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Analyzing the contributing factors of the rice supply chain in Gorontalo using SEM-PLS method

Ria Indriani*and Supriyo Imran

Gorontalo State University, Faculty of Agriculture, Department of Agribusiness, 96128, Indonesia
**Corresponding author:* ria.indriani@ung.ac.id

Abstract

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This research aims to analyze the factors that influence the performance of the rice supply chain in Gorontalo Province. The data was analyzed using the Structural Equation Model based on Partial Least Squares (SEM-PLS) method. The results indicate that rice availability, agility distribution, and interaction of rice prices affected the performance of the rice supply chain. The agility affects the availability and distribution of rice, and the rice prices impact consumers' satisfaction. However, this relationship is not always linear. Several external factors, such as the economic situation, technological developments, market competition, and consumer preference changes, can also impact the rice supply chain. In addition, the faster the flow of information, the more opportunistic nature and the independence of capital, causing farmers disloyal to one rice distributor, even though the integration process and long-term relationships have been intertwined.

Keywords: rice supply chain; SEM-PLS; distribution agility; consumer satisfaction; integration process

Introduction

Rice has been a strategic food commodity whose availability should be ensured as it is central to socio-economic and national development, thus needing government intervention. Indonesia needs the availability of rice in sufficient quantities, according to the consumption and national stock stated in the operational requirements of extensive and spread logistics, especially since the COVID-19 pandemic.

Gorontalo Province has great potential in the agricultural sector, especially rice plants. In 2022, the paddy harvested area was 46,823 ha, signifying a decline of 728 ha or 4.03 percent compared to the area in 2021, which was 48,714 ha. Rice production in 2022 was around 240,135, which increased by 5,742 tons or 2.39 percent compared to 2021, accounting for 234,393 tons (BPS, 2023). Several areas in Gorontalo Province see a surplus of rice production. This condition is a challenge in ensuring the smooth distribution of rice to all regions.

Provision and control of the supply of rice in the community in sufficient quantities is necessary to maintain the stability of this commodity's price. Meeting food demands for all people requires sufficient food supplies that align with the adequacy of consumption and sufficient national stocks stated in the operational requirements of a wide and spread logistics. Currently, the government is perplexed with major challenges in the agricultural sector. These challenges involve maintaining sufficient rice supply at affordable prices at the consumer level, fluctuating and soaring local rice prices compared to market prices, and dwindling rice supplies in the market in the coming years. Such conditions result in a distorted rice supply chain, resulting in an ineffective fulfilment of consumer demand.

Recently, there has been an increase in the price of rice: at the beginning of 2022, the price of grain was IDR 5,389, and the price of rice was IDR 11, 589 at the farmer level and retail level, respectively. However, at the end of the year, there was a spike in the price at 1,000 per kg; thus, the price

of grain and rice increased to IDR 6,436 and IDR 12,795. The soaring price from November 2022 reached its peak in February 2023. The Information Centre for Strategic Food Prices (PIHPS) from Bank Indonesia also reports a similar trend. The price varies over a fairly wide range in each region, including the Province of Gorontalo. In this province, the price of rice at the beginning of 2022 was IDR 9,000 at the farmer level and 10,000 at the consumer level. The price increased to IDR 11,000–12,000 at the consumer level at the end of 2022.

The supply chain is an applicable solution to problems revolving around meeting consumer needs for rice. The supply chain primarily aims to satisfy consumer needs, culminating in the satisfaction of consumer demand (Chopra & Meindl, 2016). The level of supply chain refers to an ability to meet consumer needs by considering key performance indicators that are appropriate at certain times and costs, including supply chain performance (Vorst, 2006). Supply chain performance can be measured qualitatively, including customer satisfaction, flexibility, integration of information and material flows, and effective risk management (Brusset & Teller, 2017; Soni et al., 2014).

Agricultural supply chain management aims to make the entire system efficient and effective, minimizing costs from transportation and distribution to supplying raw materials, materials in process, and finished goods (Courtonne et al., 2015; Indriani et al., 2019). Rice commodity supply chain management is an approach that is expected to describe the availability of rice supply and the points at which supply chain actors do not work optimally, causing rice prices to rise in Gorontalo. Therefore, examining factors contributing to the performance of the rice supply chain in Gorontalo is essential.

Research on supply chains examines the relationship between supply chain capability and resilience and moderation of the role of supply chain risk (Brusset & Teller, 2017). Furthermore, supply chain optimization and coordination with production-sharing contracts and service terms under supply and demand have been investigated (Hu & Feng, 2017). Other research involves the design of a supply chain development policy for cayenne pepper in Gorontalo and the rice supply chain model and implementation (Indriani et al., 2020; Putro et al., 2021). An extensive study on a similar matter has also been performed, focusing on optimizing the balance of the rice supply chain network using the repeated average method (Maulana et al., 2023). Complementing the above studies are papers regarding the analysis of material flows from farmers to consumers in the rice supply chain with uncertainty analysis and the application of the Critical Systems Practice meta-methodology to improve sustainability in the rice supply chain in Iran, respectively (Elyasi & Teimoury, 2023; Liu et al., 2023). Based on the several studies above, contributing factors to the performance of the rice supply chain have yet to be scrutinized. This research aims to fill such a gap by analyzing the factors that influence the performance of the rice supply chain in Gorontalo.

Methodology

The research was conducted for 3 months, from May to July 2023, in several parts of Gorontalo Province: Gorontalo Regency, Bone Bolango Regency, and Gorontalo City (Figure 1).

