Centre for ASEAN Studies

Centre for International Management and Development Antwerp

ISSN-2031-065X

Quality Management of the Tai Nguyen Rice Supply Chain in the Mekong Delta, Vietnam

Tat Duyen Thu[1]

Vo Thi Thanh Loc[2]

CAS Discussion paper No 106

September 2020

[1] Faculty of Accounting - Finance - Banking, Tay Do University, Vietnam. E-mail: tdthu@tdu.edu.vn.
[2] Mekong Delta Development and Research Institute, Can Tho University, Vietnam. E-mail: thanhloc2010@gmail.com .

Abstract

The study “Quality management of Tai Nguyen rice supply chain” in the Mekong Delta was conducted to enable local managers as well as chain stakeholders a better understanding of the current market requirements for the Tai Nguyen rice quality; to recognize quality differences of Tai Nguyen rice before the year 2009 and 2018; to find out causes for the quality decline and factors affecting the quality of Tai Nguyen rice in all stages of the rice supply chain: production stage, preservation - processing and distribution stage; to analyse factors related to the quality management process and State management influencing Tai Nguyen rice quality along the supply chain. With these objectives, 577 sample observations were interviewed including chain actors, stakeholders and experts. The two provinces of Long An and Soc Trang were chosen for the research sites, where the area and production as well as specialized region of Tai Nguyen rice are biggest in the Mekong Delta. Qualitative and quantitative researches were applied to address the research objectives. The main methods of analysis include descriptive statistics, cost-benefit analysis, amylose test, idle time of the Just In Time model, pair-sample t-test for means, factor and confirmatory factor analyses, binary logistic and multivariate regression model. The main results of the study are: (1) The quality of Tai Nguyen rice in the Mekong Delta is declining seriously compared to prior to 2009. Particularly, a large amount of Tai Nguyen rice has been being mixed with Soc Mien rice (from Cambodia) – this rice shape looks like Tai Nguyen rice but has a lower quality and a cheaper price; (2) Causes for the decline of Tai Nguyen rice quality can be found in all stages of rice supply chain, from inferior quality of paddy in the production stage, to rice preservation and processing as well as the distribution stage; (3) Regarding quality management activities in the Tai Nguyen rice supply chain, plan and test processes are the two factors influencing rice quality in all stages of the supply chain. Eventually, supports of State management consisting of research support, promotion and brand development, market development, market management, capital support, agricultural investment, support for technological and infrastructural development have crucial impacts on the quality of Tai Nguyen rice.

Key words: Quality management, supply chain, Tai Nguyen Rice

1. Introduction

1.1 Rationale

Tai Nguyen (TN) rice is one of the specialty rice varieties in the Mekong Delta (MD), Vietnam, planted 1 crop/year for 6 months during the optimal period, harvested from December to January annually. TN rice is grown mainly in 5 provinces in the MD: Long An, Bac Lieu, Ca Mau, Tra Vinh and Soc Trang (it is suitable for growing in brackish water). Before 2009, TN rice was one of the rice varieties favored by domestic consumers because of its delicate opalescent grain (also known as milk TN), fragrant, sweet and soft after being cooked. Since 2009, the quality of TN rice has deteriorated seriously: the grain has become more transparent, less soft and fragrant after being cooked. There are many reasons found. Firstly, farmers wanted to increase its yield and to make it shorter for preventing rice from falling down, so they have used growth inhibitors (containing Paclobutrazol) and more nitrogenous fertilizers, which have reduced the rice quality and shortened the growth time to 4.5 months (instead of 6-month seasonal production). In addition, local managers of the provinces also said that the quality of TN rice declined due to changes in quality of soil and water: the soil lacked organic fertilizers, the water sources were polluted and prevented from salinity compared to years before 2009. In the collecting and milling stages the rice was mixed with other kinds of rice. Also linkages with rice companies in the distribution stage were lacking. Moreover, the companies actively mixed TN rice with Soc Mien rice (which is quite similar to TN rice, but has a lower price and is harder after being cooked) for domestic distribution and export to China. Finally, in the retail stage, due to the current quality of TN rice, consumers have to mix it with softer rice such as Taiwanese rice, Mot Bui, Huong Lai, OM4900, Nang Hoa (depending on the locality) to cook. These above problems have greatly affected the quality of TN rice in the current market. As a result, most of TN rice consumers have shifted their behavior to consume or mix with other types of rice. Consequently, the TN rice products in the MD show signs of a sharp decline in its quality, distribution and long-standing brand name. Therefore, it is essential to research and propose solutions for a better quality-management of the TN rice supply chain (SC).

1.2 Research objectives

Researching and proposing solutions to improve the quality of Tai Nguyen rice under the SC, so that chain actors, as well as local managers, get reasonable grounds for planning and managing a better quality of TN rice products, meeting both the domestic and export market needs of TN rice. Specifically, the research objectives are as follows:

- Analysing the current quality of the TN rice supply chain in the Mekong Delta.
- Analysing the factors affecting the quality of TN rice under the SC stages (production, storage, processing and distribution)

- Analysing impacts of SC quality management and State management factors to TN rice quality.
- Proposing solutions for better quality management of TN rice SC to meet consumers' requirements.

1.3 Research questions and hypotheses

1.3.1 Research questions

Question 1: what are the causes of changes in the quality of TN rice SC in the Mekong Delta (2018) in comparison with years before 2009? How are the problems in each stage related?
Question 2: What are the advantages and disadvantages of the current TN rice SC quality management? Which factors in the production, preservation, processing and distribution stages affect the quality of TN rice?
Question 3: How do the TN rice quality management practices of the SC actors affect the quality of TN rice? What State management factors are related to and affect the quality of TN rice?

1.3.2 Research hypotheses

Hypothesis 1: The quality of TN rice in the Mekong Delta has deteriorated compared to years prior to 2009.
Hypothesis 2: Factors in the stages of production, preservation and processing, distribution, State management and quality management practices all affect the quality of TN rice supply chain.

1.4 The novelty of the research report

A literature review shows that a lot of studies related to quality management or supply chain management have been conducted. However, research on SC quality management of agricultural products in general, and rice in particular is rare. Therefore, the research is one of the works contributing to the new approach of combining quality management with the supply chain in Vietnam.

Managing the quality of TN rice SC is a new issue that has not been studied before, especially the novelty shown in analysis of factors affecting the quality of TN rice in each stage of the SC (production, storage, processing and distribution stages) and impacting quality management practices, State management on the quality of TN rice SC as well as considering quality of TN rice in relation to the market and consumers' demand.

Moreover, the solutions are aimed to change the mindsets of actors in the SC to improve the quality of TN rice, in order to meet the market requirements. This is a new point that has not been studied before in quality management of agricultural products' SC. In addition, the factors of quality management and State management activities affecting the quality of TN rice along the SC have been studied to change the management thinking of the local managers at all levels as well as the thinkings about production, storage, processing and distribution of all actors involved in the supply chain.

The research also analyses in-depth and integrates this with case study in a comparison between two farming methods: (1) Growing TN rice in the direction of increasing productivity (using growth inhibitors - with ingredients of Paclobutrazol and using more nitrogenous fertilizer) causing TN rice quality to decline significantly and (2) growing upon the 6-month optical period (under natural conditions) for better quality following the Ca Mau case study. This means that the production of old original, good quality TN rice (grainy, milky, spongy, soft and fragrant) is completely possible.

Finally, the idle time according to the Just in Time model in quality management of agricultural products in the SC is for the first time applied for calculating the number of idle days. Idle time is considered an important factor because it greatly affects the quality of TN rice, especially during the storage stage of paddy and rice.

