MSc Thesis Report

Exploring the Reasons Behind the Farmers' Decision Not to Participate in the National Garlic Farming Programme in Temanggung, Indonesia

Deslaknyo Wisnu Hanjagi

Exploring the Reasons Behind the Farmers' Decision Not to Participate in the National Garlic Farming Programme in Temanggung, Indonesia

MSc Thesis Knowledge, Technology, and Innovation (CPT-80833)
Study Programme Communication, Health, and Life Sciences
Specialisation Communication and Innovation

Author
Deslaknyo Wisnu Hanjagi
921210304040

Supervisors
dr.ir. Annemarie van Paassen
(Chair Group Knowledge, Technology, and Innovation, Wageningen UR)
dr.ir. Tjeerd-Jan Stomph
(Centre for Crop Systems Analysis, Wageningen UR)

Examiner
dr. ir. Laurens Klerkx
(Chair Group Knowledge, Technology and Innovation, Wageningen UR)

Wageningen, August 2018

This research is funded by:

ACKNOWLEDGEMENT

After an intensive period during my second year of the master's programme at Wageningen University and Research, today is the day to write this note of thanks as the finishing touch on my thesis. Writing this thesis has had a huge influence on me, not only in the scientific domain, but also on a personal level. I would like to reflect on the people who have given me a lot of support throughout this period. I would first like to thank to my best supervisors, Annemarie van Paassen and Tjeerd-Jan Stomph, for their valuable guidance and for all of the opportunities to learn from their experience and expertise. You definitely supported me with the tools that are necessary for me to choose the right direction and successfully complete my thesis.

I would also like to thank LPDP for giving me a valuable opportunity to pursue my MSc degree at Wageningen University and Research. I would not have reached this point without their financial support. In addition, I would also like to thank Cees Leeuwis, Noelle Aarts, Laurens Klerkx, and all of lecturers in MCH programme for being my inspirators during the two years of my master's degree. I decided to continue my study at Wageningen after I read the book of Cees, and then I met Noelle, Laurens, and all of lecturers in MCH programme here in Wageningen who gave me a lot of motivation to study communication and innovation. Furthermore, I would like to express my deepest gratitude to my family, especially my mom and dad who always support me to reach my life goals. Without them, I am nothing. Last but not least, I would also thank to my friends and families here in the Netherlands and Belgium. *Ik ben heel dankbaar dat jullie een deel van mijn leven uitmaken en voor al jullie waardevolle hulp en ondersteuning de afgelopen twee jaar. Ik heb een geweldige tijd met jullie gehad en hele goede ervaringen opgedaan! Ik wens jullie veel geluk toe, en hou heel veel van jullie!*

Wageningen, 28th of August 2018

Deslaknyo Wisnu Hanjagi

"For indeed, with hardship [will be] ease." QS 94:5

TABLE OF CONTENTS

TABLE OF FIGURES

TABLE OF TABLES

LIST OF ABBREVIATIONS

AEA	: Agricultural extension agent
AIS	: Agricultural Innovation System
BEP	: Break-even price
Bulog	: Badan Usaha Logistik (Indonesian Bureau of Logistics)
EUR	: Euro
FGD	: Focus group discussion
FWG	: Farmer with garlic
FWOG	: Farmer without garlic
GoI	: Government of Indonesia
GOVT	: Government
Ha	: Hectare (1 hectare = 2.417 acres)
IDR	: Indonesian Rupiah
PPP	: Public private partnership

ABSTRACT

The Government of Indonesia, through the Ministry of Agriculture, established a national garlic farming programme in 2016 to supply the national demand of garlic with local production and reduce imports to zero by 2021. Farmers are encouraged to cultivate garlic as they did in the past before imported garlic started to enter Indonesia in 1998. Farmers in some areas welcomed this effort. However, farmers in other areas decided not to participate in the programme. The purpose of this research is to explore the reasons behind the farmers' decision not to participate in the national farming programme. This research focusses on Temanggung Regency as it is nationally the largest programme implementation area. This research uses the concept of framing during the data collection and analysis to acknowledge the divergence of perspectives among stakeholders, namely the government, farmers, and agricultural extension agents. In this research, the concept of farming system analysis is used to analyse the feasibility of garlic production at the farmer level, and the system failure framework is used to analyse the bottlenecks and opportunities in the envisioned garlic value chain. This research finds that there are three major reasons behind the farmers' decision not to participate in this programme. Firstly, farmers see the future of local garlic as unclear due to the fact that local garlic is less competitive than imported garlic. Moreover, from a farm household perspective, the fact that other alternative crops may be less risky and more remunerative discourages farmers to produce garlic. Secondly, farmers consider that the change is not their idea since the initiative of the garlic farming programme only comes from the government, and farmers were not involved in the planning processes. Thirdly, farmers do not want to be different from their farmers' association. When an association decides not to participate, farmers will obey the decision as a form of solidarity among them.

