Effect of application of supply chain management practices on certified organic rice supply chain performance

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Abstract. This research is proposed to determine the impact of management on supply chain performance. A description analysis on each indicator’s constituent variables also carried out. Data obtained from farmer groups (Poktan), combined farmer groups (Gapoktan), organic rice farmer associations, distributors and retailers consisting of modern markets, supermarkets, and minimarkets were selected using snowball sampling method. A questionnaire was utilized to determine the perceptions of respondents. The limitation of the study was the involvement of only one area of certified organic rice producer, and several distributors and retailers who engaged in the organic sector following the supply chain flow. The analysis using partial least squares structural equation modelling obtained that the integration of suppliers has a positive significance on efficiency, responsiveness, flexibility, quality, and economic satisfaction, but it does not affect social satisfaction. Internal integration only significantly influences to quality. The integration of customer has a positive importance on efficiency, responsiveness, flexibility, and social satisfaction, but it does not affect the quality and economic satisfaction. Meanwhile, information sharing has a positive effect on economic and social satisfaction, but it does not affect efficiency, responsiveness, flexibility, and quality. Supplier integration was found to be a significant factor in supply chain management practices in influencing supply chains performance. This study authenticity is the use of measurement constructs that are adapted to conditions in the field to produce new empirical data about the relationship of management practices with supply chain performance in the certified organic rice products.

1. Introduction

In Indonesia, the area of organic agriculture is only about 0.1% of the total agricultural area with 5,700 producers[1]. The total organic area in Indonesia in 2015 was 261,147.30 ha, consisting of certified areas (79,833.83 ha), areas without certification under the Indonesia Organic Alliance (149,896.03 ha), areas in the certification process (31,381.44 ha), and areas in the certification process for small farmers certification (36 ha) [2]. Amidst the many organic products in the market, rice is the most popular for consumers. It is one of the agricultural products that are considered staple in the Indonesian society. The level of consumption of Indonesian rice is still high and cannot be replaced by other foodstuffs. In 2019/2020 Indonesia is the third highest rice consumer in the world, with about 37.7 million metric tons [3]. To increase rice production, intensification efforts have been carried, which produced positive results; however, the use of chemical fertilizers and pesticides has resulted in land degradation and environmental damage, which in turn, may reduce agricultural production. Furthermore, the negative effects on health from chemical residues in food make people start switching
to consume organic rice. Therefore, organic rice business opportunities are still prospective with good potential moving forward[4].

Although organic rice can provide more profitable business opportunities for farmers, many obstacles are still being faced such as certification sustainability, availability of inputs, productivity, marketing, partnerships, and the added value obtained by organic farmers. This condition occurs in other developing countries as well, for example, the rice supply chain in Thailand suffers from high transaction cost, power imbalance, unfair pricing, and lack of managerial skill, yet the presence of cooperative is still not sufficient to solve all these problems [5]. Meanwhile, in the corn grain supply chain (SC) of Uganda, inadequate physical and marketing infrastructure, inefficient credit institutions, and transport systems are the main concerns [6]. Furthermore, the Brazilian beef supply chain faces issues of poor information exchange, opportunistic behaviour, distrust, and lack of adequate contract enforcement [7]. Therefore, it is true that management practices from farmers to consumers within the research area are still lacking.

The success of a supply chain’s performance (SCP) is influenced by how supply chain management practices (SCMP) are implemented. However, according to[8], from the results of literature studies related to SCMP, only 15% of all existing studies were conducted in developing countries. Besides, there is not enough study about the agriculture supply chain, and most of them revolve around management practice and its research in manufacture and service areas [9]. Studies in the agriculture supply chain are mostly conducted in developed countries and are scarce in developing ones, including agrarian countries [10]. Moreover, research has done usually partial, which only includes one or two parties dominated by modern supply chain, less in the traditional supply chain [11], and specific for certain areas such as quality, safety, post-harvest, and logistics and for certain commodities such as vegetables and fruits supply chain[12].