1.5 Research structure

The paper is structured in 5 parts as follows:

Part 1: Introduction. The main contents of this part include: (i) Problem statement; (ii) Research objectives, research questions and hypotheses; and (iii) The novelty of the research report.
Part 2: Literature review. This part includes a short overview of (i) Quality management of agricultural product Supply chain research; (ii) Studies on the Supply chain; (iii) Description of the TN rice SC in the Mekong Delta; and (iv) Research and analytical frameworks of the research.
Part 3: Theoretical foundations and research methodology. The main contents of part 3 relate to the concepts, research methodology and methods of data analysis.
Part 4: Research results and discussions. Part 4 focuses on (i) Analysis of the current status of TN rice quality in the Mekong Delta; (ii) Analysis of factors affecting the quality of the TN rice supply chain; (iii) Analysis of the impact of quality management practices as well as State management, on the quality of the TN rice supply chain; and (v) Managerial solutions to improve the quality of the TN rice supply chain.
Part 5: Conclusions and policy implications. This part summarizes the research results following the research objectives, questions and hypotheses. In addition, policy implications are proposed to stakeholders in the chain to improve the quality of TN rice in the Mekong Delta.

2. Literature Review

2.1 Summary of document overview

Supply chain quality management are concepts extracted from the SC network to create an effective SC (Chu, 2006; Robinson and Malhotra, 2005; Kannan and Tan, 2005; Takahashi *et. al.,* 2005; Madu and Kuei, 2004; Tari, 2004; Kuei and Madu, 2003; Kuei, 2002; Kuei and Madu, 2001). Kuei and Madu (2001) provide a suitable definition for supply chain quality management, in which the lexicons of the entire terminology are defined as parts of an equation to identify total SC quality management (Table 1).

Table 1: Supply chain quality management

Partial definition	Connotation
Supply chain (SC)	Be a network from production to distribution
Quality (Q)	Meet the market demand, quickly satisfy customers
Management (M)	Provide conditions and increase confidence to improve the quality of a supply chain

Source: Kuei & Madu, 2001

Quality management of an agricultural product supply chain have been mentioned and studied by different authors, the main connotations of which are summarized in Table 2.

Table 2: The theoretical connotations related to the research

Topics	Contents	Authors
1. Supply chain	SC includes all steps involved, directly or indirectly, in the response to customer needs. SC actors include farmers, intermediaries (traders, processors, wholesalers and retailers) and consumers in upstream and downstream linkages. Downflow is how to manage SC effectively, backflow is to comply with market requirements in terms of quality and quantity. The combination of downflow and backflow in the SC is desirable for the end product to meet the market demand in quantity and quality at competitive prices.	- Will M. & D. Guenther (2007) - Vo Thi Thanh Loc & Nguyen Phu Son (2013) -Martin Christopher (2010) -Courtesy of Supply chain Council. Inc (2010) - Silva & Moreina (2018)
2. Quality Management	Quality management is a system of activities and measures to ensure that products are delivered to the consumers with the best quality, satisfying society's needs at the lowest cost. Quality management must also be performed throughout the life cycle of the product from the stages of production and storage to the stage of distribution.	-Kaoru Ishikawa (1990) - Robertson AG (1971) - Li et al. (2017)
3. Quality management	It manages the following quality attributes: (1) Nutritional quality; (2) Sensory quality (color, aroma, size, ...) and dietary quality (viscosity, sweetness, ...); (3) Quality of	-Surmsuk Salakpetch (2007) -Noelke & Caswell (2000)

of agricultural products	goods (Quality of packaging, quality of transportation, quality of aesthetics, ...); (4) Quality of hygiene and food safety (Environment of soil, water, air; Plant protection, growth regulator; Processing, preservation, display on sale, ...); (5) Quality of preservation; (6) Processing quality; (7) Seed quality.	-J.A. Patindol (2000) -W.C. Wong (2000) -L. Korsten & E.S. de Jager (2000)
4. Quality management of agricultural products SC	It consists of managing the quality of agricultural products from the fields or farms to the consumers (to the table) under a supply chain system; Managing the quality from (1) Quality management of agricultural products in the production stage (seeds, water, fertilizers, pesticides, field sanitation, workers' hygiene ...); (2) Managing the quality of agricultural products after harvest (clean tools, equipment, storage, packaging); and (3) Managing the quality of agricultural products in processing (clean water, tools, equipment, workshops, packaging). The research also applies the JIT (Just in time) model in industry into agricultural production (calculating idle time in the TN rice SC) and conducts experiments to measure the amylose content.	- Do Thi Bich Thuy (2009) - L.U. Opara (2000) - He, X. and J. C. Hayya (2002) - Kannan & Tan (2005)

Source: Synthesized through the literature review

Regarding the analytical methods for studying SC quality management,the literature shows that there are many methods applied, with factor analysis and multivariate regression as quite common (Table 3).

Table 3: Summary of analytical methods of SC quality management

Authors	Research topics	Research objectives	Analytical methods
Trieu Đinh Phuong (2019)	SC quality management in manufacturing enterprises of electricity - electronics - telecommunications in Vietnam	To measure and evaluate the current status of SC quality management practices in Vietnam's manufacturing enterprises of electrical/electronic/ telecommunication appliances ; to verify the relationship between best practices and performative results.	Linear regression analysis, Case studies
Soares, Soltani & Liao (2017)	Effects of SC quality management practices on quality efficiency: an empirical study	To examine by experiment the relationship between SC quality management practice and related theories	Factor analysis, multivariate regression analysis
Hang et al. (2015)	Supply Chain Quality Management: A Conceptual Model	to research and develop a conceptual model, used as a "manual" to measure and implement SCQM solutions as well as create a premise for further studies, especially experimental studies/application.	Cronbach's Alpha's Analysis, Exploratory Factor Analysis, Confirmation Factor

			Analysis, Correlation Analysis
Sukati et al. (2012)	Study of SC management strategy and practices on supply chain efficiency	To find out the effects of SC management strategy on supply chain efficiency.	Cronbach's Alpha analysis, Factor analysis, multivariate regression analysis
Flynn & Flynn (2005)	The co-ordination between SC management and quality management: new implications	To focus on customers and markets, leadership, information and analysis, human resource development and management, process management, strategic planning, quality information and control from suppliers, cooperative relationships with suppliers, JIT delivery by the suppliers, supplier involvement in quality management.	Correlation analysis and regression
Kannan & Tan (2005)	JIT, comprehensive quality management and supply chain management: understanding the interconnections and their impact on business efficiency	This empirical study examines how JIT, SC management, and quality management are correlated and how they affect on business efficiency.	Factor Analysis and Correlation Analysis

Source: Synthesized through the literature review

2.2 Factors affecting quality upon the supply chain

As to factors that affect the quality of the SC, the following can be concluded based on the literature review:

- Factors in the production stage such as seeds, water resources, soil, environmental issues, pesticides, field sanitation, workers' hygiene, fertilizers and production processes are the main factors affecting the quality of the agricultural product supply chain. In addition to the above factors, the quality of TN rice is also impacted by brackish water sources, Paclobutrazol pesticide and nitrogen fertilizers used by farmers (Salakpetch, 2007; Shaheen, B. *et. al.,* 2013; Đo Thi Bich Thuy, 2009).
- Preservation activities do not create quality of agricultural products, but are an important stage for the quality of agricultural products to be maintained and guaranteed. Factors affecting the quality of agricultural products were identified as: post-harvest technology (drying, milling, ...), pest control, equipment stockpile, storage time and cost. These

factors depend much on the stakeholders' scientific and technical knowledge and their financial capacity in the supply chain (Bagshaw and Ledger, 2000; Sidik, 2000).

- In distribution, storage time, means of transport, presevation practice during transport and storage, mixing with rice of low quality are the key factors affecting the rice quality in general and the TN rice in particular (Vo Thi Thanh Loc *et. al*., 2014).

