

Rice value chain upgrading in Vietnam: Towards increasing sustainability

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Although Vietnam is one of the biggest rice exporters today, there is an urgent need to restructure the sector. To guide the transition from a quantity focused producer to a credible supplier of high quality rice, this study explores the diversity in value chains and the sector's opportunities for sustainable value chain upgrading. During a participatory multi-stakeholder workshop participants from the public as well as the private sector were guided through several collective tasks to uncover the strengths and weaknesses of the Vietnamese rice sector, and the opportunities and threats (SWOT) the sector faces to become more sustainable. Subsequently, a Strategic Orientation Round (SOR) was used to evaluate the relative importance of the SWOT components. Results show that the stakeholders perceive the sector's capability to grasp opportunities (including growing export and domestic markets) to be higher than its resilience to potential threats (including more stringent food safety regulations and global warming). Three different strategies are discussed for making rice value chains more sustainable: embodying, disembodying and internalizing sustainability.



1 Introduction

Vietnam's development performance in the last two and a half decades is considered as one "one of the most spectacular in the developing world" (OECD 2012). Its rapid and sustained economic growth has transformed the country from one of the poorest in the world to a lower middle-income country status. The rapid growth of the agriculture sector and in particular the rice subsector served as the foundation for Vietnam's successful development success story. The rice subsector and in particular the Mekong Delta (MKD), the country's rice producing belt, have achieved this objective, effectively transforming the country from a rice deficit to a huge rice surplus economy. In fact, it has more than surpassed this goal as the rice exports now serve both commercial urban markets in Africa and the food security programs of rice importing countries like the Philippines and Indonesia by stocking their public food distribution and safety net programs (World Bank, 2012). The rice sector performed effectively the key transformative roles of providing affordable and accessible food and ensuring food security; generating foreign exchange revenues; financing the development of manufacturing and services sectors in as well as providing surplus labor for urban centers; and with stable food prices, serving as the core for low wages and stabilizing inflation (Anh et al., 2013).

In recent years, the role of rice as an engine for rural growth and poverty reduction has subsided. Rising input costs, including those for fertilizer, fuel and labor, have outpaced nominal increases in producer paddy prices (World Bank, 2012). Due to increasing production costs, the Vietnamese rice export sector can no longer rely on cost-competitiveness, a strategy that they have successfully maintained for decades. The sector is currently dealing with severe economic, social and environmental issues.

Vietnam's past growth track was based mainly on high production of low quality rice. The overarching concern then was widespread hunger which had to be resolved quickly and decisively by ensuring available stocks of rice (World Bank 2012). The rice export strategy followed the same route, specifically going for high volume of low quality rice, and selling at low price (McKinsey 2012). Coupled with low production costs, the strategy worked, making Vietnam one of the top five rice exporting economies in the world. However, the perceived



image of Vietnam's rice subsector in the world economy is that it is a supplier of low quality rice. The sector deals with the absence of a national brand and a strong reputation in international markets (Smith 2013).

Although the international commodity price spiked in 2008, most Vietnamese rice growers have benefitted little from elevated international and domestic food prices (World Bank 2012). Many of the MKD rice growers are net buyers of rice and farm households with very small landholdings are no longer able to advance their standard of living by making incremental productivity gains in rice mono-cropping. Consequently, they have to rely increasingly on off-farm sources of income and employment. These findings suggest that it is not the broad mass of smallholder rice growers that benefit from the rice exports which results in a social unsustainable situation.

The Vietnamese rice sector is also dealing with severe environmental issues. Strategies for increased production have mainly focused on intensified rice farming systems, using high-yielding varieties and increased use of agrochemicals (Berg & Tam, 2012). The use of pesticides has increased drastically the past decades (Van Hoi, Mol, & Oosterveer, 2009). The overuse of fertilizers led to high pest and disease infestations, and resulted again in even higher usage of pesticides. Also future problems should not be ignored. The Mekong Delta has been identified as significantly vulnerable to climate change (Dang, Li, Nuberg, & Bruwer, 2014), which is leading to increasing water shortages in the dry season (Dong et al., 2012).