Keywords: garlic production, value chain, feasibility, system failures

1. INTRODUCTION

Garlic has been a part of Indonesian culinary arts since ancient times. Its strong flavour enhances the taste of the food and increases people's appetite. It is hard to find Indonesian food without garlic flavour. Besides the benefits of the flavour, Indonesian people also believe that garlic is beneficial for their health. In Sumatera, for instance, people put many spices—including garlic—in their fatty foods to reduce cholesterol. There is strong evidence in scientific research that garlic is effective in reducing total cholesterol, triglycerides, and low-density lipoprotein (Alder, Lookinland, Berry, & Williams, 2003). In Javanese culture, garlic is often used as the dominant flavour in soups to relieve inflammation, infections, and flu symptoms as well as to improve the body's immunity. Garlic has an antimicrobial activity against many genera of viruses, fungi, and bacteria which is beneficial for human health (Gebreyohannes & Gebreyohannes, 2013).

The garlic consumption in Indonesia increased between 2002 and 2017 from 1.07 kg to over 1.63 kg per capita in 2017 (Indonesian Ministry of Agriculture, Statistik Konsumsi Pangan 2017 (Food Consumption Statistics 2017), 2017a). Indonesia is considered as one of the biggest garlic consumers in the world. However, about 95% of the garlic supply in Indonesia is imported from other countries—accounting for 495,000 tons—which mainly originate from China (Indonesian Ministry of Agriculture, Statistik Konsumsi Pangan 2017 (Food Consumption Statistics 2017), 2017a). Indonesia is the biggest garlic importer in the world, and its supply is managed by only a small number of importers (Amanda, Syaukat, & Firdaus, 2016). Ironically, Indonesia in the 1990s was a big garlic producer and could supply most of the domestic market, but farmers were discouraged from cultivating it because of a continuous decline of prices due to the mass supply of imported garlic from China.

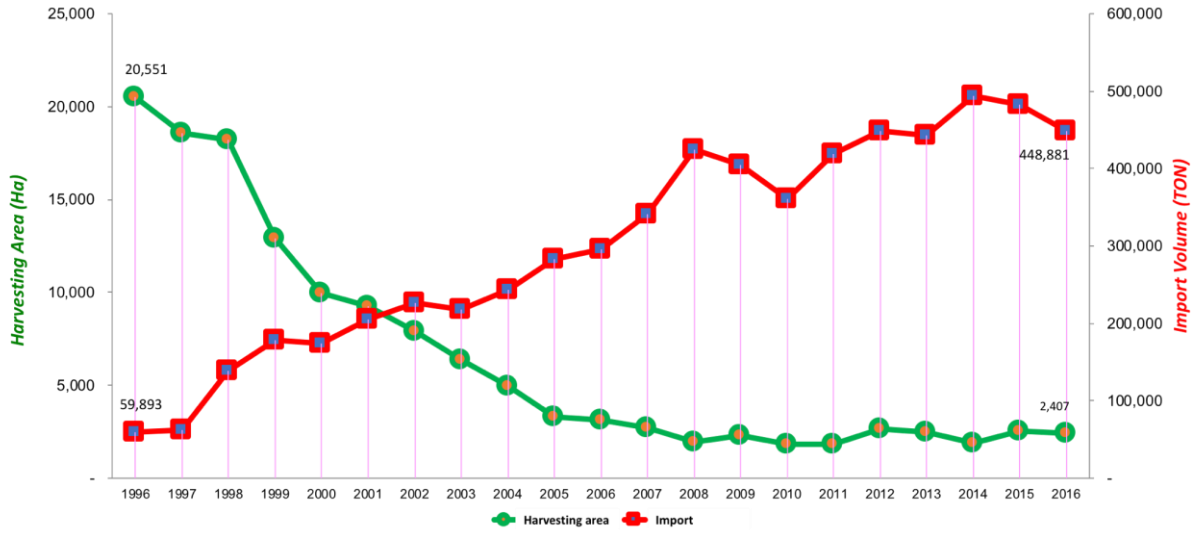

Figure 1 Trends in the harvesting area of local garlic and total amount of garlic import volume from 1996 to 2016 (Directorate General of Horticulture Indonesia, 2017)