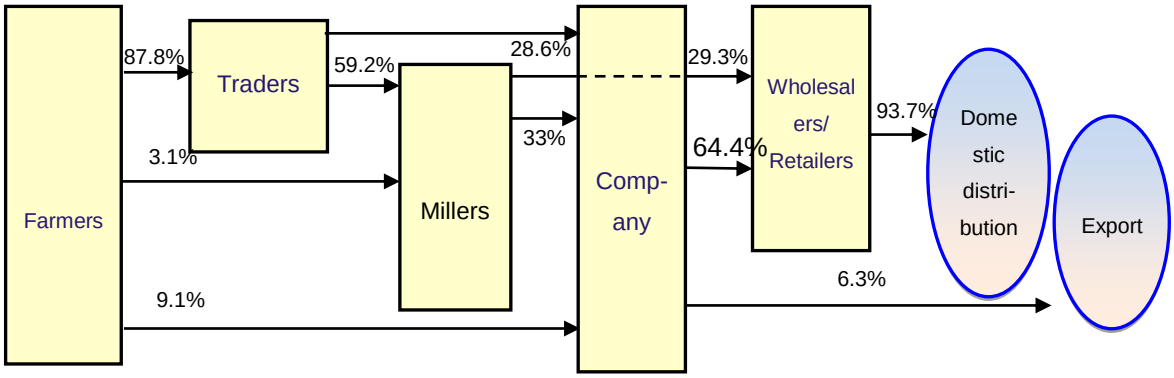
Regarding the State management factors, the State has issued different policies to develop the SC for agricultural products from production to distribution, including policies to encourage production support, capital to link the production and distribution process, support for agricultural research, promotion and branding as well as policies on market development and management in order to produce high-quality agricultural products, better responding to consumer requirements (OECD, 2015).

About the factors related to quality management activities of SC actors during the late 1980s, according to Stoner et al., (1995); Robbins and Coulter (2012), management has four functions which are the process of planning, organization, leadership and inspection/control. This is also a common definition accepted by many authors who have written about quality management, and appears in many books on management. Concerning the research, the four above functions of management will be applied in each stage of the TN rice SC.

2.3 Diagram of the TN Rice Supply chain in the Mekong Delta

Through a survey and assessment of the current status of the TN rice supply chain, a diagram can be developed with 6 actors including farmers, traders, millers, companies, wholesalers/retailers and consumers (Figure 1). TN rice in the Mekong Delta is mainly served for domestic distribution (93.7%) and for export (insignificantly 6.3%). There are 5 market channels for TN rice distribution, in which channel No.1 has the largest volume of distribution through all SC actors (nearly 90% of the TN rice produced). Of all 5 market channels, the net added value (profit/kg) of the farmers was the highest (accounting for over 68% of the total profit/kg of the whole chain).

Figure 1: Diagram of TN Rice Supply chain in the Mekong Delta



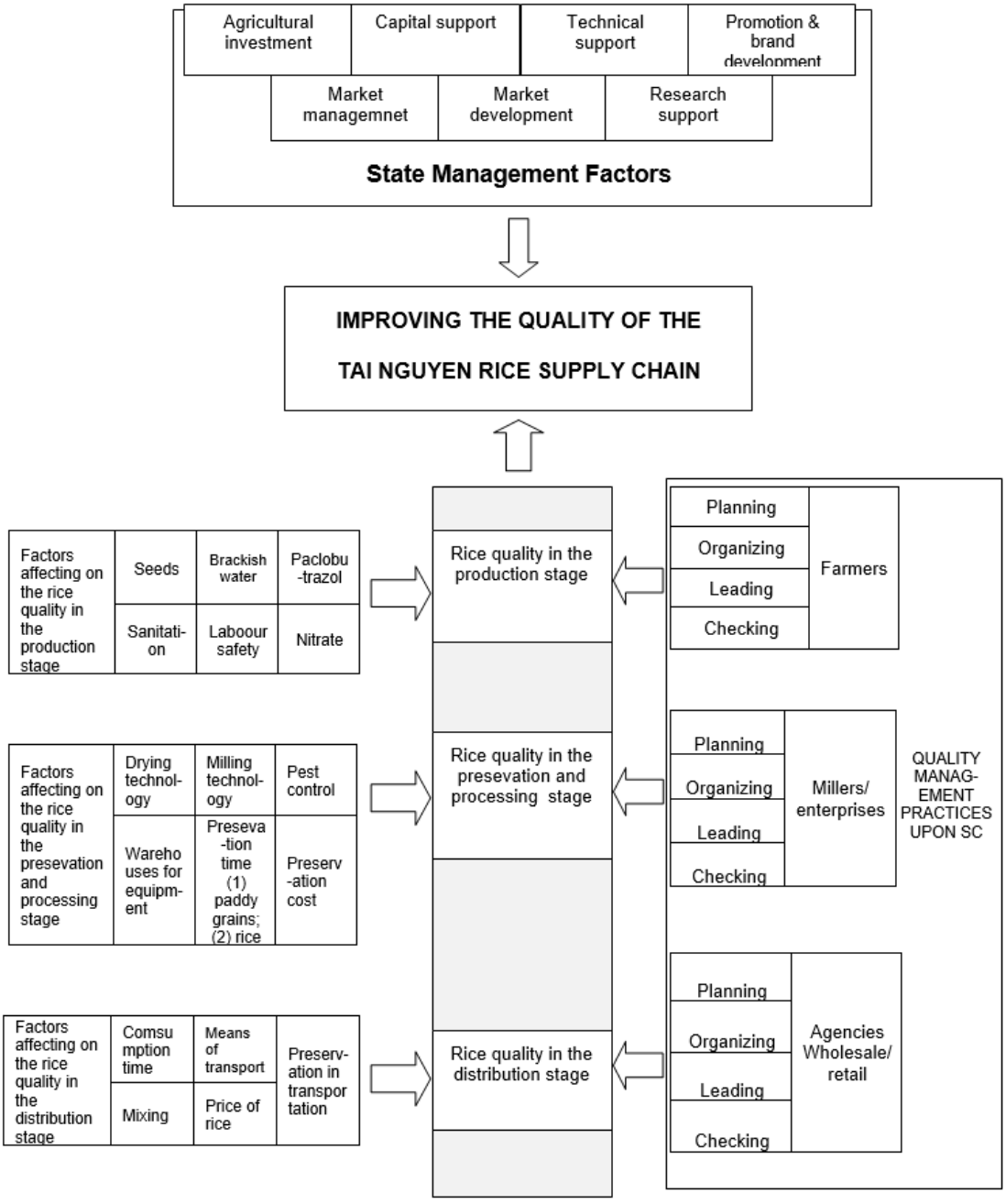
Source: Survey results, 2018

2.4 Research and analytical framework

2.4.1 Research framework

Through the literatue review and the current status of the TN rice SC in the Mekong Delta, the research framework of the study is presented in Figure 2. It describes the main contents to be done to achieve the research objectives.

Figure 2: Research framework



2.4.2 Analytical framework

The analytical framework (Figure 3) includes methods used to analyze the contents stated in the research framework in order to answer three research questions and two hypotheses.