There is an evident need to gradually, yet very substantially modernize the domestic and export-oriented rice value chains. This would help to realize major advances in technical efficiencies at different levels, and promote the introduction and spread of an ethos focused on greater (environmental) sustainability, product quality, and customer service (World Bank, 2012). The goal of the study is to support the development of a future strategy for the rice value chain in the MKD, Vietnam, to become more sustainable. The first objective of this study is to map the different rice value chains in the Mekong delta. Secondly, the study aims to provide strategies for sustainable development based on multi-stakeholder discussion. The analysis was framed around the concept of sustainable food value chain development developed by FAO (2014). The triple



bottom line approach of sustainability was used as benchmark for this study, i.e. combining economic, social, and environmental aspects (see figure 1).

>>>>> Insert figure 1

2 Material and methods

Data was collected through stacked surveys with different rice value chain stakeholders and a participatory workshop bringing several value chain actors together.

2.1 Stacked value chain survey

Stacked surveys were conducted with actors along the rice value chain of the MKD in July 2013. In total 24 interviews were carried out with farmers, millers, small and big traders, food and export companies, millers, wholesalers and supermarkets. The goal of the surveys was to gain a better understanding of (i) quality preferences, (ii) vertical coordination and integration trends and (iii) incentive mechanisms for the adoption of sustainable practices throughout the rice value chain.

2.2 Multi-stakeholder workshop

2.2.1 Participants

Key stakeholders of the Vietnamese rice sector gathered to discuss strategies towards a sustainable rice value chain in the MKD on 5-6 June 2014 in Ho Chi Minh City, Vietnam. The 2-day workshop engaged a multi-stakeholder discussion about the future of the Vietnamese rice industry. Participants included representatives from the public sector (n=14) including the Department of Agriculture and Rural Development, research institutes and universities as well as representatives from the private sector (n=10) including exporters, farmer cooperatives and the food industry.

2.2.2 Method

The data collection was performed using the mixed sequential design of Van Wezemaal, Verbeke, and Alessandrin (2013). Data collection and analysis were executed in two stages. The

first stage consisted of a listing of SWOT components. The second stage consisted of scoring of a SWOT matrix and performing a quantitative analysis through a Strategic Orientation Round (SOR).

2.2.2.1 Qualitative research stage

The evaluation of the MKD rice sector is based on a SWOT-analysis (i.e. an analysis of Strengths, Weaknesses, Opportunities and Threats), a strategic planning tool used to evaluate in a systematic way the external threats and opportunities, and the internal weaknesses and strengths of a business or sector (Fine, 2009). A SWOT analysis is a stepwise method, consisting of specifying the sector's objectives, i.e. becoming more sustainable as a sector, and identifying the internal and external factors that support or hinder achieving the specified objective. The SWOT analysis does not only evaluate the sector itself, but also provides insights into the further possibilities of the sector as well as the emerging threats. This step allows the identification of the main points of interest for future strategy development (Sabbe, Verbeke, & Van Damme, 2009). SWOT analysis is typically done by so-called "prime witnesses", i.e. people who are well familiarised with the topic. In the present study these were different stakeholders in the Vietnamese rice sector. The diversity in backgrounds of participants ensured variability in the obtained SWOT components.

The first day of the workshop, the stakeholders were divided in three randomly selected groups and were asked to list all possible internal strengths and weaknesses, and external opportunities and threats of the Vietnamese rice sector to become more sustainable. To obtain a common understanding of the concept of sustainability, the discussion was framed around an introductory session on the concept of sustainable food value chain development. After the aggregation, those lists were filtered from repeated and overlapping answers. Misclassifications of internal (strengths and weaknesses) and external (opportunities and threats) characteristics were relocated by the researchers. Based on the complete list, the stakeholders were asked to select the five most important strengths, weaknesses, opportunities and threats. This task was first executed in different smaller groups and about some final differences in opinion, consensus was reached through a final group discussion.

2.2.2.2 Quantitative research stage

In the second (i.e. the quantitative) stage of the study a SOR analysis was performed in order to translate the statements in the SWOT analysis into more practical strategic objectives. The SWOT-analysis is mainly a descriptive and synthesizing instrument. Within the analysis, no hierarchy between the components is established and therefore there is no solid base from which to define a strategy. However, based on the qualitative SWOT method, variations have been developed that make the step to a quantitative strategic approach (Dyson, 2004). One such variation is the Strategic Orientation Round (SOR) method (Rutsaert et al., 2014; Van Wezemael et al., 2013). The SOR analysis relies on the outcome of the SWOT analysis. The SOR is a planning instrument that is used to define strategic objectives. While the SWOT analysis makes a situation analysis, the SOR analysis is used to make the step from analysis to strategy. The advantage of strategic orientation is that it explicitly links diagnosis and assessment to strategic decisions and action planning, while the connection between analysis and planning is often implicit.