Prihasto Setyanto[1] explained in a direct interview on 16 December 2017 that, starting from 1996, imported garlic from China began to enter the Indonesian market with a lower price than local garlic. At that time, Chinese garlic could be 50-70% cheaper than local garlic, making people switching from local to imported garlic. Although the government argues that the quality of local garlic is better than imported (Directorate General of Horticulture Indonesia, 2017), people still prefer to buy the cheaper product. Local garlic was unable to compete. The cost of local garlic production is still higher than imported garlic from China. The Indonesian farmers eventually did not want to plant garlic because it was a loss, and they moved to other crops that were more profitable. As a result, the amount of imported garlic in the domestic market is increasing, and the harvesting area of local garlic is decreasing year by year, as depicted in Figure 1. Now, there are no more than 3,000 Ha of garlic farms, a massive decrease from the 20,551 Ha of farms in 1996 (see Figure 1).

In 2016, the Government of Indonesia (GoI) started their efforts to restore the glory of local garlic by establishing a national garlic self-sufficiency programme which targets Indonesia. The intention of the programme is to supply the national demand of garlic with local production and reduce imports to zero by 2021. This effort would lead to an increase in the area of production from 2,407 Ha in 2016 to 72,249 Ha by 2021 in 19 locations. The GoI is committed to enhancing the production of local garlic through subsidies. The subsidies cover up to half of total production cost, including some agricultural inputs like plastic mulches, fertilisers, and pesticides. Farmers only need to provide seeds and labour. Besides that, the GoI also provide technical assistances via agricultural extension agents and students from various universities. In 2017, for instance, the Academy of Agricultural Extension (Sekolah Tinggi Penyuluhan Pertanian) and Gadjah Mada University Jogjakarta sent 267 students who were willing to plant garlic to support farmers in Temanggung Regency, Central Java Province.

Temanggung Regency is targeted by the GoI to become the largest location of garlic plantations in Indonesia, with a planned 20,000 total harvesting area in 2019 (Indonesian Ministry of Agriculture, 2017b). In the past, Temanggung was well-known as one of the main garlic-producing areas in Indonesia, hence there are farmers with experience in cultivating garlic. The GoI encourages them to plant garlic as before as an alternative crop in the wet season, substituting other horticultural crops such as chili peppers, tomatoes, and shallots. In the past, farmers in Temanggung called garlic the 'white diamond' because its high prices provided a very good source of income for them. The upland area in Temanggung has a suitable agro-climate and land resources for garlic plantations. The local garlic varieties from Temanggung are called Lumbu Hjau and Lumbu Kuning. Those two local garlic varieties have a better quality than imported garlic because of their stronger flavour and more allicin content. Allicin is the most essential active compound in garlic with antiviral, antifungal, and antibacterial properties which are beneficial for human health (Directorate General of Horticulture Indonesia, 2017).

The total area of garlic plantations in Temanggung increased from 530 Ha in 2016 to 640 Ha in 2017. To reach the goal of 20,000 Ha garlic plantations in 2019, the government should put in a large effort to encourage farmers to switch their crops to garlic during the wet season.

[1] Prihasto Setyanto is the Director of Vegetables and Medicinal Plants at the Directorate General of Horticulture, Ministry of Agriculture, the Republic of Indonesia who is responsible for the national garlic self-sufficiency programme.

Farmers in some areas welcomed this effort; they are eager to plant garlic with subsidies from the government. For one hectare, farmers receive about 20 million Indonesian Rupiah (IDR) which is equal to ± 1,212[2] EUR from the government in the form of agricultural inputs, namely 10 rolls of plastic mulches, 750 kg nitrogen-phosphorus-potassium (NPK) fertiliser, 150 kg *zwavelzure kali* (ZK) fertiliser, 1,320 kg dolomite, 10 litres decomposer, and 20 litres liquid organic fertiliser. Farmers also receive subsidies for environmentally friendly pest controls and other technical devices such as cultivators, water pumps, and hand sprayers, managed by farmers' associations.

However, farmers in other locations ignore the initiative; they do not want to cultivate garlic as before. Hence, the question is: what reasons are behind the farmers' decision not to participate in this governmental programme? It is important for the government to know these reasons so that they can set further action plans for encouraging more farmers to cultivate garlic plantations. Therefore, the research in this thesis aims to explore the reasons behind the farmers' decision not to participate in the national garlic farming programme in Temanggung planned by the GoI to reach their national garlic self-sufficiency goal. The research results will be given to the GoI as inputs for their policymaking processes to reach their goal of national garlic self-sufficiency and zero imports by 2021.