The data consists of primary and secondary data. Primary data covers aspects of rice production and distribution and filling out questionnaires by respondents consisting of lowland rice farmers, millers, rice traders, Indonesian Farmers Shop Center (TTIC), BULOG Gorontalo, and rice consumers. Secondary data is in the form of relevant data from the Gorontalo District Agriculture Office, the Bone Bolango District Agriculture Office, the Gorontalo City Food Service, the Gorontalo Logistics Agency, and Statistics Indonesia. The population of lowland rice farmers in Gorontalo Regency, Bone Bolango Regency, and Gorontalo City, spread in Kabila, Tilongkabila, Limboto Barat, Tolangohula, Sipatana District, and Kota Utara Districts is 2000 people. All of these areas were chosen as they are rice production centres. Below was used to determine the sample (Umar, 2019):

$$n = \frac{N}{1 + Ne^2}, \tag{1}$$

where: n = sample size = 95; N = population size = 2000 people; e = tolerance of sampling inaccuracy = 10%

Farmers or the sample were selected purposively by considering the requirements of the samples established by the researcher. In addition, using snowball sampling, samples from millers, rice traders, Bulog, TTIC, and consumers were selected. Snowball sampling is a data collection technique in which the samples grow resembling snowballs (Sugiyono, 2017). Such allows the researcher to retrieve adequate data. This study's sample consisted of 22 wholesalers, 13 millers, 74 consumers, 11 Bulog, and TTIC employees, totalling 215 individuals. Variable measurement relies on a Likert scale, which is often used to measure one's responses to social objects (Suliyanto, 2011). The sample chooses one of the five choices, ranging from worse to very good, for each question as a form of their perception of the condition of each variable in the study area.

Analysis of the factors affecting the performance of the rice supply chain was performed using the structural equation modelling (SEM) of the partial least square (PLS) type.

Partial Least Squares (PLS) represents a pivotal component within the realm of Structural Equation Modeling (SEM), initially conceptualized by Herman Wold in 1974 (Hair et al., 2022). As expounded by Ghozali (2014), PLS constitutes an alternative paradigm, diverging from the covariance-based SEM approach towards a variance-based perspective. While covariance-based SEM predominantly scrutinizes causal or theoretical models, PLS distinguishes itself as a predictive modeling technique. Its efficacy stems from its flexibility, as it does not hinge upon stringent assumptions such as normality of data distribution or the necessity for large sample sizes. SEM-PLS aims to explain the relationship between constructs and emphasize the understanding of the value of the relationship SEM-PLS, consisting of external relations (outer model or measurement model) and internal relations (inner model or structural model). The relationship is defined as two linear equations: a measurement model that unifies the relationship between latent variables and a group of explanatory variables and a structural model, namely the relationship between latent variables (Tedjo et al., 2017). The utilization of Partial Least Squares Structural Equation Modeling (PLS-SEM) stands as a robust methodological choice within the realm of supply chain analysis. However, it is imperative to acknowledge that solely relying on a quantitative approach may prove insufficient in certain contexts. To address this limitation, this study elucidates a nuanced approach by advocating for the integration of PLS-SEM results with complementary methods, thereby proposing an advanced mixed methods design (Kurtaliqi et al., 2024). PLS-SEM was selected as the primary analytical tool in this research due to the presence of intervening and moderator variables requiring simultaneous examination. Conventional Structural Equation Modeling (SEM) tech-