The identified SWOT components were combined in a matrix where the rows were filled with the internal strengths and weaknesses, and the columns with the external opportunities and threats. In this matrix, each of the internal components was confronted with each of the external components. The stakeholders were asked individually to attribute scores to every single cell of the matrix. These scores represented their answers on four questions related to the quadrant encompassing the cell (see Table 1). Scores were attributed according to two guidelines: firstly, a maximum of 12 points could be attributed to each column; and secondly, each single cell score had to be within the range of 0 to 3, indicating points of no (0) / low (1) / medium (2) / high (3) importance.

>>>>> Insert table 1

The attributed scores in the SOR matrix can be analyzed on different levels. Aggregated scores per quadrant reveal the most relevant strategic choice for improving sustainability in the MD rice sector. Secondly, the total score per strength, weakness, opportunity or threat can be analyzed. This level of analysis makes a distinction between the different components found in the qualitative stage where all the components received an even weight. In this stage, it is possible to



rank them according to their importance. Thirdly, the aggregated scores per cell indicate the relevance of each cell relative to other cells of the SWOT matrix. This allows identifying the key points of interest.

3 Results

3.1 Stacked value chain surveys

Figure 2 depicts the traditional structure and the new trends in the Vietnamese rice value chains. In traditional rice value chains, traders are the first link between farmers and buyers as they collect small lots of paddy from individual farmers or farmer cooperatives. Afterwards, traders sell the paddy to millers. Some millers are engaged only in de-husking or polishing activities while other processors incorporate all activities. Afterwards, rice is sold to wholesalers and/or exporters. Subsequently, wholesalers distribute the rice to retailers or supermarkets who distribute the final product to consumers. In case of the exporters, the rice is sold to foreign countries.

>>>>>Insert figure 2

Increasingly, Vietnamese rice value chains are evolving from traditional procurement to modernized procurement, with a rise in direct sales from farmers to exporters. Exporters are looking for efficient ways to source high-quality raw produce and they are integrating various stages of rice processing in their business models (for example exporters such as AFIEX, Gentraco and Kigimex). Additionally, some exporters engage in close monitoring of production processes providing farmers with certified seeds and control the input use (for example An Giang Plant Protection Joint-Stock Company). Vertical coordination has also led to strong investments in technological infrastructure such as a dryer, de-husker, polisher, color-sorter and packaging equipment.

AGPPS started as a leading agricultural services supplier and recently integrated downstream by incorporating processing and wholesale into their business model. The company provides seed to farmers and buys paddy rice through outgrower contracts. This model has soon inspired major exporters like AFIEX, Angimex, Gentraco, etc. that have recently started similar outgrower



contracts. Hence, we see that increased coordination may come from traditional upstream firms like AGPPS, but also from downstream firms such as exporters. Production contracts and provision of seed allows these firms to better govern rice quality and volumes tailored to their customers' needs. This form of governance has important implications for varietal adoption and diffusion strategies. It is essentially a form of value chain upgrading, which tends to go hand in hand with the implementation of sustainable production standards although some exporters have stopped contracting GlobalGAP¹ or VietGAP² rice due to limited demand. Some small, high-quality rice exporters are still interested in these standards since they claim to have access to certain niche markets (e.g. Hongkong) where consumers would be willing to pay for them.

3.2 *Multi-stakeholder workshop*

3.2.1 Qualitative research stage

The five most important strengths, weaknesses, opportunities and threats of the MKD rice sector to become more sustainable according to the participants of the workshop are presented in table 2. According to the participants, the strengths of the MKD include characteristics from the farmers, the local infrastructure as well as the environmental conditions. High yields are mentioned as an important strength as well as strong government support and extension for farmers. The critical weaknesses of the MKD rice sector are linked to post-harvest equipment, value chain development and linkages, and the size of farmer fields according to the participants.

>>>>> Insert table 2

Growing national as well as international markets are perceived as very important opportunities for the sustainable development of the sector. Other important opportunities are the development and adoption of advanced farming technologies as well as the strong focus on agricultural

¹ GlobalGAP sets voluntary standards for the certification of production processes of agricultural products around the globe, using the production method that minimizes the negative environmental impacts of farming operations, reducing the use of chemical inputs and ensuring a responsible approach to worker health and safety as well as animal welfare.