2. RESEARCH QUESTION

The main question for this research is **'what are the reasons behind the farmers' decision not to participate in the national garlic farming programme in Temanggung?'**. It is hypothesised that there are three factors behind the farmers' decision to not cultivate garlic, including 1) farmers have a reasoned perception of why garlic is not a feasible alternative crop for their current farming system, 2) there are system failures in the garlic value chain, or 3) there is a lack of communication between the farmers, government, and other garlic value chain actors which leads to the inabilities of actors involved to overcome their constraints. Therefore, to get a more comprehensive understanding of those factors, the following three specific questions are developed:

1. Is garlic perceived by the government, farmers, and agricultural extension agents (AEAs) as a feasible and desirable alternative crop to be cultivated in the wet season within the farming system?
2. Do the government, farmers, and agricultural extension agents perceive system failures in the garlic value chain, prohibiting the adoption of garlic production? What are critical issues for the innovation process?
3. How do the government, farmers, and agricultural extension agents interact with each other in the programme planning and implementation process?

[2] 1 EUR = 15,000 IDR (average currency rate in 2017)

3. THEORETICAL FRAMEWORK

This section discusses the theories that are used for comprehensively analysing the research questions. The first subsection describes the concept of framing. Since this research tends to get the various perspectives of government, farmers, and agricultural extension agents regarding the national garlic farming programme in Temanggung, the concept of framing is used in this research. Secondly, the concept of farming system analysis is explained; this concept is used in this research to explore whether the national garlic farming programme is feasible or not for implementing in Temanggung based on the government, farmers, and agricultural extension agents' perspectives. Thirdly, the system failure framework is provided to explore the bottlenecks during the implementation of the national garlic farming programme in Temanggung. This framework covers infrastructural, institutional, interaction, and capability issues. By doing farming system and system failure analyses, this research aims to reveal the rationale of farmers regarding their decision not to join the national garlic farming programme.

3.1. The concept of framing

In social science, framing is defined as a set of concepts which explains how people perceive, construct, organise, and communicate about social reality (Wicks, 2005). Aarts and van Woerkum (2005) argue that the concept of framing is used for understanding '*the rules which govern our appreciation of our world and enables us to differentiate between different sorts of reality.'* People frame a reality through making sense of, perceiving, interpreting, and giving meaning to what is going on in the world (Aarts & van Woerkum, 2005)The frame determines how people notice, understand, and remember a problem, and further defines how they act upon it (Entman, 1993).

In order to understand the stakeholders' perspectives on the feasibility of the garlic farming programme in Temanggung and the system failures attached to the programme, four functions of framing by Robert Entman (1993) are used in this research:

1. *Define problems*: stakeholders define what kind of problems there are in the programme;
2. *Diagnose cause*: stakeholders identify the forces creating the problems;
3. *Make moral judgement:* stakeholders evaluate the problems and determine to what extent the programme is or is not feasible;
4. *Suggest remedies:* stakeholders offer and justify treatments for the problems and predict their likely effects.

3.2. Farming systems analysis

Farming is not only a source of food for a large number of people in developing countries, it also provides a livelihood from which people get food and income to meet their daily needs—for instance, clothing, shelter, health, and education. In many cases, farming is also a source of pride for people in their community. In the past, agricultural research was only focusing on how to increase production per unit of land area of certain crops, also known as commodity

approach research (Fresco, 1988). While increased output has been an important thing for improving the farmers' conditions in many countries, at the same time it is clear that yield increase is not enough to reduce rural poverty because it works only for technical problems and does not address the social issues attached to rural poverty (Fresco, 1988).

Farming system analysis (FSA) has turned up as a response to the concern of commodity approach which is only focused on increasing productions rather than adapting new agricultural technology to farmers' socio-economic and ecological constraints. The most distinguishing feature of FSA when compared with other types of farming analysis is its interdisciplinarity, which combines technical elements with economic and other elements (Fresco, 1988). FSA tries to integrate biological, physical, social, and economic factors into a holistic approach towards rural life. This is a beneficial approach due to the fact that the farming system is a complex interlinked system of soils, crops, climate, capital, labour, knowledge, market, and interdependent farming enterprises (Oben & Boukong, 2014).