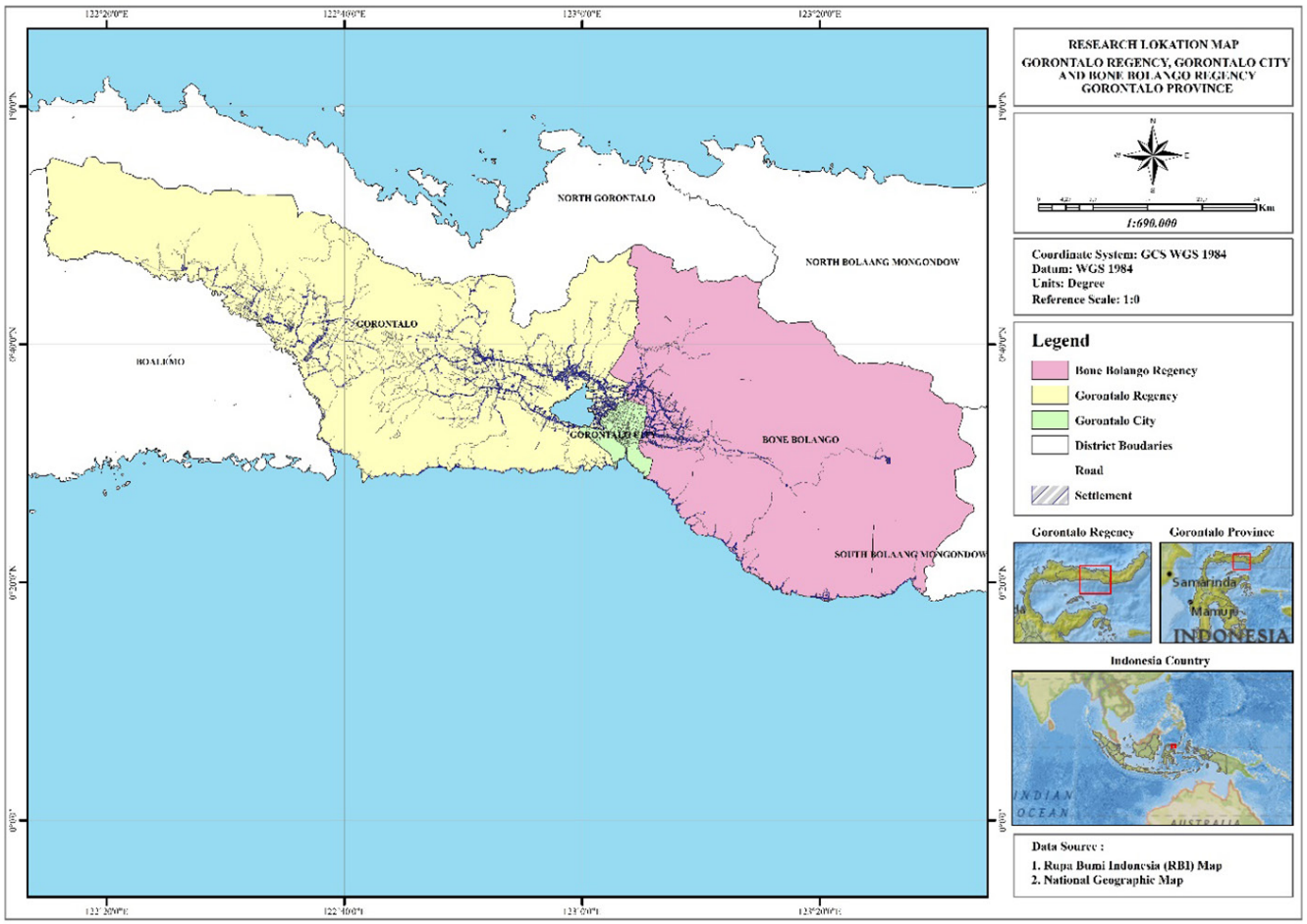

Fig. 1. Research Location Map

niques encounter challenges when tasked with analyzing models incorporating both intervening and moderator variables concurrently. Therefore, the flexibility and capability of PLS-SEM to accommodate such complexities render it an ideal choice for unravelling the intricacies of the studied phenomenon. SEM-PLS analyzes the contributing factors of the performance of the rice supply chain, i.e., the availability and smooth distribution of rice (intervening variable), agility, process integration, information sharing, long-term relationships, rice prices (moderator variable), and consumer satisfaction (intervening variables). All data were processed using the Smart-PLS 4 software.

Table 1. Factors affecting the performance of the rice supply chain in Gorontalo

No.	Item	Variable	Indicator
1.	Y	Performance of supply chain	Reliability (Y.1) Responsibility (Y.2) Flexibility (Y.3) Cost (Y.4) Asset (Y.5) (Dissanayake & Cross, 2018; Jain et al., 2022; Suud et al., 2021; Vorst, 2006;)
2.	X1	Agility	Building good communication with suppliers (X1.1) Develop anticipatory plans when uncertain conditions occur (X1.2) Building collaborative relationships (X1.3) (Munir & Dwiyanto, 2018)
3.	X2	Integration Process	Prioritizing logistics activities (X2.1) Good integration in logistics activities (X2.2) Effective material flow (X2.3) (Perdana et al., 2022)
4.	X3	Information Sharing	Information sharing in finance, production, and design (X3.1) Continuous exchange of information (X3.2) Information can help all involved parties (X3.3) (Munir & Dwiyanto, 2018)
5.	X4	Long-term Relationship	The basis of the relationship with the supplier is a long-term relationship (X4.1) Relationships established for a long time (X4.2) Long-term Relationship through Cooperation (X4.3) (Ariani & Dwiyanto, 2013)
6.	Z1	Availability and effective distribution of rice	Level of rice availability (Z1.1) Level of rice affordability (Z1.2) Level of supply stability (Z1.3) Level of rice adequacy (Z1.4) Level of equality of distribution (Z1.5) Level of logistics efficiency (Z1.6) Stock number (Z1.7) Level of use (Z1.8) Level of import and export regionwide (Z1.9) Local production (Z1.10) Price change (Z1.11) (Djama et al., 2023; Lantarsih et al., 2016; Yi et al., 2022)
7.	Z2	Consumer satisfaction	Satisfaction with the availability of rice (Z2.1) Satisfaction with rice quality (Z2.2) Satisfaction with rice prices (Z2.3) Satisfaction with the accessibility of rice (Z2.4) Satisfaction with service (Z2.5) Satisfaction with rice sustainability (Z2.6) Satisfaction with rice product information (Z2.7) (My et al., 2021)
8.	M	Rice price	Food prices consumer index (M1) Market price (M2) National regional commodity prices (M3) Production and supplies (M4) Government policy (M5) (Asrin et al., 2022; Fitrawaty et al., 2023)

The analysis of intervening and moderator variables concurrently through SEM-PLS can exclusively be facilitated using SMART-PLS 4 software, developed by SmartPLS GmbH in Germany since its inception in 2015. As elucidated by Wong (2013), SmartPLS has emerged as a prominent software application for conducting Partial Least Squares Structural Equation Modeling (PLS-SEM). Originally developed by Ringle et al., (2015), SmartPLS has garnered widespread acclaim within the academic and research communities owing to its accessibility and user-friendly interface, alongside its sophisticated reporting capabilities. Since its introduction, SmartPLS has become a preferred choice among researchers due to its open-access availability and intuitive design. Despite the abundance of scholarly literature focusing on PLS modeling, educational resources pertaining to this software remain relatively limited. Therefore, its popularity persists not only due to its functionality but also its ease of use, making it a valuable tool for researchers seeking to navigate the intricacies of PLS-SEM analysis. The samples were given a list of questions in the form of variables, which, according to theory, are factors that can affect supply chain performance. These are depicted in the following Table 1.

