in the good category by 18%. Meanwhile, 41% (9 performance metrics) need to improve performance, namely in the Average category of 32%, the Marginal category of 5%, and the Poor category of 4%. Performance achievement can be seen in Figure 4.

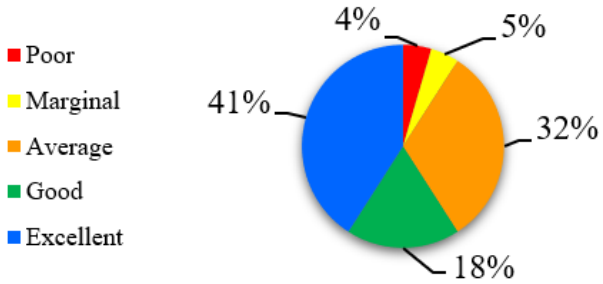

Figure 4. Performance achievement per indicator

Performance metrics that are included in the low category in XYZ are total additional worker, finished product delivery performance on time, productivity with available working hours, finished product delivery cycle time, finished product delivery planning cycle time, waste handling, and production cost where on averaged from January 2021 to May 2022 was 56.60%, 58.16%, 61.02%, 62.95%, 64.16%, 65.61%, and 68.01% respectively. Performance metrics that are categorized as low for suppliers and consumers are raw material delivery performance on time and days sales outstanding, they are 42.42% and 33.26% respectively. Performance metrics that have not been achieved are shown in Table 4.

Performance metrics	Score	Improvement strategy
Days sales outstanding	33.26	Selling finished product through third party
Raw material delivery performance on time	42.42	Selecting suppliers
Total additional worker	56.60	Simulation system design for production system
Finished product delivery performance on time	58.16	Review operating system
Productivity with available working hours	61.02	Simulation system design for production system
Finished product delivery cycle time	62.95	Review operating system
Finished product delivery planning cycle time	64.16	Review operating system
Waste handling	65.61	Increase the utilization of wood waste through collaboration with independent carpenter
Production cost	68.01	Improving productivity

Table 4. Performance metrics need to improve

Industry is considered sustainable if it can balance the economic, social and environmental aspects. Industry must be able to efficiently use raw materials, manage industrial waste, and have a positive impact on the surrounding environment. XYZ has created job opportunities for the surrounding community, and fostered economic activity in other sectors. The reliability of XYZ not only adds value to sawn wood raw materials but also to wood waste. Through the efficient use of wood raw materials and the utilization of waste wood scraps, XYZ has played a role in preserving the environment and natural forest resources.

4. CONCLUSION

Supply chain configuration of the downstream woodworking industry consist of the forest (IUPHHK-HA and Perhutani), upstream industry (IUIPHHK), downstream woodworking industry, distributors/consumers, and end consumers. The result of the supply chain performance measurement of the downstream woodworking industry obtains a value 76.21 indicating that XYZ supply chain performance in the good category.

From the result of analysis there are 9 performance metrics need to improve from 22 validated performance metrics. Sustainability balance of economic, social and environmental aspects. The presence of XYZ has created job opportunities for the surrounding community. Its activities have value added to timber forest products, have the ability to manage waste

wood scraps into economic value products. So that the downstream woodworking industry is considered sustainable.

For further research, seeing the importance of the role of suppliers, it is better to analyze the supplier selection and design a simulation system for the production system.

REFERENCES

Andiwibowo, R. R., Susetyo, J., & Wisnubroto, P. (2018). Pengendalian Kualitas Produk Kayu Lapis Menggunakan Metode Six Sigma & Kaizen Serta Statistical Quality Control Sebagai Usaha Mengurangi Produk Cacat. *Jurnal Rekavasi*, *6*(2), 100-110.

Asrol, M., Marimin, M., & Machfud, M. (2017). Supply chain performance measurement and improvement for sugarcane agro-industry. *International Journal of Supply Chain Management*, *6*(3), 8-21.

Asrol, M., Yani, M., & Taira, E. (2021). Risk management for improving supply chain performance of sugarcane agroindustry. *Industrial Engineering & Management Systems*, *20*(1), 9-26. https://doi.org/10.7232/iems.2021.20.1.9.

BES, A. P. M. S., Helmi, M., & Rianawati, F. (2021). Produktivitas Pemanenan Kayu Dengan Teknik Ril di PT. Wijaya Sentosa, Papua Barat. *Jurnal Sylva Scienteae*, *4*(1), 36-43.

Bukhori, I. B., Widodo, K. H., & Ismoyowati, D. (2015). Evaluation of poultry supply chain performance in XYZ slaughtering house Yogyakarta using SCOR and AHP method. *Agriculture and Agricultural Science Procedia*, *3*, 221-225.