In FSA, the fact that there are diverse socio-economic and biophysical environments in the farming system should be considered (Oben & Boukong, 2014). Each household is not the same; they develop different livelihood strategies based on the material goods, properties, barriers, and opportunities in each environment. Small-holder farmers are highly heterogeneous, diverse, and dynamic (Tittonell, 2013). Households are different in production orientation (marketing vs. food security), resource endowment (land vs. livestock owned), objectives (profit vs. survival), soil-landscape associations, land use, education, management skills, ethnicity, past experience, and attitudes towards risks (Oben & Boukong, 2014; Tittonell, 2013).

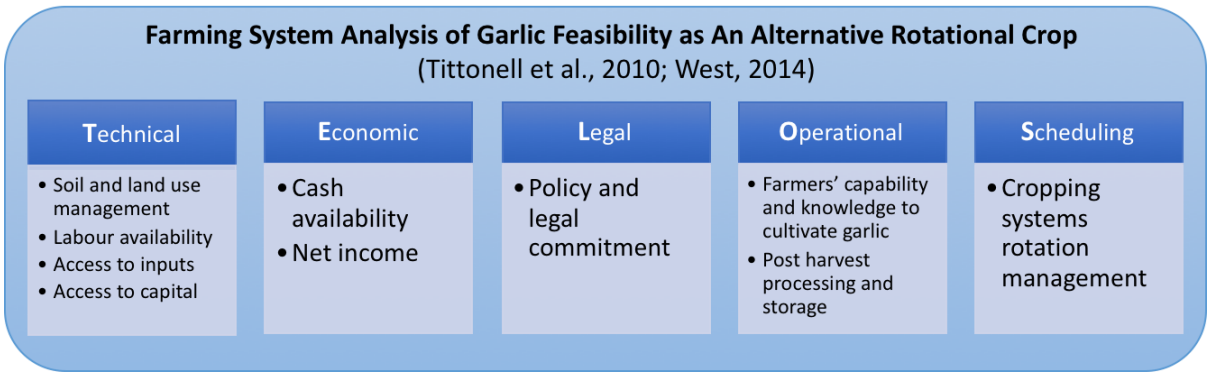

Figure 2 Farming system analysis framework used in this research (adapted from Tittonell et al., 2010 and West, 2014)

In this research, FSA is used to explore the feasibility of garlic cultivation in the wet season for substituting other horticulture crops in Temanggung. The feasibility here refers to a condition that garlic can be attractive to produce in the targeted farming systems. This FSA focuses on the perspectives of the government, farmers, and agricultural extension workers. There are five feasibility areas distinguished in this FSA, namely technical, economic, legal, operational, and scheduling (Figure 2) as elaborated hereafter.

Technical feasibility

Technical feasibility refers to an assessment based on the system requirements of both software and hardware which allow certain commodities to be technically producible (Rouzbahani, Babaei, Mehdi, Mojarad, & Yaghoubi, 2013; Roberts & Mosey, 2014). FSA looks at not only the options farm households have, but also their aspirations, and then considers what cropping or other activities potentially match their goals, aspirations, and means. In the agricultural sector, technical feasibility is strongly related to physical factors influencing the crop productions. Tittonell et.al. (2010) described four physical factors that should be assessed to find out whether a crop is suitable to a particular area or not, including soil and land use management, labour availability, input management, and access to capital.

Economic feasibility

Although the economic element of the crop substitution scheme is not the only deciding factor for farmers to apply the crop substitution programme (Elzen & Barbier, 2012), it may be used as the primary factor influencing their decision-making processes. In this research, the analysis of economic feasibility is done by assessing how the government, farmers, and agricultural extension agents describe the cash availability and net income for farmers provided by garlic compared to other alternative crops.

Legal Feasibility

Legal feasibility refers to legal commitments and state legislation for a certain programme (Rouzbahani, Babaei, Mehdi, Mojarad, & Yaghoubi, 2013). The analysis of legal feasibility determines whether the national garlic farming programme in Temanggung conflicts with legal requirements or not (West, 2014). In this research, the legal feasibility describes the legislation underlying the development of the national garlic farming programme in Temanggung as an effort to reach the national garlic self-sufficiency goals in 2021.

Operational feasibility

Operational feasibility shows the ability of the targeted group to implement a certain programme, for instance, by observing their skills (Syaifullah & Widianto, 2014; West, 2014). The analysis of operational feasibility will indicate whether farmers perceive themselves as skilled enough to cultivate garlic, access infrastructure, and do post-harvest processing and storage. This analysis also assesses how the government and agricultural extension agents help farmers to gain more knowledge and best practices in garlic farming.