Figure 3: Analytical framework

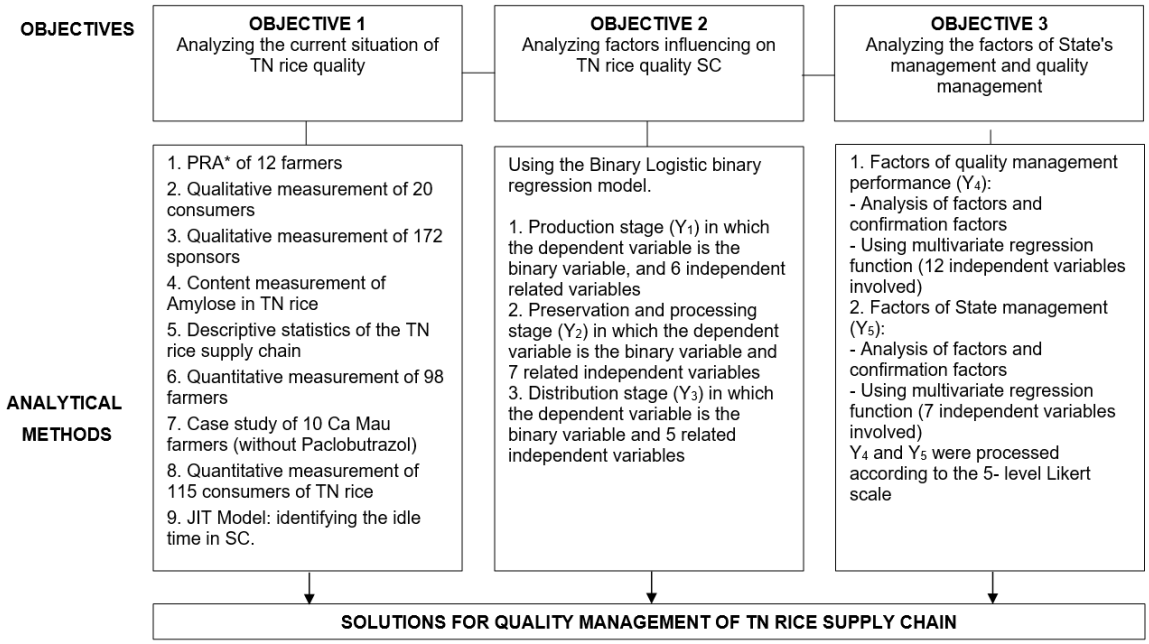


Figure 3: Analytical framework

(*) Participatory Rural Appraisal

3. Theoretical Foundations and Research Methodology

3.1 Theoretical foundations

This part presents some concepts related to rice quality, quality characteristics of paddy/rice, physical/chemical properties of paddy/rice and how to measure rice quality in countries such as Australia, India, Japan, Bangladesh, the Philippines and Vietnam. In general, different countries have different rice quality criteria and measurement methods. However, most countries are interested in the criterion of the amylose content in the rice, which determines the quality of viscid rice, soft or both dry and hard rice (gelatinization resistance). Particularly in the Mekong Delta, when conducting research on rice quality, Bui Chi Buu and Nguyen Thi Lang (2011)

indicated that the quality of rice includes: quality of milling, rice quality after being cooked and nutritional quality. Consumers often pay attention to the quality of cooked rice: amylose content, gel strength, nutritional content including protein, vitamins, and minerals. Amylose was measured by using method of “amylose-iodine complex” wave-spectrum absorption. Similarly, Le Thu Thuy *et. Al.,* (2005) affirmed that the amylose content can be considered as an important component in the quality of cooked rice. Rice varieties with low amylose content (< 21%) usually become wet, viscid, and glossy after being cooked whereas rice with a high amylose content is often dry and hard.

3.2 Research Methodology

3.2.1 Methodological approaches

Analytical methods are applied to reach the research objectives, combining different approaches, especially “Quality management of agricultural product supply chain” (Do Thi Bich Thuy, 2009), the Just-in-time management model in agriculture, the analysis of factors and confirmation factors, binary regression model, multivariate regression and experimental measurement of the amylose content.

3.2.2 Selection of research sites

Criteria to select research sites on TN rice in the Mekong Delta are based on area and yield of TN rice. There are 5 main producing provinces of TN rice in the Mekong Delta. The provinces of Long An and Soc Trang were selected as research sites because they have the largest area and yield of TN rice in the region – accounting for 50.42% of the total area and 54.34% of total yield. They are also the two provinces that show great changes in quality of TN rice from production to distribution in the Mekong Delta.

3.2.3 Sample size and methods

The minimum sampling size is based on the formula of Tabachnick and Fidell (1996): n = 50 + 8m (where m is the number of independent variables). The total number of independent variables of the research is 18 (see below). Therefore, the minimum sample size must be 194 observations, whereas the number of observations in the present study is 577 (Table 4).

Table 4: Structure of sample observations

No.	Chain actors and facilitators	No. of observed samples in 2018	Selection of observed samples

1	Farmers	108 10	Conditional non-random method* Intensive interviews (Ca Mau case)
2	Traders	39	Chain- linking method
3	Millers	18	Chain- linking method
4	Company	19	Chain- linking method
5	Wholesalers/retailers	49	Non-random method
6	Consumers	135	Non-random method
7	Supporters	167	Non-random method
8	Experts	20	Expert method
9	Participatory rural appraisal of famers	12	Group discussion method

(*) The condition is to have a continuous time of TN rice production and trade at least 10 years

3.2.4 Data collection process and analysis methods

3.2.4.1 Conducting qualitative research

- PRA of farmers : A group of 12 farmers were interviewed in the Thanh Tri district using a semi-structured questionnaire, to collect information on (1) Changes in the TN rice production, (2) Reasons of changes of quality in the current TN rice (2018) compared to years before 2009 and (3) Changes in TN rice consumption behavior by the farmer's family themselves.
- Interviewing experts and facilitators of all levels: based on 172 observations, including 15 experts and facilitators using semi-structured questionnaires to (1) redefine the first two issues of the PRA group's results, (2) Determine the scale to measure factors affecting the quality of the TN rice, (3) Determine the scale to measure factors in quality management activities, (4) Orient improvement of TN rice quality in the future and (5) Change in TN rice consumption behavior by the respondents' family.
- Individual interviews with two consumer groups in the Can Duoc and Thanh Tri districts*:* (each group of 10 people) using semi-structured questionnaires in order to explore changes in attributes of TN rice products under consumer perception before and after 2009. The condition of the interview is that the consumers of the two groups have used TN rice continuously for a long time (at least 10 years before, from 2009 to 2018).

3.2.4.2 Conducting quantitative research

(a) Analyzing the current situation of the TN rice quality in the Mekong Delta *(Objective 1),* the following methods were employed:

- *Direct interview with 98 farmers* in the Can Duoc district (49) and Thanh Tri (49) with structured questionnaires, the farmers growing TN rice using Paclobutrazol pesticide and a production time of 4.5 months.
- *Intensive interview with 10 farmers* in U Minh district, Ca Mau province with structured questionnaire, the farmers growing TN rice without using Paclobutrazol and with a production time of 6 months.
- *Direct interviews with 115 TN rice consumers* in the provinces of Soc Trang (30), Long An (30), Can Tho (20), Tien Giang (20) and Tra Vinh (15).

(b) Analyzing the factors affecting the quality of the TN rice supply chain (Objective 2). Specifically, the factors influencing the quality of TN paddy in the production stage (Y_1), in the storage and processing stage (Y_2) and in the distribution stage (Y_3) are conducted by the following Binary Logistic regression model:

$$\log_e\left[\frac{P(Y_i)}{P(Y_i=0)}\right] = \alpha_i + \beta_{i1}X_{i1} + \beta_{i2}X_{i2} + \beta_{i3}X_{i3} + \beta_{i4}X_{i4} + \cdots + \varepsilon_i$$

with $Y_{i\ (i=1\text{-}3)}$ the dependent variable, representing the quality of TN paddy/rice in all stages measured by the dummy variable, expressing the perception towards the statement: “According to you, TN paddy/rice is of good quality” (value 1) for *Agree* responses and value 0) for *Disagree* responses.

Note that “good quality of TN rice” is defined as the quality of TN rice perceived by producers and consumers before 2009 (fine grain, milky, soft, spongy and with a typical aroma).