Delipinar, G. E., & Kocaoglu, B. (2016). Using SCOR model to gain competitive advantage: A Literature review. *Procedia-Social and Behavioral Sciences*, *229*, 398-406.

Gunasekaran, A., Patel, C., & McGaughey, R. E. (2004). A framework for supply chain performance measurement. *International journal of production economics*, *87*(3), 333-347.

Jalali, M. S., Ghomi, S. F., & Rabbani, M. (2020). A System Dynamics Approach Towards Analysis of Hybrid Make-to-Stock/Make-to-Order Production Systems. *Industrial Engineering & Management Systems*, *19*(1), 143-163.

Kulkarni, P. P., Kshire, S. S., & Chandratre, K. V. (2014) Productivity Improvement Through Lean Deployment & Work Study Methods. *International Journal of Research in Engineering and Technology*, *03*, 429-434.

Maier, D. (2021). Building materials made of wood waste a solution to achieve the sustainable development goals. *Materials*, *14*(24), 7638. https://doi.org/10.3390/ma14247638.

Maizi, H., Sastra, H. Y., & Arhami (2020). Mapping Upstream and Downstream Process in The Patchouli Oil Industry Using Supply Chain Operations Reference Model Version 12.0 (SCOR 12.0). *IOP Conference Series: Materials Science and Engineering*, *931*(1), 012008. IOP Publishing. https://doi.org/10.1088/1757-899X/931/1/012008.

Mutaqin, D. J., Nurhayani, F. O., & Rahayu, N. H. (2022). Performa Industri Hutan Kayu dan Strategi Pemulihan Pascapandemi Covid-19. *Bappenas Working Papers*, *5*(1), 48-62.

Ntabe, E. N., LeBel, L., Munson, A. D., & Santa-Eulalia, L. A. (2015). A systematic literature review of the supply chain operations reference (SCOR) model application with special attention to environmental issues. *International Journal of Production Economics, 169*, 310-332.

Peraturan Menteri Lingkungan Hidup dan Kehutanan Republik Indonesia Nomor P.9/Menlhk-II/2015 tentang Tata Cara Pemberian, Perluasan Areal Kerja dan Perpanjangan Izin Usaha Pemanfaatan Hasil Hutan Kayu dalam Hutan Alam, Izin Usaha Pemanfaatan Hasil Hutan Kayu Restorasi Ekosistem Atau Izin Usaha Pemanfaatan Hasil Hutan Kayu Hutan Tanaman Industri pada Hutan Produksi.

Peraturan Menteri Lingkungan Hidup dan Kehutanan Republik Indonesia Nomor P.13/Menlhk-II/2015 tentang Izin Usaha Industri Primer Hasil Hutan.

Peraturan Menteri Perindustrian Republik Indonesia Nomor 119/M-IND/PER/10/2009 tentang Peta Panduan (Road Map) Pengembangan Klaster Industri Furniture.

Purwanto, D. (2009). Analisa jenis limbah kayu pada industri pengolahan kayu di Kalimantan Selatan. *Jurnal Riset Industri Hasil Hutan, 1*(1), 14-20.

Reddy, K. J. M., Rao, A. N., & Krishnanand, L. (2019). A review on supply chain performance measurement systems. *Procedia Manufacturing, 30*, 40-47.

Singh, C. S., Soni, G., & Badhotiya, G. K. (2019). Performance indicators for supply chain resilience: review and conceptual framework. *Journal of Industrial Engineering International, 15*(1), 105-117.

Syafii, L. I., Thoyib, A., & Nimran, U. (2015). The role of corporate culture and employee motivation as a mediating variable of leadership style related with the employee performance (studies in Perum Perhutani). *Procedia-Social and Behavioral Sciences, 211*, 1142-1147.

Sutarman, I. W. (2016). Pemanfaatan limbah industri pengolahan kayu di kota Denpasar (studi kasus pada CV Aditya). *Penelitian dan Aplikasi Sistem dan Teknik Industri*, *10*(1), 15-22.

Taouab, O., & Issor, Z. (2019). Firm performance: Definition and measurement models. *European Scientific Journal, 15*(1), 93-106.

Tokede, M.J., Mambay, B.V., Pangkali, L.B., & Mardiyadi, Z. (2013). Antara Opini dan Fakta, Kayu Merbau. Jenis Niagawi Hutan Tropika Papua Primadona yang Dikhawatirkan Punah. *WWF Indonesia dan Universitas Negeri Papua*.

Undang-undang Republik Indonesia Nomor 5 tahun 1967 tentang Ketentuan-ketentuan Pokok Kehutanan.

Usman, F. H. (2010). Kadar Air dan Stabilitas Dimensi Berdasarkan Suhu Pengeringan dan Jenis Kayu (Moisture Content and Dimension Stability Based on the Temperature of Dry Kiln and Wood Types). *Jurnal Tengkawang, 1*(2), 67-73.