Scheduling feasibility

Scheduling feasibility refers to an assessment of the implementation schedule of a certain crop cultivation in the whole cropping calendar used at the farming system level (Syaifullah & Widianto, 2014). Tittonell et al. (2010) mention that timely crop management is a part of farming systems analysis. The analysis of scheduling feasibility describes to what extent garlic farming fits the cropping systems rotation and labour management in the farming systems as perceived by the government, farmers, and agricultural extension agents.

3.3. The system failure framework

In order to analyse the failures of the national garlic farming programme in Temanggung, this research uses the system failure framework for innovation policy design developed by Woolthuis et al. (2005). This framework aims to analyse what kind of and where the failures of the national garlic farming programme occur, which actors are involved, and to what extent the relationships between actors happen. Figure 3 depicts four categorisations of system failures by Woolthuis et al. (2005) and van Mierlo et al. (2010) which provide a possibility to analyse where there are bottlenecks which hamper the success of the national garlic farming programme in Temanggung.

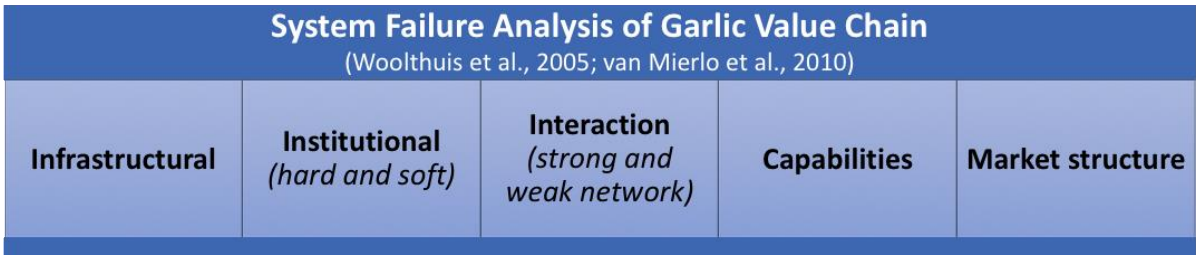

Figure 3 Categorisations of system failures used in this research

1. *Infrastructural failure*: A reliable infrastructure is needed to enable innovations to be adopted by people in a particular area. The lack of infrastructure leads to the inability of farmers to adopt the new farming practices (garlic farming).
2. *Institutional failure*: The institutional failure is conceptualised as the socio-political environment in which all actors—including farmers, government, extension agents, and markets—are embedded. It is distinguished into hard- and soft-institutional failures.
   - Hard-institutional failure refers to the regulations, formal mechanisms, and written laws that may hinder the new farming practices.
   - Soft-institutional failure refers to the wider context of social values and political culture which form the implicit rules of the game that can hinder new farming practices.
3. *Interaction failure*: This involves the relationship between all of the actors in the system. Interaction failures can occur in two ways: either too much interaction that creates a strong network, or too little that makes a weak network.
   - Strong network failure leads to groupthink that generates blind spots, lack of information exchange, and makes people close-minded and averse to new ideas.
   - Weak network failure leads to a lack of shared vision and possibilities for interactive and complementary learning.
4. *Capability failure*: The capability failure refers to the lack of absorptive capacity, competences, or resources needed from all of the actors for the new farming practices.
5. *Market structure failure*: This failure refers to the system barriers that emerge because of market phenomena such as supply, demand, and monopoly.

This framework does not suggest that in practice, all types of infrastructure, institutions, and actors are present in every system (Wieczorek & Hekkert, 2012). However, the system failures cannot be addressed directly or solely by a single actor (Woolthuis et al., 2005).

It is an interesting phenomenon that the way people interact will influence the creation of issues and events (Aarts & van Woerkum, 2005). Leeuwis (2003) argues that an agricultural policy is unlikely to be successfully applied unless an adequate effort has been made by the government during the policy design and implementation processes to listen and interact with actors in the value chain. This research uses the system failure framework to study how farmers and other stakeholders perceive the garlic value chain and government initiative to function, and whether it motivates farmers to get involved in the system. Thus, by focusing on the interaction failures, this research will also explain the communication between the government, farmers, and agricultural extension agents involved in the value chain of the national garlic farming programme in Temanggung.