The independent variables in the three stages are shown in the following tables:

Table 5: Factors in the production stage

Independent variables	Marks	Elaborations	Expectations
Renew TN rice variety	X_{11}	Using the restored TN rice variety as a dummy variable, with value 1 if using the restored variety and value 0 otherwise.	+
Influenced by brackish water	X_{12}	It is a dummy variable, with value 1 if TN rice grown in brackish water and value 0 otherwise.	+
TN rice with Paclobutrazol use	X_{13}	It is a dummy variable. Get value 1 if using Paclobutrazol and value 0 otherwise.	-
Field cleaning	X_{14}	TN rice fields are cleared of weeds, plowed to dry the soil, plant residues as germs of pests and diseases are destroyed. Dummy variable, with value 1 if field sanitation is done and value 0 otherwise.	+
Labor safety	X_{15}	People working directly on the TN rice fields are trained in the use of chemicals, plant protection products; guided about the first aid to labor accidents and poisonings of plant protection drug; personal hygiene; integrated pest management measures. Dummy variable with value 1 if the labour safety is performed and	+

Independent variables	Marks	Elaborations	Expectations
		value 0 otherwise.	
Use lots of nitrogenous fertilizer	X_{16}	The amount of nitrogenous fertilizer used higher than the average level of agricultural extension (Kg/ha).	-

Source: Proposal through review and the actual production stage of TN rice

Table 6: Factors in the presevation and processing stage

Variables	Marks	Elaborations	Expectations
Drying technology	X_{21}	Drying technology is used for TN rice, creating appropriate and safe moisture for preservation. Dummy variable, with value 1 if the dryer is used within 24 hours after harvest and value 0 otherwise.	+
Milling technology	X_{22}	Proper milling technology is used to create rice products of good quality. Dummy variable with value 1 if appropriate milling technology is used and value 0 otherwise.	+
Pest control	X_{23}	Control of harmful organisms and micro-organisms in the preservation stage. Dummy variable, with value 1 if a pest control is performed and value 0 otherwise.	+
Warehouse	X_{24}	Warehouses of equipment help prevent the bad influence of the external environment from the rice. Dummy variable, with value 1 if there is a suitable warehouse and value 0 otherwise.	+
Presevation time of paddy grains	X_{25}	The time from when TN paddy grains are purchased and brought to the warehouse for storage to the time they are processed into rice (day/crop).	-
Presevation time of rice	X_{26}	The time when paddy grains are milled into rice until sold to buyers (day/season).	-
Cost of presevation	X_{27}	Investment in preservation activities (VND/crop).	+

Source: Proposal through review and the preserving and processing stage

Table 7: Factors in the distribution stage

Variables	Marks	Elaborations	Expectations
Time of distribution	X_{31}	The time from when the wholesalers/retailers buy rice to the time when they sell it all to consumers (Date/order).	-
Means of transport	X_{32}	Using specialized means of transport to transport rice. Dummy variable, with value 1 if a specialized means of transport is used and value 0 otherwise.	+
Rice preservation in the distribution stage	X_{33}	Variable with value 1 if sellers meet 3 criteria or more out of the 5 criteria, and value 0 if they meet 2 criteria or less. Criteria to evaluate the status of TN rice preservation in the distribution stage: (1) Plastic or wooden pallets are used on the floor	+

Variables	Marks	Elaborations	Expectations
		(2) There is a cover when delivering rice to the buyer (3) Clean containers made of plastic or ceramic (4) Display shelves are clean, not exposed to sunlight or rain (5) New bags are used; no old bags are reused.	
Mixing with lower quality rices	X_{34}	TN rice is mixed with Soc Mien rice or other types of rice with the same shape but of lower quality. Dummy variable, with value 1 if it is mixed with other types of rice, and value 0 otherwise.	-
Price of TN rice	X_{35}	Prices of TN rice quoted on the market, transformed into a discrete variable as follows: value 1 if the selling price is from: 10,000-12,000 VND/ kg value 2 if the selling price is from: 12,000-14,000 VND/kg value 3 if the selling price is from: 14,000-16,000 VND/ kg	+

Source: Proposal through review and the actual stage of rice distribution

(c) Analysis of factors in the quality management operation of the TN rice supply chain (Y_4) and factors in State management (Y_5) (Objective 3). This is done by analysing EFA discovery factors and CFA affirmative factors, based on a 5- level Likert scale model. Levels express the perceptions of the respondents towards the statement: "According to you, TN rice is of good quality": (1) Totally disagree, (2) Disagree, (3) Relatively Agree, (4) Agree and (5) Strongly agree, with the independent variables shown in the following tables.

Table 8: Factors related to quality management activities upon SC

Actors in the SC	Activities *	Marks	Expectations
Farmers	Planning	X_{41}	+
	Organizing	X_{42}	+
	Leading	X_{43}	+
	Checking	X_{44}	+
Millers/Enterprises	Planning	X_{45}	+
	Organizing	X_{46}	+
	Leading	X_{47}	+
	Checking	X_{48}	+
Agencies Wholesalers/retailers	Planning	X_{49}	+
	Organizing	X_{410}	+
	Leading	X_{411}	+
	Checking	X_{412}	+

Source: Proposal through literature review

(*) The activity scale is defined specifically before the interview and determined through qualitative analysis

Table 9: Factors in relation to the State management

Variables	Marks	Expectations
1. Policies on agricultural extension	X_{50}	+
2. Agricultural investment	X_{51}	+
3. Capital support	X_{52}	+
4. Technical assistance	X_{53}	+
5. Promotion and brand development	X_{54}	+
6. Market development	X_{55}	+
7. Market management	X_{56}	+
8. Research support	X_{57}	+

Source: Proposal through literature review

Note that results of the analysis of factors, discovery factors (EFA) and affirmative factors (CFA) are considered under suitable conditions of these analytical models.

4. Research Results and Discussions

4.1 The current situation of TN rice quality

The consumer opinions and testing results show that the quality of TN rice is declining seriously: cooked rice is stiffer, drier and less sweet. That is also the reason why the majority of the consumers, chain actors and stakeholders have switched to consume other kinds of better quality rice. Specific analysis results are as follows:

(a) The pair-mean test results in following table show that 6 out of 9 quality attributes of TN rice have changed (Table 10).

Table 10: Testing results of pair-mean of TN rice quality attributes

Quality attributes of TN rice	Average marks before 2009	Average marks in 2018	Sig. value	Conclusion
1. Opalescent rice	4.83	4.19	0.000	*More transparent rice*
2. Dedicate grain	4.69	4.61	0.454	Remain unchanged
3. Viscid after cooked	4.10	2.50	0.000	*Dry after being cooked*

Quality attributes of TN rice	Average marks before 2009	Average marks in 2018	Sig. value	Conclusion
4. Fragrant after cooked	3.39	2.35	0.000	*No more scent*
5. Soft after cooked	3.96	2.63	0.000	*Dry and hard after being cooked*
6. Sweet after cooked	4.24	3.08	0.000	*No more sweetness*
7. Blooming after cooked	3.17	3.11	0.765	Remain unchanged
8. Spongy after cooked	3.24	3.23	0.921	Remain unchanged
9. Softness and viscidity remained when cooled or left overnight	4.03	2.77	0.000	*The cooked rice completely gets dry and hard when left overnight*

Source: Survey results, 2018

(b) Analytical results of the amylose content of TN rice in 2018 with the case of improved TN seed were 25.4% while that of the unimproved variety were 26.6%. Both results are in very high levels of amylose content. According to rice experts, the amylose content for soft rice is between 21.3% - 22.1%. Particularly, the amylose content of Ca Mau rice (without using paclobutrazol) was 19.41% (Box 1). Simillarly, the amylose content of TN rice varieties (1994) at the Gene Bank from Cantho University is in the range of 18-20%. They are also the TN varieties of dedicate, milky, soft, spongy, blooming, sweet and fragrant attributes as they used to.