² VietGAP (Vietnamese Good Agricultural Practices) is a standard issued by the Ministry of Agricultural and Rural Development. VietGAP consists of different criteria with respect to different agricultural products including vegetables, rice, fruit, etc. This is a food safety inspection program, starting from farm preparation, cultivation to harvesting, post-harvest storage, taking into account the environment, chemicals, crop protection products, packaging and the working condition as well as the welfare of the workers on the farm.



investment. The fifth opportunity mentioned by the stakeholders is increasing the focus on diversification of quality and by-products of rice such as mushroom production. Threats for the MD rice sector include both worldwide threats such as climate change and diminishing natural resources as well as more specific threats that are linked to Vietnam's export policy such as increasing global competition, increasingly stringent requirements and demands for food safety and national rice self-sufficiency strategies in importing countries

3.2.2 Quantative research stage

Table 3 presents the total score of the 24 participants. Firstly, the total scores attributed to the different SWOT components are compared. The most important strength of the MKD rice sector in relation to the presented opportunities and threats is the strong government support and extension (332). The most important weakness is the lack of strong linkages in the value chain (258). When comparing the scores of the opportunities, adoption of advanced technologies (272) and the growing export market (261) have the highest scores. Important to notice is that adoption of advanced technologies mainly scores high because of the strengths of the mekong delta rice sector while growing export population also has a high score for the weaknesses. The threats that stand out most are global competition (256) and stringent food safety and hygiene regulations (237). The high score for stringent food safety and hygiene regulations is mainly because of high scores of the weaknesses.

>>>>> Insert table 3

The aggregated cell scores in the first quadrant of the grid (confronting strenghts and opportunities) indicate to what extent a specific strength from the MKD rice sector allows to benefit from a specific opportunity. The high score for adoption of advanced technologies (162) is mainly contributed to the experience level of the farmers (42) and the strong government support and extension (35). The latter strength also has a key contribution for grasping opportunities such as the growing export market (45) and an increasing focus on agricultural investment (40).

The aggregated cell scores in the second quadrant show whether a particular strength enables the rice sector to cope with a threat. Both the threats global competition (38) and self-sufficient

strategies in importing countries (39) can be mitigated by good government support and extension. Otherwise, there are no specific high scores for strengths of the MKD rice sector identified by the participants to adequately deal with the most important threats.

The aggregated cell scores in the third quadrant indicate whether a weakness of the rice sector prevents to cope with a specific threat. Two weaknesses are fairly dominant in this area: insufficient branding, market development and strategy (131) and the lack of strong linkages in the value chain (148). Both weaknesses have very high scores in relation to stringent food safety and hygiene regulations (respectively 41 and 40) and the threat of global competition (respectively 34 and 36).

The aggregated cell scores in the fourth quadrant indicate whether a weakness prevents from benefiting from a particular opportunity. The opportunity to benefit from a growing export market is mainly blocked by two weaknesses: insufficient branding, market development and strategy (35) and the lack of strong linkages in the value chain (31). The latter also prevents to benefit from adoption of advanced technologies (30). An overall strong weakness is the insufficient investment in agricultural machinery (119).

3.2.3 Strategy comparison between the private and public sector

The overall scores of the SWOT analysis can be translated into strategic choices and related policy options, obtained by summing the scores per quadrant in the SOR. Strategy is hereby understood as the way the internal strengths and weaknesses are used to grasp the most important external opportunities and tackle the most important threats. The quadrant with the highest relative score implies the main strategy, which can be offensive (strength-opportunity), defensive (strength-threat), clean-up (weakness-opportunity), or crisis (weakness-threat). A comparison between the public and private sector scores based on the overall strategy is presented in Table 4. The total scores per quadrant are compared to the maximum possible quadrant score taking into account the number of participants, the numbers of rows and the maximum column score of 12. The result shows that for both groups an offensive strategy, i.e. exploiting strengths to take advantage of possible opportunities, is perceived as the most suitable strategy to increase the sustainability of the MKD rice sector. When the private sector is compared with the public

sector, results indicate an increased reservation towards benefiting from opportunities as well as a lower worry towards possible threats of the private sector participants.