3.4. Summary of research framework

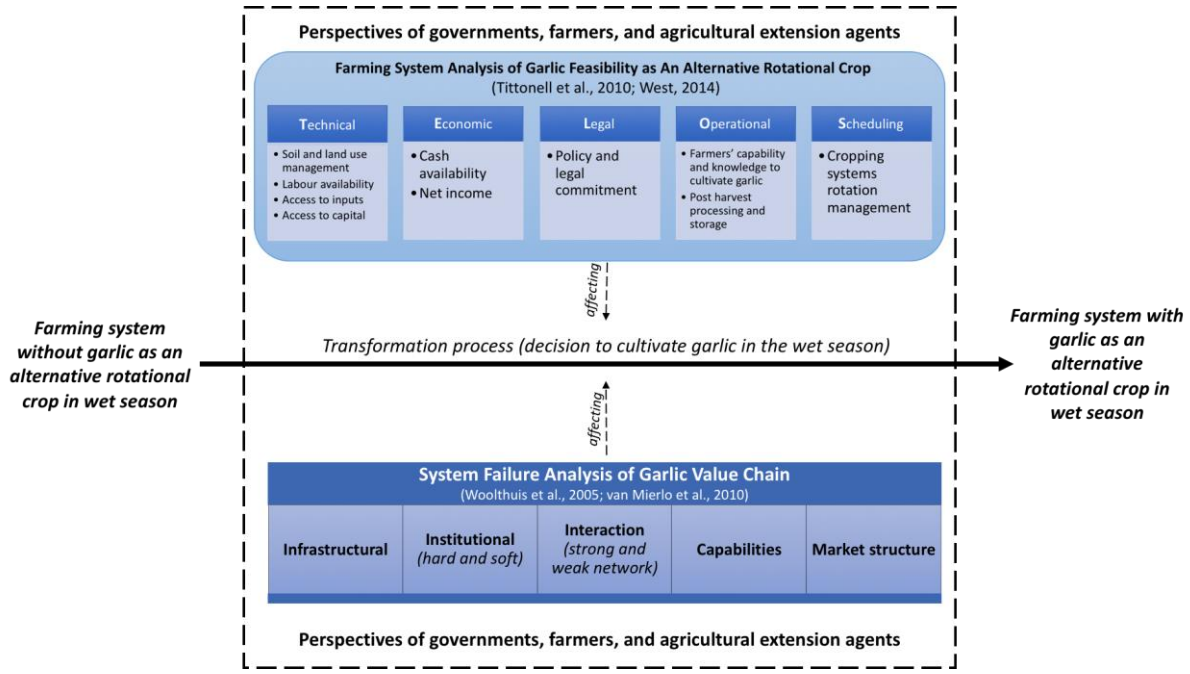

Figure 4 Research framework for reflexive analysis of the transformation potential of garlic as an alternative crop in the local farming system

To give a broad understanding of why farmers in Temanggung do not plant garlic as an alternative crop in their farming system during the wet season, the research framework depicted in Figure 4 is proposed. All of the analyses in this research are based on the perspectives of stakeholders involved in the programme including the government, farmers, and agricultural extension agents. It is important to study all stakeholders' perspectives (includes their goals, aspirations, and analyses of risks) because each actor has a different interpretation of the world, so that they have their own perspective and reasoning on what happened in the implementation process of national garlic farming programme in

Temanggung. Therefore, this research acknowledges the different perspectives of every stakeholder (government, farmers, and agricultural extension agents) during interviews and then uses the research framework to analyse those different perspectives.

Firstly, to answer the first specific research question, a farming system analysis is conducted to understand farmers' livelihood and farm aspirations and strategy as well as the perceived fit of garlic as an alternative crop to be cultivated by farmers during the wet season. This research considers factors influencing the farming system as mentioned by Tittonell et al. (2010), classified into five feasibility elements mentioned by West (2014)— including technical, economic, legal, operational, and scheduling—to make the analysis more structured. This farming system analysis is conducted based on the perspectives of the government, farmers, and agricultural extension agents while also considering how those stakeholders frame farmers' livelihoods and aspirations, problems and opportunities attached to the national garlic farming programme, and possible solutions to solve the problems.