Results and Discussion

Outer Model

Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis is a technique to confirm or validate whether the indicators used are following the variables. Based on the test results, several variable indicators have loading factor values below 0.5. Thereby, the indicator is issued for further testing. The issued indicators are the second indicator of the Agility variable (X1), the first, third, and fifth indicators of rice price variables (M), the seventh, eighth, nine, tenth, and eleventh indicators of the availability and smooth distribution of rice (Z1) as well as the first and fourth indicators of the four variables of consumer satisfaction (Z2).

From the confirmatory factor analysis results, several variable indicators have loading factor values below 0.5, culminating in their exclusion. The indicators are the fifth indicator variable, availability and smooth distribution of rice (Z1), and the sixth indicator variable is consumer satisfaction (Z2). Furthermore, all variable indicators above 0.5 are declared feasible or valid for research use and can be used for further analysis (able to measure constructs in Structural Equation Modeling (SEM)).

Discriminant validity, composite reliability, and Cronbach's Alpha

Discriminant validity encompasses the evaluation and comparison of discriminant validity and the square root of the average extracted (AVE). If the AVE square root value of each construct is greater than the correlation value between the construct and the other constructs in the model, then it is said to have sufficient discriminant validity and the expected AVE value is greater than 0.5.

Composite reliability is an indicator that measures the extent to which a measuring device can be considered reliable. Data with a composite reliability greater than 0.6 has high reliability. The composite reliability of the indicator block that measures a construct can be evaluated using internal consistency and Cronbach's alpha.

Reliability tests with composite reliability can be strengthened using Cronbach's alpha value. A variable is reliable or meets Cronbach's alpha if the value is greater than 0.6. The AVE, Composite Reliability, and Cronbach's alpha values for each variable are provided in the following Table 2.

Table 2 shows the results of the AVE variable agility, process integration, information sharing, long-term relationship, rice price, consumer satisfaction, availability and smoothness of rice distribution, and rice supply chain performance are > 0.5. This means each variable is in the fit category and has good discriminant validity.

As shown in Table 2, the Composite Reliability value of each research variable is > 0.6. The results indicate that each

Table 2. Results of discriminant validity, composite reliability, and Cronbach's Alpha

Variable	AVE	Composite Reliability	Cronbach's Alpha
Agility	0.820	0.784	0.781
Process integration	0.603	0.679	0.681
Information sharing	0.606	0.747	0.694
Long term relationship	0.770	0.855	0.851
Rice price	0.638	0.771	0.696
Consumer satisfaction	0.513	0.689	0.683
Availability and effective distribution of rice	0.550	0.830	0.797
Performance of rice supply chain	0.541	0.713	0.683

Source: Processed PLS, 2023

research variable has met the value requirements, signifying that all variables have a high level of reliability. Table 2 confirms that the value of Cronbach's alpha for all research variables is > 0.6. Thus, each research variable has met the value requirements with a high level of reliability.

Research Design

The Structural Equation Modeling (SEM) research model in this study is displayed in Figure 2. Based on Figure 2, it can be seen that all variable indicators, i.e., agility, process integration, information sharing, long-term relationships, rice prices, consumer satisfaction, availability, and smoothness of rice distribution and rice supply chain performance, have a good construct validity value to describe each influence variable.

The figure also reveals that the R Square value is 0.407. In other words, 40.70% refers to agility, process integration, information sharing, and long-term relationship influence on rice availability and smooth distribution in Gorontalo Province. Meanwhile, the remaining 59.30% refers to the percentage of other influencing variables. The result of a determination coefficient of 40.70% shows that the effect of agility, process integration information sharing, and long-term relationships on the availability and smooth distribution of rice is quite substantial. Such a finding confirms the six variables' significant, simultaneous effect on rice availability and smooth distribution.

Figure 2 shows the R-square value of 0.439, which means that at 43.90% of the agility, process integration, information sharing, long-term relationship, rice prices, consumer satisfaction, availability and smooth distribution of rice and the interaction of rice prices with consumer satisfaction contributes to the performance rice supply chain in Gorontalo Province. Meanwhile, the remaining 56.10% refers to the percentage of other variables not included in the present work. The results of the coefficient of determination of 43.90% confirm that the influence of agility, process integration, information sharing, long-term relationship, rice prices, consumer satisfaction, availability and smooth distribution of rice, and the interaction of rice prices with consumer satisfaction on rice supply chain performance is sufficient and substantial. Simply put, there is a simultaneous significant effect of the eight variables on the performance of the rice supply chain.

The figure also reveals that the R Square value is 0.093, indicating that agility, process integration, information sharing, and long-term relationships affect 9.30% of rice availability and smooth distribution in Gorontalo Province. The rest 90.70% refers to the percentage of other variables not examined in this study. The results of the coefficient of determination of 9.30% confirm that the influence of the variables previously mentioned is not substantial or the influence is significant. Yet, the price of rice has a less substantial effect on consumer satisfaction.