>>>>> Insert Table 4

4 Discussion

4.1 *Public vs private sector*

Overall perceptions of the weights of the strengths and weaknesses in grasping opportunities or coping with threats are remarkably consistent among private and public sector stakeholders (row averages). In contrast with the public sector, the private sector tends to be pessimistic in how MKD rice value chains can tap into the expanding export market. Since this is essentially their responsibility, their pessimism should receive more weight in the overall strategic orientation. Moreover, they do not share the public's sector optimism about capturing advanced technological opportunities and opportunities stemming from diversification and by-products. They are, however, less pessimistic about the threats of global competition and the drive towards self-sufficiency in major importing countries. Perhaps they implicitly anticipate that these effects will be canceled out through their planned strategic repositioning of the MKD rice sector from cost towards quality-competitiveness, i.e. those markets are going to play a decreasing role in Vietnam's future rice export sector anyway. However, there is a problem because we saw earlier that they do not feel quite prepared to capture the expanding market due to lack of brand and value chain coordination. Hence, this brings brand development and value chain governance to the front of the priority agenda.

The public sector, on the other hand is more pessimistic about how the MKD rice sector can comply with increasingly stringent food safety and hygiene regulations and less optimistic about the threat from reduction in natural resources. This is a crucial result and indicates that the private sector may have a tendency to underinvest in standards and sustainability. Here, there is a clear role for the government and therefore, the public scores should receive more weight here in the overall strategic orientation. Hence, the optimal strategic orientation should try to strike a balance between the private sector's pessimism in regards to the strategic repositioning of the

MKD rice sector in the global market and the public sector's pessimism with respect to the private sector's willingness to adopt sustainable practices and comply with food standards.

4.2 Different roads towards sustainable production

A crucial pillar of Vietnam's repositioning strategy towards structural and quality-based competitiveness in international markets will be to increase sustainability of current rice production systems in the Mekong Delta. Whilst sustainable production and trade have been addressed for a number of higher-value commodities, the rice value chain has generally been neglected, despite its critical importance for global food security. However, attention is growing. The Irrigated Rice Research Consortium (IRRC) in collaboration with the NARES promoted the "Three Reductions, Three Gains (3R3G)" and later the "One Must Do, Five Reduction (1M5R)" integrated technology packages as a means to reduce production costs, improve farmers' health, and protect the environment in irrigated rice production (Rejesus, Martin, & Gypmantasiri, 2014). The focus of the program is on 1 Must (use quality seed) and 5 Reductions (seed rate, water use, fertilizer use, insecticides use, post harvest losses).

It is often assumed that the implementation of more sustainable farming practices is costless for farmers when it is linked to the reduction of inputs. However, such calculation ignores the non-pecuniary costs (inconvenience, loss of flexibility, loss of economies of scale) that farmers experience in implementing these practices and/or standards. However, many of these costs are of a fixed nature and can be considered as "sunk" after a few years. The point is that farmers need initial investment costs or risks in learning and after a few years, they are used to the practices to the extent that the incremental costs have decline sufficiently such that they do no longer need substantial support. Developing a market driven system for sustainable farming practices is key to providing the well needed resources for the promotion and support of sustainable farming practices. Three different strategies are discussed for making rice value chains more sustainable: embodying, disembodied and internalizing sustainability.

Rising incomes and fast urbanization are driving up the demand for high-value produce as well as heightening consumer concern for food safety (Wang, Moustier, & Nguyen, 2014). There is an increasing attention on the food safety aspect in Vietnam. Such changes in consumer demand

are creating new market opportunities, but are also present novel challenges on small-scale farmers and traders, as new markets may have special requirements in terms of quality and delivery deadlines. Local markets are changing and supermarkets are taking a prominent place in most major cities in South East Asia (Figuíé & Moustier, 2009; Reardon et al., 2014; Reardon & Timmer, 2012). Therefore consumers can be seen as a first financier of sustainable production when sustainable characteristics are embodied in the product and shown through labeling. Food labeling has become more important in supplying information for the consumers to make their buying decision (Verbeke, 2005). The use of information on food labels is crucial to consumers since it helps consumers to make informed decisions when buying a safe and environmentally friendly product. However, it should be acknowledged that sustainability labels currently do not play a major role in consumers' food choices in Europe (Grunert, Hieke, & Wills, 2014).