4.2 Analytical results of factors affecting the quality of TN rice supply chain

4.2.1 Factors affecting the quality of TN rice in the production stage

Table 11: Analytical results of factors in production stage

Variables	Coefficient B	Standard error	Wald test	Sig. value	Exp. coefficient (B)
Constant	3.658	2.363	2.397	0.122	38.783
Restored rice variety(X_{11})	2.980	1.336	4.975	0.026	19.687
Influenced by brackish water (X_{12})	2.613	1.208	4.677	0.031	13.647
Using Paclobutrazol (X_{13})	-3.649	1.328	7.549	0.006	0.026
Field sanitation (X_{14})	0.193	1.098	0.031	0.860	1.213
Labour safety (X_{15})	2.849	1.320	4.658	0.031	17.265

Using plenty of nitrate (X_{16})	-0.057	0.022	6.487	0.011	0.945
Chi-square coefficient = 108.513; Sig. value = 0.000					
Value -2 Log likelihood = 25.870					
Coefficient Cox & Snell R^2 = 0.670; coefficient Nagelkerke R^2 = 0.897					

Source: Results of data analysis

The coefficient Nagelkerke R^2 = 0.897 implies that the variables have explained 89.7% of the change in quality of the TN rice. 5 out of 6 variables have affected the quality of TN rice in the production stage, including restored rice varieties, influence of brackish water, paclobutrazol use, labor safety and use of more nitrogenous fetilizer at the 5% significance level.

Box 1: Summary of TN rice information of the Ca Mau Case study

- TN rice area in Ca Mau: 7,000 ha, of which 60% from U Minh district.
- The number of interviewed farmers: 10, who have a production experiences of TN rice of more than 10 years in U Minh.

The main results as below:

- Rice variety: milk TN rice (old TN seeds before 2009), only producing a winter-spring crop per year, lasting 6 months according to the period (sowing in December and harvesting in June). Paddy from the previous season will be kept as seed for the next season.
- Absolutely no use of Bonsai / Paclobutrazol
- Less use or no use of fertilizers and pesticides (low cost of production)
- Average yield: 4.5 - 4.8 tons / ha (while average yield of TN rice in Soc Trang and Long An is about 6.5 ton/ha but lower quality of rice)
- Many bugs, mouse and birds damaging rice
- Amylose content of Ca Mau TN rice: 19.41%
- Selling price of dry TN paddy: 8,000 - 9,000 VND/kg (while average price of TN rice in Soc Trang and Long An is between 5,500 – 6,000 VND/kg at main crop due to lower quality)
- Paddy selling to traders: 60%; The remaining 40% used as seed for the next crop and consumption for the family during the year.

In summary, TN rice in Ca Mau is grown under natural conditions. Although the yield is low, the quality is very good – soft rice, fragrant and fluffy when cooled or left overnight.

Source: The survey results, 2018

4.2.2 Factors in the preservation and processing stage

Table 12: Analytical results of factors in the preservation and processing stage

Variables	Coefficient B	Standard error	Wald test	Sig. value	Exp. coefficient (B)
Constant	17.887	5.618	10.136	0.001	66.877
Drying technololy (X_{21})	4.266	1.445	8.720	0.003	71.218

Milling technology (X_{22})	1.810	1.060	2.917	0.088	6.110
Pest control (X_{23})	-0.867	1.106	0.614	0.433	0.420
Warehouses (X_{24})	4.178	1.487	7.899	0.005	65.247
Time of presevation before being milled (X_{25})	-1.489	0.425	12.294	0.000	0.226
Time of presevation after being milled (X_{26})	-0.708	0.272	6.789	0.009	0.493
Cost of presevation (X_{27})	0.051	0.190	0.071	0.790	1.052
Chi-square coefficient = 117.204; Sig value. = 0.000					
Value -2 Log likelihood = 29.403					
Coefficient Cox & Snell R^2 = 0.669; coefficient Nagelkerke R^2 = 0.893					

Source: Results of data analysis

The coefficient Nagelkerke R^2 = 0.893 reveals that the variables explain 89.3% of the change in the quality of TN rice. 5 out of 7 variables affect the quality of TN rice at 1% significance level including drying technology, warehouses, time of preservation for paddy grains and rice, particularly the milling technology influences at significance level 8.8%.

4.2.3 The analytical results of factors in the distribution stage

Table 13: The regresssive results of factors in the distribution stage

Variables	Coefficient B	Standard error	Wald test	Sig. value	Exp. coefficient (B)
Constant	-15.377	4.265	13.001	0.000	0.000
Time of distribution (X_{31})	0.506	0.214	5.601	0.018	1.659
Means of transport (X_{32})	1.242	1.010	1.513	0.219	3.464
Preservation of TN rice before distribution (X_{33})	2.854	1.189	5.766	0.016	17.363
Mixture with lower quality rices (X_{34})	-2.428	1.114	4.747	0.029	0.088
Price of TN rice (X_{35})	4.522	1.173	14.874	0.000	92.044
Chi-square coefficient = 93.266; Sig. value. = 0.000					
Value -2 Log likelihood = 34.099					
Coefficient Cox & Snell R^2 = 0.637; coefficient Nagelkerke R^2 = 0.850					

Source: Results of data analysis

The coefficient Nagelkerke R^2 = 0.850 shows that the variables explain 85.0% of the change in quality of TN rice in the distribution stage. And, 4 out of 5 variables influence at the significance

level of 5%, including distribution time, preservation of TN rice during distribution, mixture with other lower quality rices.

4.3 Factors of quality management and State management

4.3.1 Factors of quality management (QM) affecting Tai Nguyen rice quality

Through Cronbach's Alpha analysis, factor analysis, exploratory factors (EFA) and affirmative factors (CFA), the results are shown as below:

Table 14: Results of regressive analysis with adjusted QM factors

Variables	Coef.	Robust Std. Err.	t	P>ltl	VIF
(Constant)	2.314	0.0252	91.89	0.000	
X_{41}	0.184	0.0236	7.80	0.000	1.094
X_{42}	0.023	0.0260	0.89	0.377	1.038
X_{43}	0.258	0.0320	8.05	0.000	1.056
X_{44}	0.062	0.0247	2.52	0.013	1.073
X_{45}	0.002	0.0275	0.08	0.936	1.132
X_{46}	0.356	0.0278	12.83	0.000	1.033
X_{47}	0.253	0.0256	9.89	0.000	1.048
X_{48}	0.205	0.0253	8.09	0.000	1.067
X_{49}	0.224	0.0245	9.16	0.000	1.027
X_{410}	0.390	0.0254	15.83	0.000	1.007
X_{411}	0.005	0.0269	0.18	0.861	1.075
X_{412}	0.165	0.0283	5.83	0.000	1.084

Source: Results of data analysis

The determinant coefficient $R^2 = 0.847$ shows that the variables in the model explain 84.7% of the change in the quality of TN rice. And, 9 out of 12 variables have positive effects at sig. level of 1% including Production - Planning (X_{41}), Production - Leadership (X_{43}), Production - Checking (X_{44}), Processing - Organization (X_{46}), Processing - Leadership (X_{47}), Processing - Checking (X_{48}), Distribution - Planning (X_{49}), Distribution - Organization (X_{410}), Distribution - Checking (X_{412}).

4.3.2 Factors in State Management

Through Cronbach's Alpha analysis, and analysis of factors, EFA exploratory factors and CFA affirmative factors, the results are shown as following table:

Table15: Adjusted regressive results of factors in State management

F (8, 163) = 39.40 Prob > F = 0.0000					R-squared = 0.645 Root MSE = .87372	
Variable	Coef.	Robust Std. Err.	t	P>ltl	[95% Conf.	Interval]
X_{50}	0.4184771	0.0715538	5.85	0.000	0.2771852	0.5597690
X_{51}	0.1361976	0.0963478	1.41	0.159	-0.0540532	0.3264484
X_{52}	0.4143962	0.0649477	6.38	0.000	0.2861488	0.5426435
X_{53}	0.2568488	0.0614541	4.18	0.000	0.1355	0.3781977
X_{54}	0.3846772	0.0666731	5.77	0.000	0.2530228	0.5163315
X_{55}	0.4483783	0.0628857	7.13	0.000	0.3242026	0.5725540
X_{56}	0.5741877	0.0725505	7.91	0.000	0.4309279	0.7174475
X_{57}	0.4649751	0.0676895	6.87	0.000	0.3313138	0.5986364
_cons	3.261628	0.0666207	48.96	0.000	3.130077	3.393179