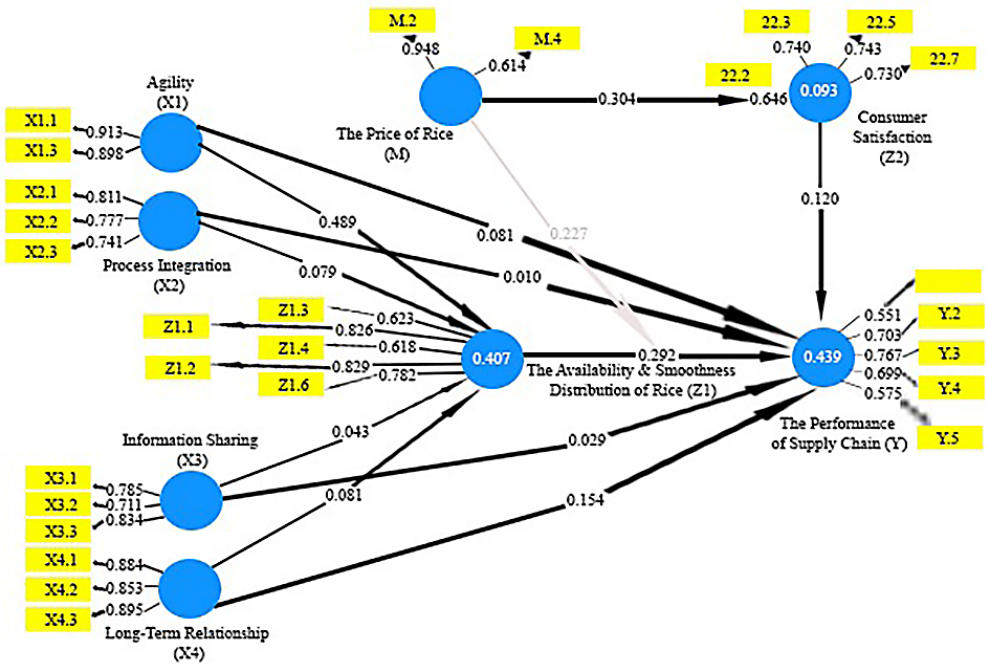

Fig. 2. Full Model Structural Path Diagram

Goodness of Fit Analysis

The model fit test is related to Goodness of Fit (GOF) analysis. This test will evaluate whether the model is fit or not. The Structural Equation Modeling (SEM) research model in this study is displayed in Table 3.

Table 3. Structural Equation

GOF Measurement Results	Acceptance Parameters	Description
Chi-squared = 1,309.32	Less is better	Good fit
SRMR = 0.078	< 0.08	Good fit
d_ULS = 7.250	> 2.000	Good fit
d_G = 1.139	> 0.900	Good fit
NFI = 0.848	> 0.9	Marginal fit
HTMT = highest 0.837	< 0.9	Good fit

Source: Processed Data (2023)

Based on Table 3, the model is a good fit; structural equations can be carried out to assess the value of the path coefficient as well as to test the hypothesis to determine the effect of agility, process integration, information sharing, and long-term relationship on the performance of the rice supply chain. The hypothesis is intervened using variables mediation of rice's availability and smooth distribution, as well as consumer satisfaction and moderated by the price of rice.

Results of Hypothesis Test

Based on the results of the analysis above, the hypothesis testing is interpreted in full as follows in Table 4.

Based on Table 4, the P-value of the effect of agility on the availability and smooth distribution is less than the probability value of 0.05 (0.000 <0.05), so agility had a positive and significant effect on rice availability and smooth distribution in Gorontalo Province. Regarding the indirect effect (through the availability and smooth distribution of rice), it is found that the probability value (P-value) is 0.008, which is smaller than the probability value of 0.05 (0.008 < 0.05). In other words, agility through the availability and smooth distribution of rice has a positive and significant effect on the performance of the rice supply chain in Gorontalo Province. This shows that the availability and smooth distribution of rice can be a good intervention for the effect of agility on the performance of the rice supply chain. Since the P-value of the effect of agility on the performance of the rice supply chain in Gorontalo Province is greater than the probability value of 0.05 (0.376 > 0.05), agility has a positive, but not significant effect on the performance of the rice supply chain in Gorontalo Province.

Table 4. Results of hypothesis test

Causality Relationship	Path Coefficient	t-Statistics	p-Value
X1->Z1	0.489	5.665	0.000***
X1 -> Z1 -> Y	0.143	2.647	0.008***
X1 -> Y	0.081	0.886	0.376^{ns}
X2->Z1	0.079	0.893	0.372^{ns}
X2 -> Z1 -> Y	0.023	0.826	0.409^{ns}
X2 -> Y	0.010	0.099	0.921^{ns}
X3->Z1	0.043	0.516	0.606^{ns}
X3 -> Z1 -> Y	0.012	0.487	0.627^{ns}
X3 -> Y	0.029	0.376	0.707^{ns}
X4->Z1	0.081	0.803	0.422^{ns}
X4 -> Z1 -> Y	0.024	0.738	0.461^{ns}
X4 -> Y	0.154	1.729	0.084
M*Z1->Y	-0.227	4.112	0.000***
M -> Y	0.095	1.206	0.228^{ns}
M->Z2	0.304	5.279	0.000***
M -> Z2 -> Y	0.036	1.519	0.129^{ns}
Z1 -> Y	0.292	3.017	0.003***
Z2 -> Y	0.120	1.621	0.105^{ns}

^{ns} not significant.
* Significant at the 0.1 level (2-tailed).
** Significant at the 0.05 level (2-tailed).
*** Significant at the 0.01 level (2-tailed).
Source: Processed Data (2023)

Agility (X1)

Agility refers to providing information throughout the supply chain, enabling knowledge sharing about plans, requirements, and status that can improve supply chain performance for supply chain partners (Munir & Dwiyanto, 2018). The positive sign on the path coefficient indicates that agility has a unidirectional relationship with the availability and distribution of rice. If the agility factor is considered good, then rice availability and smooth distribution in Gorontalo are also good. The factors of availability and smooth distribution of rice can also strengthen the unidirectional relationship between agility and the performance of the rice supply chain in Gorontalo. Agility positively influences supply chain performance; if other factors mediate this relationship, the impact on supply chain performance will increase (Geyi et al., 2020).