A second possibility to gain value out of sustainable production is to disembody sustainability from the product. Book and claim certificate trading originated in the energy sector for the trade in electricity of renewable energy through renewable energy certificates. This system was primarily introduced in this sector because physical flows of electricity cannot be followed (Scarlat & Dallemand, 2011). The idea is simple: consumers pay a premium for green electricity, which is electricity produced from renewable sources of energy such as wind and solar power, without directly expecting or demanding that they are also the ones who actually receive and make use of that particular green electricity. More recently, book and claim certificate trading has been adopted by the agricultural sector, starting with the trading in sustainable palm oil (Oosterveer, Adjei, Vellema, & Slingerland, 2014), but it has never been applied to the rice sector. The Book and Claim system would allow for the transfer of sustainable rice credits from the supply base to the end user, independently of the physical rice supply chain. A credit buyer acquires credits corresponding to sustainably produced rice. The certified farmer/mill then sells its rice into its existing supply chain as conventionally produced rice.

The third possibility is to internalize sustainability in the value chain. There is a strong tendency in the mid-stream segment of the rice value chain towards vertical coordination and integration. The more the mid-stream segment (processors, wholesalers, exporters) of the rice value chain engages into vertical coordination and integration, the stronger the linkages become between



(larger) farmers and buyers and the more governance of the value chain and market power shifts downstream, i.e. towards mid-stream actors. Our stacked survey suggests that first experiences with sustainable production practices such as GlobalGAP and VietGAP are mixed. The question is whether the MKD rice value chain is willing to adopt and pay for GAP standards. The success of the implementation of sustainable production practices will crucially hinge on consumer demand for sustainably produced rice and, hence, consumer awareness of the value of the latter.

5 Conclusion

Due to increasing production costs, the Vietnamese rice export sector can no longer rely on cost-competitiveness, a strategy that they have successfully maintained for decades. This implies that the sector will increasingly need to move towards structural, quality-based competitiveness. The SWOT analysis indicated that the sector's major weaknesses are the poor linkages in the value chain and the absence of a national brand and international reputation in international markets. The development of a national brand and its promotion through generic advertising are largely lacking. The analysis also indicated that the Vietnamese rice sector is insufficiently prepared to tackle global competition, increased standards on food safety and hygiene and adapt to reduced international demands for imports from countries that are implementing ambitious national food self-sufficiency programs (e.g. several African countries, Philippines, etc.). The absence of a national brand and image and insufficient horizontal and vertical coordination are key to Vietnam's ill-preparedness to face global competition from other exporting countries such as Cambodia, India and Myanmar. Developing a national brand and a stable reputation of being a quality exporter in international markets takes time. Horizontal and vertical coordination similarly is time-intensive, but these processes will be necessary for sustainable growth.

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Table 1: Meaning of the quadrants of the SWOT matrix

	Opportunities	Threats
Strengths	To what degree does the strength facilitate to benefit from the opportunity?	To what degree does the strength allow to cope with the threat?
Weaknesses	To what degree does the weakness prevent to benefit from the opportunity?	To what degree does the weakness prevent to cope with the threat?



Table 2: Most important SWOTs according to stakeholders

Strengths	Weaknesses
<ul style="list-style-type: none"> • Experienced farmers • Suitable environmental conditions (for multiple cropping) • Good infrastructure for rice production (irrigation) • High yield • Government support and extension 	<ul style="list-style-type: none"> • Insufficient branding, market development and strategy • Small-sized farms • No strong linkages in the value chain • Inadequate postharvest infrastructure leading to quality and quantity losses • Insufficient investment in agricultural machinery
Opportunities	Threats
<ul style="list-style-type: none"> • Growing export market due to population growth • Big domestic market • Adoption of advanced technologies • Diversification and by-products • Increasing focus on agricultural investment 	<ul style="list-style-type: none"> • Climate change • Increasing global competition on world market • Requirements and demands for food safety • National rice self-sufficiency strategies in importing countries • Diminishing natural resources

Table 3: Aggregated SWOT scoring matrix for the public and private sector stakeholders (n=24)