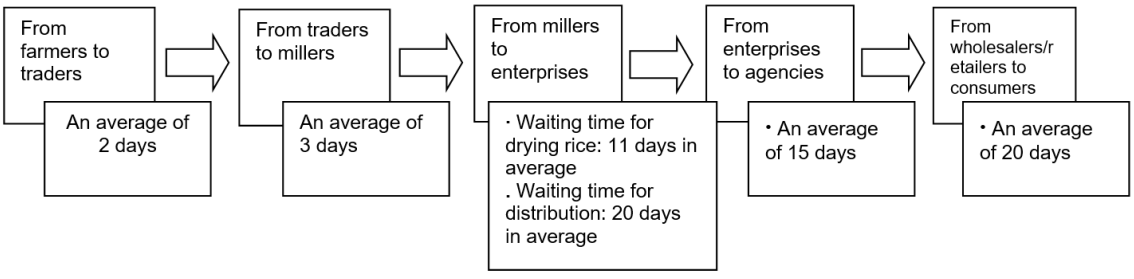
Source: Results of data analysis

From the R^2 it follows that 64.5% of the change in TN rice quality is explained by 08 independent variables at a significance level of 1%, consisting of policies on agricultural extension, Agricultural Investment, Technical Assistance, Promotion and brand development, Market Development, Market Management and Research Support; particularly the variable of Capital Support has an impact at significant level of 15.9%.

4.4 Analysis of idle time in the Tai Nguyen rice supply chain

According to market actors (millers and companies), in order to gain good quality TN rice, the maximum time for paddy/rice to be operated in all chain stages is 39 days (preferably 24 days). However, in reality the total time is on average of 71 days (Figure 4). Thus, the average idle time compared to the factory's/company's requirement is 32 days (71 days - 39 days). If the best time calculated to achieve the best rice quality, the actual idle time in the SC is even higher (71 days - 24 days = 47 days).

Figure 4: Operation time of the Tai Nguyen rice supply chain



Source: Results of data analysis

In short, the idle time in the TN rice SC in the Mekong Delta ranges from 32 to 47 days, of which the waiting time for drying paddy and for rice distribution accounting for 63.7% of the total rice operating time in the SC, which has seriously impaired the quality of TN rice. This result coincides with the results of the binary regression model of the factors in the preservation and processing stages – two variables including the time of preserving paddy grains before drying and storage time of rice after processing have inverse effects on the quality of TN rice.

4.5 Managerial solutions for improving the quality of TN rice supply chain

Based on the analytical results above, the following solutions are suggested to improve the TN rice quality in order to better meet the future consumer requirements.

(1) Build up managerial institutions for managers at all levels and actors in the supply chain to understand the real situation of TN rice quality decline through conferences.

(2) Ensure good management of brackish water for TN rice production by timely opening and closing sluice gates, especially for large areas specializing in TN rice cultivation such as Thanh Tri and Can Duoc districts.

(3) Review and issue new policies on management and support. For example, local authorities need to support funds for researching the nutritional composition of TN rice - cultivating soils, growing TN rice in controlled trials to propose suitable production processes, and improve the quality of TN rice (using seeds, fertilizers (including organic fertilizers) and suitable pesticides).

(4) Continue the support from the local government to further improve the quality of the milky TN varieties; to implement the restoration and propagation as well as to conduct research on soil nutrition of the rice field.

(5) Support to build voluntary large-scaled horizontal links among farmers; Reorganize production co-operatives with an impartial and prestigious leader for better management. These cooperatives focus on producing high-quality TN paddy grains to link with millers/companies.

(6) Evolve and implement policies to encourage more effective and practical linkage investment to attract millers/companies to invest in material areas of high quality TN rice. Furthermore, local authorities at all levels need to assign high-ranking and reputable personnel to closely follow these links and to participate in solving problems associated with millers/companies (change management mindset) timely and promptly.

(7) Support by local authorities of the development of high quality TN rice cultivation models according to the 6-month crop, without Paclobutrazol fertilization to link with millers/companies together to invest in the implementation, in order to strengthen the establishment of high-quality TN rice material areas later. Only successful business links between the above-said farmer cooperatives and millers/enterprises can build up and develop a brand for high-quality TN rice in domestic and foreign markets,

supplying the highly competitive TN rice market,which is also the foundation for the stable and sustainable development of the TN rice supply chain in the long term.

(8) Extend training support by local authorities and other supporting organizations (programs, projects) to farmers of high-quality TN rice in accordance with the above-certified technical procedures.

(9) Evolve and implement policies to support, train, guide and remind traders, managers in millers, enterprises by local authorities about the operation of quality management, about organizing book records and performing the assessing and testing activities to enhance the quality of TN rice, especially to reduce the time of preservation.

(10) Continue to develop large-scale (large field) production models with quality and technical processes and output connection, ensuring the model to develop stably in the long term and in accordance to market requirements, responsibility and risk sharing.

(11) Need to support by local authorities and cooperative alliances to train co-operative leaders on team leader skills, knowledge of effective supply chain and quality management, and business planning as required by millers/enterprises.

(12) Propagandise and disseminate market information, market requirements on the quality of TN rice, benefits of horizontal and vertical linkages, propagating production according to market requirements in quantity and quality to maintain the TN rice brand in the long term through training workshops, house-to-house brochures, local loudspeakers, TV and radio broadcasts.

In summary, all of the above solutions aim to change ways of thinking about management, production and business to improve the quality of TN rice throughout the supply chain. Therefore, these solutions need the consensus of all stakeholders for implementation to bring the best quality of TN rice, to meet the consumers needs.

5. Conclusions and Policy Implications

5.1 Conclusions

Conclusion 1: The quality of TN rice currently has seriously declined compared to 2009 and before

(1) The comparative results of the pair-mean test showed that 6 out of 9 quality characteristics of TN rice changed toward poorer quality.

(2) Analytical results of amylose content in TN rice were high, from 24.66% to 26.26% (This is the reason why the cooked rice becomes dry, hard and no longer soft, spongy and fragrant).

Conclusion 2: Factors in all stages of the TN rice supply chain influences the quality of TN rice

(3) In the production stage: The statistical results confirm that the restored / improved variety and brackish water had positive effects, whereas using more Paclobutrazole and nitrogenous fertilizer had a negative effect on quality of TN rice.

(4) In the preservation and processing stages: There are many factors affecting the quality of TN rice such as drying technology, milling technology and warehouses for equipment, which have positive effects, but the time to preserve paddy before drying and storage time of rice after milling have negative effects, which means that the longer storage time is, the poorer the rice quality gets.

(5) In the distribution stage, the mixing of other poorer quality rice is the factor seriously affecting the quality of TN rice. Similarly, the duration of rice storage and distribution has negative effects.

(6) The idle time in the entire TN rice supply chain is 32 days. In particular, the free time in pre-drying preservation of paddy grains is 9 days and the post- processing time is 5-20 days. These dramatically reduce the quality of TN rice: rice color changes, lots of rice grains are broken after being processed, and weevils infiltrate.

In addition, the activities in quality management and State management both have impacts on the quality of TN rice. Specifically, (1) quality management activities in all stages of production, preservation, processing and distribution affect the quality of TN rice: the planning, leadership and checking factors in the production; the organizing, leading and checking factors in the processing and preservation stage; and the planning, organization and checking factors in the distribution stage positively affect on the quality of TN rice; (2) State management factors such as research support, brand promotion and development, market development, market management, capital support, agricultural investment, and technical assistance all have effects on the quality of TN rice.

To improve the quality of TN rice throughout the supply chain, many managerial solutions are suggested. Among these, 12 main solutions were proposed to change the mindset in management, production and business to improve the quality of TN rice in the entire supply chain, to better meet the demand of domestic and foreign consumers of TN rice.