Integration Process (X2)

Table 4 shows the P-value of the effect of process integration on the availability and smoothness of rice distribution of 0.372. The P-value is greater than the probability value 0.05 (0.372 > 0.05). Process integration, information sharing, and long-term relationships do not significantly af-

fect the availability and distribution of rice. Regarding the indirect effect (through the availability and smooth distribution of rice), it is found that the probability value (P-value) is 0.409, which is smaller than the probability value of 0.05 (0.409 < 0.05). In other words, process integration through the availability and smooth distribution of rice has a positive and insignificant effect on the performance of the rice supply chain in Gorontalo Province. This shows that the availability and smooth distribution of rice is not a good intervention for the effect of process integration on the performance of the rice supply chain. Meanwhile, the P-value of the effect of process integration on the performance of the rice supply chain is measured at 0.921. The P-value is greater than the probability value of 0.05 (0.921 > 0.05), signifying that process integration has no significant positive effect on the performance of the rice supply chain in Gorontalo Province. The positive sign on the path coefficient indicates that process integration has a directional relationship with the availability and distribution of rice. On that ground, if the integration process factor is considered good, then the availability and smooth distribution of rice and the performance of the rice supply chain in Gorontalo are also good. However, the availability and smooth distribution of rice cannot strengthen or weaken the unidirectional relationship between the integration process and the performance of the rice supply chain in Gorontalo.

The integration process considers all aspects of the organization that must work together to create a sustainable and efficient flow of raw materials and resources (De Souza Miguel & Brito, 2011). The growing competition makes companies improve their operations and internally and focus on integrating suppliers and consumers in the supply chain value process (Prajogo & Olhager, 2012).

Most of the lowland rice farmers in Gorontalo have not been cooperating with new traders for around 2-3 years, causing a lack of coordination and information as well as discrepancies in the distribution process. In addition, there are rapid changes in the business environment, e.g., an increase in rice prices, causing farmers to partner not only with one trader but also to move to other traders who can buy their rice at higher prices. In addition, less involvement of parties related to the rice supply chain, such as Bulog and TTIC caused the integration process not to run smoothly. Lowland rice farmers seldom supply rice to Bulog Gorontalo because the HPP (government purchase price) is lower, at IDR 9,950/kg compared to the market price of IDR 13,000/kg. The same issue was also seen in TTIC (Toko Tani Indonesia Centre): lowland rice farmers did not prefer supplying rice at TTIC because payments by TTIC were in the form of cash delays. Therefore, the integration process has no significant effect on the performance of the rice supply chain in Gorontalo. Such a finding aligns with the one seen in Bodendorf et al. (2023), reporting that supply chain integration is a condition to which a producer cooperates strategically with its supply chain partners and jointly manages intra- and inter-organizational processes to achieve superior operational performance. This research shows that a lack of organizational fit, supply chain planning, and information sharing are major barriers to SCI success.

Information Sharing (X3)

Table 4 shows the P-value of the effect of information sharing on the availability and smooth distribution of rice is greater than the probability value of 0.05 (0.606 > 0.05). In other words, information sharing has no significant positive effect on rice availability and smooth distribution in Gorontalo Province. In terms of the indirect effect (through the availability and smooth distribution of rice), it is found that the probability value (P-value) of the information-sharing variable is 0.627. The P-value is greater than the probability value of 0.05 (0.627 > 0.05), meaning that information sharing through the availability and smooth distribution of rice has no significant positive effect on the performance of the rice supply chain in Gorontalo Province. This shows that the availability and smooth distribution of rice is not a good intervention for the effect of information sharing on the performance of the rice supply chain. Meanwhile, the P-value of the effect of information sharing on the performance of the rice supply chain is measured at 0.707. The P-value is greater than the probability value of 0.05 (0.707 > 0.05), signifying that information sharing has no significant positive effect on the performance of the rice supply chain in Gorontalo Province. The positive sign on the path coefficient indicates that information sharing has a directional relationship with the availability and distribution of rice. On that ground, if information sharing is considered good, then the availability and smooth distribution of rice and the performance of the rice supply chain in Gorontalo are also good. However, the availability and smooth distribution of rice cannot strengthen or weaken the unidirectional relationship between information sharing and the performance of the rice supply chain in Gorontalo.

This may be due to the lack of relevance of information, especially regarding prices, distrust and not being open about information, and the inability of lowland rice farmers in Gorontalo to manage information. Distrust and non-disclosure of information are caused by lowland rice farmers having cooperative relationships with short rice traders. They also establish partnerships with more than one trader who can provide higher prices. On the other hand, farmers

are also quick to find information on rising prices. They ultimately will look for traders or other mills that can offer higher prices. The price of rice in Gorontalo at the consumer level varies depending on the market mechanism, ranging from IDR 11,500-13,000 per kg. Information distortion hinders the factor of information sharing from having a significant effect. Information distortion is a phenomenon where actual demand is relatively stable at the end-customer level and changes to fluctuate upstream, and the higher the upstream, the greater the increase (Zhou et al., 2023). Such a condition is also known as a bullwhip effect. The consequences of this bullwhip effect phenomenon include the occurrence of an excess number of products, increased holding costs, and stock-out costs. Information distortion is common in supply chains, especially information demand distortion. An easy way to think of eliminating information distortion is by sharing information. Although many information-sharing mechanisms can coordinate supply chains, they are not easy to implement due to the rigid implementation conditions.

Consequently, many upstream producers generally buy data from downstream retailers to eliminate distortions of demand information. This notion echoes the results that supply chain performance can be affected by relationships with partners, information exchange, and supply chain integration (Chang et al., 2013). The mediating role of information sharing is crucial, information sharing among partners in the supply chain facilitates higher overall performance, as a result of Supply Chain Management practices that improve the reliability and quality of information (Marinagi et al., 2015).