		Opportunities						Threats							
		Growing export market due to growing population	Big domestic markets	Adoption of advanced technologies	Diversification and by-products	Increasing focus on agricultural investment	Subtotal	Climate change	Global competition	Food safety and hygiene regulation	Self-sufficiency strategies in importing countries	Diminishing natural resources	Subtotal	Sum	
		First quadrant						Second Quadrant							
Strengths	Experienced farmers	17	20	42	25	27	131	24	24	24	12	28	112	236	
	Suitable environmental conditions	28	29	27	18	30	132	17	18	13	9	30	87	207	
	Good infrastructure for rice production (irrigation)	21	21	25	15	27	109	28	16	10	6	20	80	187	
	High yield	25	26	33	31	25	140	29	23	12	16	19	99	226	
	Government support and extension	45	27	35	33	40	180	30	38	32	39	26	165	332	
Subtotal		136	123	162	122	149		128	119	91	82	123			
		Fourth quadrant						Third quadrant							
Weaknesses	Small-sized farms	19	12	20	14	13	78	18	29	24	12	28	111	180	
	Insufficient branding, market development and strategy	35	26	14	14	11	100	14	34	41	31	11	131	215	
	No strong linkages in the value chain	31	21	30	25	19	126	23	36	40	27	22	148	258	
	Inadequate postharvest infrastructure leading to quality and quantity losses	18	24	21	24	12	99	20	17	20	14	15	86	180	
	Insufficient investment in agricultural machinery	22	28	25	23	21	119	22	21	21	23	19	106	221	
Subtotal		125	111	110	100	76		97	137	146	107	95			
Sum		261	234	272	222	225		225	256	237	189	218			

Table 4: proportion of the maximum score per quadrant for public sector (n = 14) and private sector (n=10) participants.

	Opportunities	Threats
Strengths	Strategic choice: ATTACK	Strategic choice: DEFEND
	Public sector: $422/840 = 50\%$	Public sector: $308/840 = 36\%$
	Private sector: $270/600 = 45\%$	Private sector: $235/600 = 39\%$
Weaknesses	Strategic choice: CLEAN UP	Strategic choice: CRISIS
	Public sector: $299/840 = 34\%$	Public sector: $349/840 = 41\%$
	Private sector: $231/600 = 39\%$	Private sector: $233/600 = 39\%$