5.2 Policy implications

In order for the solutions to be taken, some of administrative implications for improving the quality of Tai Nguyen rice in each stage of the supply chain are suggested as below.

(1) For the production stage:

Encourage farmers to be aware of the production of TN rice according to quality-standard technical processes in order to build and develop a brand for the existing TN trademark (Tai Nguyen Chau Hung of Soc Trang province and Tai Nguyen Cho Dao of Long An province). High-quality TN rice production and distribution should be considered for market orientation.

Propagandise the benefits of horizontal and vertical linkages so that farmers voluntarily cooperate in large-scale production with the same production process, technical process (including using organic fertilizers) in order to have the same quality of rice and reduced cost.

Recommend the producers to use the restored TN rice varieties provided by the Agricultural Extension Center or other prestigious providers.

Organize training courses for the farmers to improve their qualification for production, to access and process market information and issues related to the production–distribution process.

Be willing to participate in business partnership with millers / companies, participate in training courses on TN rice market, quality and process of producing high – quality TN rice organized by millers / companies.

(2) For the preservation and processing stage

Disseminate to all the actors of this stage the causes of quality decline of TN rice after harvest, preservation and milling to have a proper plan of implementation, to bring into play the important role of the TN rice SC, through linkages with TN rice farmers, with millers / companies in order to minimize the idle time as well as risks causing the quality decline of TN rice.

Encourage actors to invest in, innovate, and maintain well means of transport in order to reduce losses and ensure the quality of TN rice.

Instruct actors to carefully study the business area and coordinate with related parties in the SC to have a suitable purchasing schedule at reasonable cost.

Encourage investments in improving the drying, processing and presevation technology for rice products in general and for TN rice in particular to reduce the idle time, to ensure that the post-processed TN rice is not degrading in quality and has a low rate of broken rice.

Strengthen consistent quality management. It is necessary to apply a professional process of planning, organizing, leading and checking / controlling to be able to traceability and to qualify to participate in the high-end rice markets.

Facilitate actors to develop areas of high-quality TN rice with investment in materials, technical processes (including using organic fertilizers) and purchasing TN rice products, creating prestige, building and developing its brandname in the future.

Provide market information for horizontal links to produce TN rice by market requirements.

Take sanctions against actions of mixing poor-quality rice with TN rice.

(3) For the distribution stage

Have a business plan to shorten the distribution time and maintain the quality of TN rice.

Sell goods in accordance with the trademark.

Invest in selling areas of standard commodities to ensure rice quality during distribution.

Change distribution habits of TN rice mixed with other types of rice.

Learn carefully the origin characteristics of TN rice, buy rice with appropriate labels and packages and from a reputable agent.

REFERENCES

Australian Centre for International Agricultural Research (ACIAR) (2000). *Quality assurance in agricultural produce*. Edited by G.I. Johnson, Le Van To, Nguyen Duy Duc and M.C. Webb. 714 pp.

Bakker-Arkema, F. W. (Editor) (1999). *CIGR Handbook of Agricultural Engineering.* The American Society of Agricultural Engineers, 4 Agro-Processing Engineering.

Bui Chi Buu, Nguyen Thi Lang (2011). *Improving rice varieties to approach new strategies*. Mai Thanh Phung (Editor). Producing and supplying rice seeds in southern provinces. 5th Agriculture Promotion Forum @ 12/07/2011, An Giang, Agricultural publisher, Hanoi. Page 13-18.

Christopher, M. (2010). *Logistics and Supply chain Management: creating value-adding networks*. 4th edition. FT Prentice Hall. New Jersey. 208 pp.

Chu, S. Y. (2006). Exploring the relationships of trust and commitment in supply chain management. *The Journal of American Academy of Business*, 9(1): 224-228.

Đo Thi Bich Thuy (2009). *Lecture on quality management of agri-product supply chain*. Hue University of Agriculture and Forestry. Vietnam - Netherlands Cooperation Project.

Flynn, B. B., and Flynn, E. J. (2005). Synergies between supply chain management and quality management: emerging implications , *International Journal of Production Research*, vol. 43, no. 16, pp. 3421-3436.

He, X. and J. C. Hayya (2002). The impact of just-in-time production on food quality. *Total quality management*, 13 (5): 651- 670.

Kannan, V. R. and K. C. Tan (2005). Just in time, total quality management, and supply chain management: Understanding their linkages and impact on business performance. *Omega*, 33 (2): 153-162.

Kano, N., N. Seraku, F. Takahashi and S. Tsjui (1984). Attractive quality and must-be quality. *Hinshitsu*, 14(2): 147–156.

Kuei, C. and C. N. Madu (2001). Identifying Critical Success Factors for Supply Chain Quality Management. *Asia Pacific Management Review*, 6(4): 409-423.

Madu, C. N. and C. Kuei (2004). *ERP and Supply Chain Management*. Chi Publishers. Connecticut. 214 pp.

Hang, N.T.T, T. T. Tuan, H. T. M. Loan, L. H. Đang, N. T. Quyen and T. Q. Huy (2015). Supply chain quality management: A conceptual model, *Journal of Science and Technology Development*, 18(4): 114-123.

OECD (2015). *Agricultural policies of Vietnam 2015*, OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264235151-en., accessed March 28, 2018.

Opara L. U. (2000). New market-pull factors influencing perceptions of quality in agribusiness marketing (or quality assurance for whom?). In: G. I. Johnson, Le Van To, Nguyen Duy Duc and M. C. Webb (Editors). *Quality Assurance in agricultural produce*, ACIAR Proceedings 100. Australian Center for International Agricultural Research. 244–252.

Robinson, C. and M. Malhotra (2005). Defining the concept of supply chain quality management and its relevance to academic and industrial practice. *International Journal of Production Economics,* 96: 315-337

Robbins, S and Coulter, M. (2012). *Management*. 11th Edition. Prentice Hall.

Soares, A., Soltani, E., and Liao, Y.-Y. (2017). The influence of supply chain quality management practices on quality performance: an empirical investigation, *Supply Chain Management: An International Journal*, vol. 22, no. 2, pp. 122-144.

Stoner, J., Freeman, R., and Gilbert, D. (1995). *Management*. 6th Edition. Prentice Hall.

Salakpetch, S. (2007). *Quality Management System: Good Agricultural Practice (GAP) in Thailand.* Food and Fertilizer Technology Center.

Shaheen, B. and et al (2013). *Total Quality Management*. Bachelor Project. University of Management and Technology. Lahore, Pakistan.

Sukati, I., Hamid, A.B, Baharun, R. and Yusoff, R. Md., (2012). The Study of Supply Chain Management Strategy and Practices on Supply Chain Performance. *Procedia - Social and Behavioral Sciences* 40 (2012) 225 – 233

Tari, J. J. and V. Sabater (2004). Quality tools and techniques: Are they necessary for quality management? *International Journal of Production Economics*, 92: 267-280.

Trieu Đinh Phuong (2019). *Supply chain quality management in Vietnam's electricity - electronics - telecommunications manufacturing enterprises*. PhD thesis, Vietnam Academy of Social Sciences, Academy of Social Sciences.

Vo Thi Thanh Loc và Nguyen Phu Son (2013). *Product value chain analysis*. Can Tho University Publishing House. Can Tho. 144 pages.

Vo Thi Thanh Loc, Tat Duyen Thu, Nguyen Phu Son, Huynh Huu Tho, Nguyen Thi Kim Thoa and Le Huu Danh (2014). Improving the quality of agricultural products: Solutions for Tai Nguyen rice in Soc Trang province. *Can Tho University Journal of Science* 35: 40-49.

Will, M. and D. Guenther (2007). *Food Quality and Safety Standards as required by EU Law and the Private Industry with special Reference to MEDA Countries' Exports of Fresh and Processed Fruits and Vegetables, Herbs and Spices. A Practitioners' Reference Book*. 2nd Edition. GTZ – Division 45. Eschborn, Germany. 178 pp.