To address this potential issue, stakeholders in the supply chain need to communicate openly, identify concrete benefits from sharing information, and ensure appropriate incentives exist for all parties. Careful planning, adequate information technology, and effective management of information flows are also required to ensure that information sharing has a positive impact on supply chain performance.

Long-term Relationship (X4)

Table 4 shows the probability value (P-value) of the effect of the long-term relationship on the availability and smoothness of rice distribution of 0.422. The P-value is greater than the probability value of 0.05 (0.422 > 0.05), thus indicating that the long-term relationship has no significant positive effect on rice availability and smooth distribution in Gorontalo Province. In terms of the indirect effect (through the availability and smooth distribution of rice), it is found that the probability value (P-value) of the long-term relationship variable is 0.461. The P-value is greater than the probability value of 0.05 (0.461 > 0.05), meaning that the long-term relationship through the availability and smooth distribution of rice has no significant positive effect on the performance of the rice supply chain in Gorontalo Province. In other words, the availability and smooth distribution of rice is not a good intervention for the effect of long-term relationships on the performance of the rice supply chain. The above table shows the probability value (P-value) of the effect of the long-term relationship on the availability and smoothness of rice distribution of 0.084. The P-value is greater than the probability value of 0.05 (0.461 > 0.05), meaning that the long-term relationship through the availability and smooth distribution of rice has no significant positive effect on the performance of the rice supply chain in Gorontalo Province. The positive sign on the path coefficient indicates that the long-term relationship has a unidirectional relationship with the availability and distribution of rice. On that ground, if the aspect of a long-term relationship is considered good, then the availability and smooth distribution of rice and the performance of the rice supply chain in Gorontalo are also good. Still, the factors of availability and smooth distribution of rice cannot strengthen or weaken the unidirectional relationship between the long-term relationship and the performance of the rice supply chain in Gorontalo.

The long-term relationship with no significant effect blames the incompatibility of objectives and strategies, changes in the market, and environmental conditions. Other changes include market demand, government policies whereby the government raised the floor price for grain, long-term relationships were not flexible enough, lack of resources such as money, time, and manpower, as well as uncertainty and risk in the rice supply chain in Gorontalo. Lowland rice farmers, especially in Gorontalo and Bone Bolango districts, have had a long-term and longstanding relationship with mills. The basis for this relationship is the proximity of the mill location to the farmers, debts, and trust in the mill. However, this is different from lowland rice farmers in Gorontalo City. They are the two regions because they are less restricted due to having greater capital. If the price is deemed suitable or profitable at the time of negotiation, they will supply the milled rice. The relationship does not last long, depending on the mill, which gives a higher price. In addition, farmers are also looking for mills that can provide loans. However, this is in contrast to farmers and traders, Bulog, and TTIC. There is only one mill cooperating with Bulog for a long time. If there is no stock at the partner mills, Bulog will look for other suppliers. Most of the rice supply in the Gorontalo Logistics Warehouse is from outside the region: Central Sulawesi, South Sulawesi, and East Java. This is in line with the rice supply to rice traders, especially wholesalers from Central Sulawesi and South Sulawesi.

The supply of rice at mills, especially large mills, fulfils

demand from local retailers and consumers, as well as demand from outside areas such as Bitung and Manado. Supply chain integration is widely considered by practitioners and researchers as an important contributor to supply chain performance (Prajogo & Olhager, 2012). The two main flows in the relationship are material and informational. The integration of the two flows occurs between supply chain partners and their impact on operational performance. Logistics integration has a significant effect on operating performance. Information technology capabilities and information sharing both have a significant influence on logistics integration. In addition, long-term supplier relationships have a significant direct or indirect influence on performance through the effect on information integration and logistics integration. The success of the food supply chain is highly dependent on strong and effective interactions between raw material suppliers, primary packaging material providers, repackers, manufacturers, intermediary traders, and other suppliers (Djuric & Götz, 2016; Suryaningrat et al., 2015).

Price (M)

Based on Table 4, the P-value of the interaction of rice prices with the availability and smooth distribution of rice on the performance of the rice supply chain is 0.000. The P-value is smaller than the probability value of 0.05 (0.000 <0.05), signifying that the interaction of rice prices with the availability and smooth distribution of rice has a positive and significant effect on the performance of the rice supply chain in Gorontalo Province. The negative sign on the path coefficient indicates that the interaction between price and the availability and smooth distribution of rice has the opposite relationship with supply chain performance. If the price factor rises and the availability and smoothness of distribution are low, the performance of the rice supply chain in Gorontalo is also low.

The probability value (P-value) of the effect of rice prices on supply chain performance is 0.228. The P-value is greater than the probability value of 0.05 (0.228 > 0.05), indicating that the price of rice has no significant positive effect on the performance of the rice supply chain in Gorontalo Province. This may be because even though rice has increased because rice is a basic need for the people of Gorontalo, consumers will still buy rice without reducing the amount or quality of rice consumed. Moreover, the central government's policy, through the Gorontalo Bulog, is to carry out the Cheap Food National Movement program. Such an approach aims to stabilize the increasing price of rice and help the less fortunate distribute subsidized rice. The rice from Bulog is a medium type of rice, which costs IDR 8.500-IDR 9.950/kg as stipulated by the government. Subsidized rice marketed by Bulog is imported rice originating from Thailand. Over 95% of Indonesia's population consumes rice as a staple (Hermawan et al., 2023). Therefore, rice is a superior commodity that greatly influences poverty. In addition, the Indonesian nation's per capita rice consumption in 2017 was 97.6 kg, while in 2020, it reached 140 kg. Moreover, Indonesia's per capita rice consumption is higher than neighbouring countries where rice is also a staple food. Food subsidies are widely implemented as part of government policies globally to mitigate food insecurity among the poor (Zhong et al., 2023). Subsidies to retail outlets are one type of supply-side subsidy designed to make food more affordable for low-income consumers.