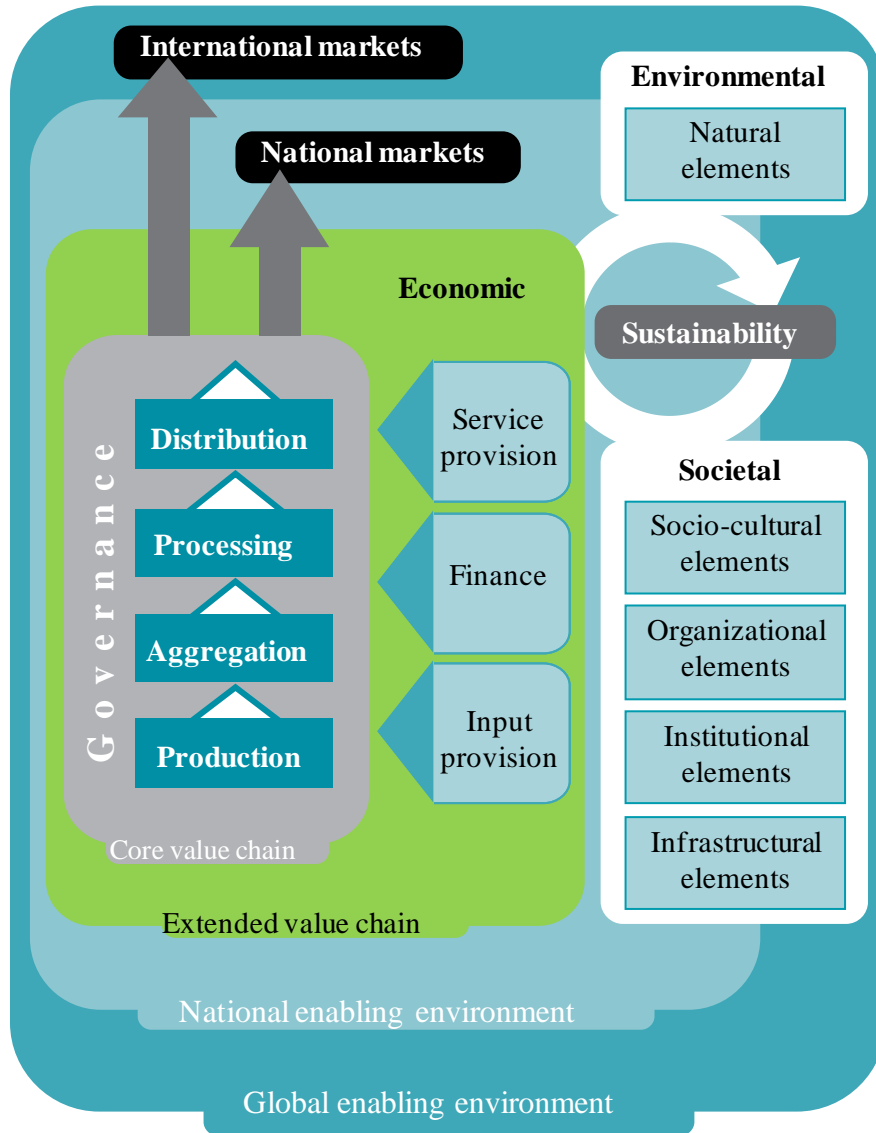


Figure 1: The sustainable food value chain framework

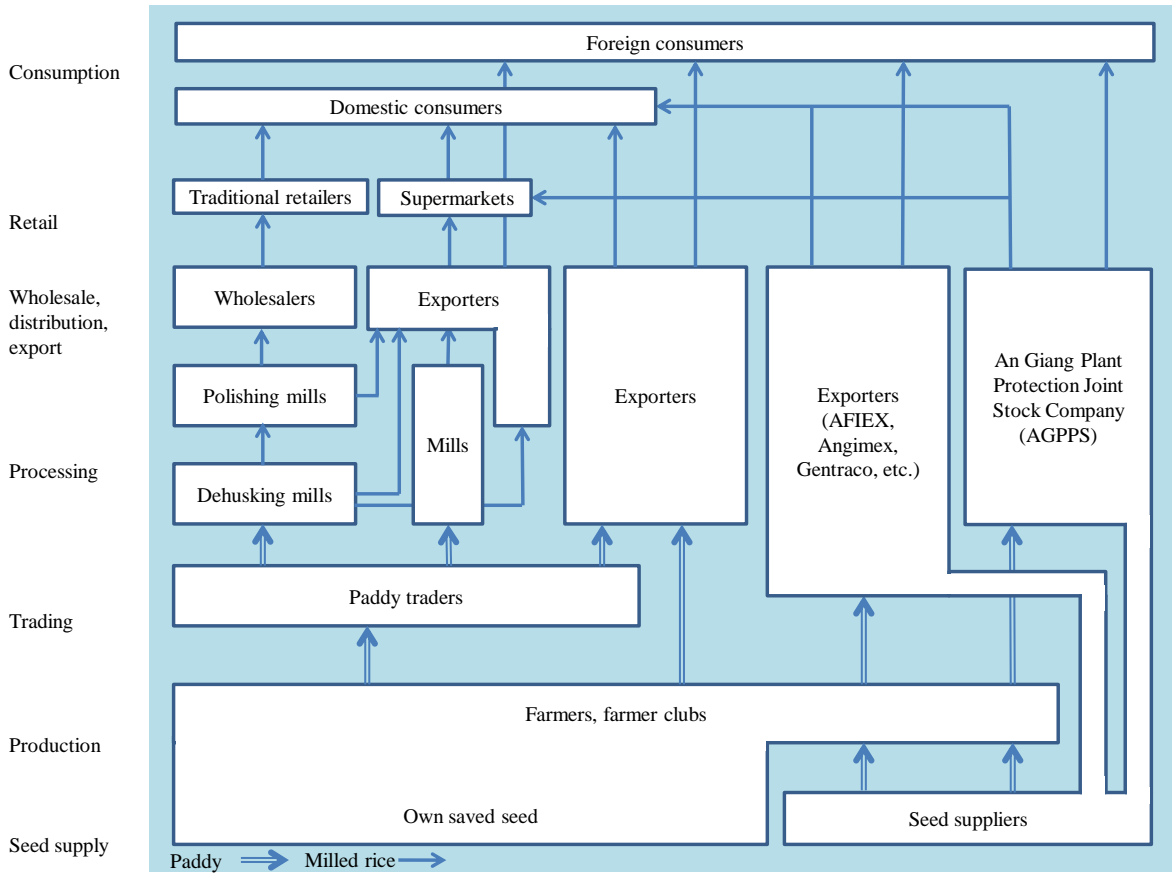


Figure 2: Value chain map of the rice sector in the MKD, Vietnam