There are various dimensions of SCMP including supplier partnerships, customer relations, sharing information, information quality, internal lean practices, and delays, which have been carried out to jointly enhance the efficiency of the company and the supply chains[8,13,14]. It is stated that the dimensions of management practices include the reduction of basic suppliers, lifelong relationships, communication, cross-organizational units, and supplier participation [14]. Good supply chain management depends on the effectiveness of the implementation of its practices [8],[15-18]. Research conducted in developed countries and manufacturing industries shows that firm performance positively affected by SCMP implementation[19-21]. Researches undertaken in the retail companies obtained similar results [18,22]. A study in organic coffee supply chain across country borders reveals that good information flow between members in terms of quality, accuracy, credibility, adequacy, and timeliness influences the relationship coordination, leading to a robust supply chain [23]. A recent study in the public food distribution agency (PFDA) supply chain in India showed that SCMP positively influences the performances [24]. SCMP cannot be separated from the term integration, which refers to the extent to which strategic organizations work together with supply chain members and oversee intra- and interorganizational processes to acquire excellent product, service, information, profit, and decision flow to transfer ultimate value to customers [25]. This study uses the dimensions of SCMP that have often been used in the manufacturing and service sectors by adjusting to the certified organic rice supply chains condition, namely (1) supplier integration, (2) internal integration, (3) customer integration, and (4) information sharing.

SCP evaluation is the degree of supply chain fulfilment of the needs of its’ members. Relating to performance measurement in supply chains are limited [26,27], with most of them in the manufacture and service sectors and less in the agribusiness sectors[6], [26,28]. Performance measurement systems must be adjusted to the particular needs of each supply chain, which will help in identifying problems and managing a business in a competitive and uncertain market environment [29]. This study adopts the model of Aramyan et al. [26] which includes efficiency, flexibility, responsiveness, quality and also used the indicators of customer satisfaction adopted from the study of [30-32].

This research aims to understand how SCMP factors affect SCP. As discussed in the literature review, SCMP has a positive effect on SCP. SCMP are applied in many forms, in which integration and sharing information are the main components on forming effective and efficient supply chain [23,25]. Thus, the
hypothesis is formulated to see if integration and sharing information within SCMP affects SCP factors in certified organic rice supply chain (Figure 1).

![Figure 1. Research hypothesis diagram.](image)

2. Materials and methods

2.1. Location, sample, and data

The research was conducted from August 2018 to December 2019. The selection of locations was carried out using a purposive method, which started with a certified organic rice producer center in Central Java Province, that is, in Sawangan District, Magelang Regency called the Sawangan Organic Farmers Association (i.e., GATOS). The location was selected after looking at important factors such as the area of organic land, the sustainability and consistency of the supply chain network. Respondents from distributors and retailers were selected using the snowball sampling technique, looking at a perception between supplier, distributor, and retailer.

2.2. Data analysis

The analysis uses PLS-SEM model testing with WArpPLS 6.0 program. The number of respondents are less than 100 people; thus, the PLS is appropriate choice because it can be used for small samples of between 30 and 100 and can overcome multicollinearity between independent variables [33]. On the other hand, the sample required in SEM is quite large; in many references, as many as 200-800 samples are recommended [33]. Model modification to achieve better model feasibility is needed in SEM, whereas this is not necessary in PLS [34]. In addition, the assumption about distribution is an important requirement in SEM where the data in modeling must meet the multinormal distribution, while in PLS the assumption of a multinormal distribution is not needed because direct estimation uses bootstrapping techniques [34]. PLS analysis has three stages where is the third stage is constructing a path diagram in this study (Figure 2) [33,35].
3. Results and discussion

The results of coefficient and hypothesis test show that SI has a significant influence on efficiency of 0.30 (p = 0.001), on responsiveness of 0.37 (p < 0.001), on flexibility of 0.30 (p = 0.001), on quality of 0.60 (p < 0.001), and on ES of 0.42 (p < 0.001), but it does not affect SS. The main indicator in supplier integration is the level of importance of supplier quality with a loading factor of 0.80. The results of the analysis above show that SI can improve SCP, including efficiency, responsiveness, flexibility, quality, and economic satisfaction. Results from research by [36] state that leading SI will reduce costs and inventory, minimize waiting times, and improve SCP or increase supply chain in a competitive advantage. Compared with other dimensions in SCMP such as II, CI and IS, the results of the study state that SI is the most influential on SCP because almost all are significant to SCP indicators, except for SS, where it does not have any influence. This is consistent with the results of research by Giménez and Ventura [15], who were able to identify SI as one of the important factors that enable all members to behave in an integrated manner to optimize the creation of the value. However, the results of the study indicate that SI does not affect the SS of the SC members.