Based on Table 4, the results of the probability value (P-value) of the effect of rice prices on consumer satisfaction obtained a result of 0.000, which is smaller than the probability value of 0.05 (0.000 < 0.05). Rice prices positively and significantly affect consumer satisfaction in Gorontalo Province. The P-value of the indirect effect (through consumer satisfaction) of the rice price variable was 0.129. The P-value is greater than the probability value of 0.05 (0.129 > 0.05). Simply put, the price of rice through consumer satisfaction has no significant positive effect on the performance of the rice supply chain in Gorontalo Province. These results indicate that consumer satisfaction has not been able to provide a good intervention for the price of rice on the performance of the rice supply chain in Gorontalo Province.

The positive sign on the path coefficient indicates that price has a direct relationship with consumer satisfaction and rice supply chain performance. If the price factor is considered good, the performance of the supply chain in Gorontalo is also good. In addition, consumer satisfaction has not been able to strengthen or weaken the unidirectional relationship between price and rice supply chain performance in Gorontalo. Such a notion is supported by the results of Ngadino et al. (2017), revealing that product, price, and service quality simultaneously or partially positively and significantly affect consumer satisfaction for Raskin rice (medium rice for the poor) managed by BULOG.

Availability and effective distribution of rice (Z)

Table 4 shows the P-value for the effect of the availability and smooth distribution of rice on the performance of the rice supply chain 0.003. The P-value is smaller than the probability value of 0.05 (0.003 <0.05). Hence, the availability and smooth distribution of rice have a positive and significant effect on the performance of the rice supply chain in Gorontalo Province. The positive sign on the path coefficient indicates that rice's availability and smooth

distribution have a unidirectional relationship with the performance of the rice supply chain in Gorontalo. If the factors of availability and smooth distribution of rice are considered good, then the rice supply chain's performance in Gorontalo is also good. Increasing upstream yields leads to a rise in the availability of rice at the level of supply chain actors, which impacts performance transformation and optimization of supplies to minimize costs and maximize distribution for consumption needs (Maghfiroh & Bantacut, 2023).

Consumer Satisfaction (Z2)

Based on the table above, the result shows that the P-value of the effect of consumer satisfaction on supply chain performance is 0.105. The P-value is greater than the probability value of 0.05 (0.105 > 0.05), so consumer satisfaction has no significant positive effect on the performance of the rice supply chain in Gorontalo Province. The positive sign on the path coefficient indicates that consumer satisfaction has a unidirectional relationship with the performance of the rice supply chain in Gorontalo. If the consumer satisfaction factor is considered good, then the performance of the rice supply chain in Gorontalo is also good.

The cause of consumer satisfaction with an insignificant positive effect is that rice is a basic need, so consumer satisfaction with rice tends to be more influenced by availability, number of family members, and affordable prices than other factors in the supply chain. When the price of rice increased to Rp 1000–2000 per kg, consumers did not change their buying behavior in quantity or brand. They, however, are not completely satisfied with the price and quality. The role of the government, in this case, the District and Provincial Food Office BULOG, is to regulate the price of rice or monitor the daily distribution of rice in the market. This can reduce the direct impact of prices on consumer satisfaction because the price and availability of rice can be more controlled by external factors. Therefore, managing and improving customer satisfaction remains important to rice supply chain performance. Price affects consumer satisfaction (Ngadino et al., 2017). The price determined will be influenced by consumer purchasing power, which satisfies consumer needs. During a transaction, consumers will compare product prices with other similar products. Products aligning with the purchasing power of consumers with desired specifications will satisfy consumers. The price and product packaging have a statistically significant relationship with the buyer's decision process (Zhao et al., 2023). The introduction of satisfaction as a mediating variable led to the observation of full mediation in the case of product prices and partial mediation in product packaging.

Conclusion

The availability of rice distribution and the interaction variable of rice price with the availability and rice distribution have a significant effect on the performance of the rice supply chain. The agility variable significantly affects the availability and distribution of rice. Rice price significantly impacts consumers' satisfaction. The agility variable significantly affects the availability and distribution of rice through the availability and distribution of rice.

Meanwhile, agility, process integration, information sharing, long-term relationships, rice price, and consumer satisfaction have no significant effect on the performance of the rice supply chain. Process integration, information sharing, and long-term relationships do not significantly affect the availability and distribution of rice. Process integration, information sharing, and long-term relationships through the availability and distribution of rice have no significant effect on the performance of the rice supply chain. The price of rice through consumer satisfaction has no significant positive effect on the performance of the rice supply chain in Gorontalo Province.

In the present work, the novelty refers to the finding reporting that the price of rice affects the performance of the rice supply chain through consumer satisfaction and the availability and distribution of rice. However, this relationship is not always linear or one-way. External factors, e.g., the economic situation, technological developments, market competition, and consumer preference changes, can also impact this relationship. An increase in the price of rice, if managed properly by the parties in the supply chain, can positively impact aspects of supply chain performance, including consumer satisfaction and the availability and smooth distribution of rice. In addition, the faster the flow of information, the more opportunistic nature and the independence of capital, making farmers disloyal to one rice distributor, even though the integration process and long-term relationships have been developed.

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