Internal integration (II) only has a barely impact quality on 0.13 (p = 0.10). The main indicator of II is the availability of integrated information with a loading factor of 0.843. The quality in SCP is the quality of products, namely, organic rice, which includes the level of management of product safety, the level of management of the appearance of the product so that it can be appealing to consumers, and the status of managing the characteristic of the organic rice itself (smell, color, and taste). The results showed that II affected the above matters. Research from Wong et al. [37] found that in internal integration, there was a collaboration of all functions to produce product design, procurement, production, distribution, and sales aimed at meeting customer needs. However, in the organic rice circumstance, packaging innovation is the only result by uncomplicated product design. This finding is also in alignment with research by Giménez and Ventura [36]. They found that companies implementing internal integration in their supply chains perform better than their competitors, including responding to special needs, which in this study is the fulfillment of certified organic rice from GATOS.

Customer integration (CI) shows a positive effect on efficiency of 0.23 (p = 0.01), on responsiveness of 0.27 (p = 0.003), on flexibility of 0.34 (p < 0.001), and on social satisfaction of 0.29 (p = 0.002). The main indicators of customer integration are twofold, namely the level of sharing information on
sales/production plans) with a loading factor of 0.933 and the level of meeting customer needs with a loading factor of 0.932. CI is unity and cohesion, which involve cooperation and data exchange between a company and its consumers to increase their satisfaction [35]. CI will lead to lifelong relationships with consumers and further affect their complacency [38]. However, CI does not affect the quality and economic satisfaction.

Sharing Information (SInf) positively influences ES by 0.24 (p = 0.008) along with SS by 0.21 (p = 0.02). However, it has no influence on efficiency, responsiveness, flexibility, and quality. The main indicator is the level of information credibility with a loading factor of 0.85. This finding confirms a study done by Sundram et al. [16], which states that the level of data exchange on supply chains is influenced by things such as when and where information is shared, what information is provided, and to whom information is shared. Meanwhile, according to Li and Ling [39], the more information is given, the more efficient and effective is the communication built in the supply chain. Moreover, Aramyan and Van Gogh [38] found that information sharing illustrates the level of accuracy, timeliness, credibility, and completeness of an exchanged information. Claro and Olivera [23] and Kumar et al. [24] also found that SInf promotes good SCP. Additionally, the impact of SInf on SCP also affect ES and SS. Financially fulfilled chain individuals consider a relationship to be effective with the accomplishment of objectives [31]. This can be fulfilled with the adequacy and efficiency of the relationship with its accomplices whereas creating monetarily. Meanwhile, chain individuals are fulfilled with the social outcomes of relationships, value contact with partners to personal relationships, and like a collaboration with partners because they believe partners have the focus, appreciation, and desire to exchange ideas [31].

4. Conclusions
Research shows that SI features a positive impact on efficiency, responsiveness, flexibility, quality, and economic satisfaction, but it does not affect social satisfaction. Internal integration only encompasses little effect on quality. CI positively affect efficiency, responsiveness, flexibility, and social satisfaction, but it does not affect the quality and economic satisfaction. Information sharing has a positive effect on economic as well as social satisfaction, but it does not affect efficiency, responsiveness, flexibility, and quality. SI was found to be a dominant factor in SCMP in influencing the performance of certified organic rice supply chains in Central Java. Descriptive analysis results show SCMP has been applied well, especially in the integration of suppliers and information sharing. In general, SCP has also been in good condition where the level of efficiency in very good conditions is followed by social satisfaction and economic satisfaction for certified organic rice supply chain actors in Central Java.

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