In farming system analysis, soil and land use management are prominent for being considered (Tittonell, et al., 2010). It includes how stakeholders see to what extent garlic farming influences and is influenced by the soil fertility and land use management at the farm level. Labour availability, access to inputs, and access to capital are also parts of farming system analysis to see whether garlic can be produced by the farmers. In the economic aspect, the seasonal cash availability and total net income are factors influencing the farmers' decision to undertake farm activities, as well as choosing what crops they are going to cultivate (Tittonell, et al., 2010; Derpsch, Lange, Birbaumer, & Moriya, 2016). Tittonell et al. (2010) also mention that changes in policy have implications for farming system design. Thus, policy and legal commitment have to be considered in the analysis of the farming system.

Farmers' capability and knowledge to cultivate certain crops are also mentioned by Tittonell et al. (2010) as a factor influencing the farming system. It includes the farmers' access to agricultural information and knowledge. Therefore, the farmers' capability and knowledge for cultivating garlic as well as for doing post-harvest processing and storing will influence their decision to add garlic to their current farming system. Those two factors are grouped into the operational element of farming system analysis of garlic farming. In the end, Tittonell et al. (2010) also consider timely crop management as part of farming system analysis. To what extent garlic farming fits the crop rotation management will influence the farmers' decision to add garlic in their current farming system.

Although the feasibility of cultivating garlic in Temanggung during the wet season may be considered as high, the system of the garlic value chain itself may be perceived as troublesome by the farmers and cause a disinterest for farmers to cultivate garlic. Therefore, secondly, in a broader view, this research uses the system failure framework of Woolthuis et al. (2005) to analyse if there are failures in the garlic value chain—and if so, what kind of failures there are—to answer the second specific research question. This research investigates the possible system failures of the national garlic farming programme in Temanggung by using five failure categories—including infrastructural, institutional, interactional, capabilities, and market structure failures—within the following actors: farmers, government, agricultural extension agents, input suppliers, and consumers. The system failure analysis as applied in this research can be seen in Table 1.

Thirdly, this research will further observe the interaction and communication space between all actors during the planning and the implementation of the national garlic farming programme in Temanggung starting from 2015 until 2017. Schut et al. (2014) argue that more attention is needed for the interactional dimension since it is always overlooked in publications of system approaches to innovation. Thus, as highlighted in Table 1, this research hones-in on and pays specific attention to the interactional dimension of the system failure analysis on the garlic value chain to see whether and how communication constrained the implementation of the national garlic farming programme in Temanggung, at what level it occurs, and then look whether the issues playing at farming systems level and differences in views from stakeholders is linked with this interactional dimension creating a situation in which stakeholders fail to communicate on what is essential.

Table 1 The matrix table of system failure analysis to see, for each of the five system features, at which level in the garlic value chain the failures occur (Woolthuis et al., 2005 and van Mierlo et al., 2010)

	Farmers	**AEAs**	**Government**	**Suppliers**	**Consumers**
Infrastructural failure					
Institutional failure Hard-institutional					
Soft-institutional					
Interaction failure Weak network					
Strong network					
Capabilities failure					
Market structure failure					

4. RESEARCH METHODOLOGY

This section describes the case study area, the data collection methods that are used during the field work, and how to analyse the data. The field work is held in two villages in Temanggung, including one village which implements the national garlic farming programme (Wonosari Village) and one village which refuses the national garlic farming programme (Bansari Village). This research uses three different data collection methods, namely literature studies, individual in-depth interviews, and focus group discussions. Data analysis is conducted using methodological triangulation with a pattern-matching logic strategy conducted in Microsoft Excel.

4.1. Case study area

Figure 5 Case study area (based on Google Maps)

This research is conducted as qualitative explanatory research with the case studies of the two villages, Wonosari Village and Bansari Village, in January 2018. Figure 5 shows the location of the two villages (the red and the blue lines indicate village territories and the hydrological infrastructure, respectively). These two villages have the same natural and socio-demographical characteristics because they are located in the same area. The distance between the two villages is around two kilometres, and the people even have adjoining farm lands.

4.2. Data collection

In case study research, it is important to use different sources of evidence (Yin, 2009). Therefore, this research uses three methods of data collection which compliment to each other, including literature studies, individual in-depth interviews, and focus group discussions (FGDs).

The literature study is conducted through a review of policy papers to obtain specific information about the area of study. The policy papers are obtained through offline access in the local government office since there are a limited number of documents uploaded to the internet.

The individual in-depth interview is one of the most essential sources of case study data (Yin, 2009). In this research, individual in-depth interviews are arranged with the government, farmers, and agricultural extension agents. The individual in-depth interview allows the researcher to ask key informants about their opinions about events and the facts of a matter (Yin, 2009). The key informant sampling is used to look for persons who are able to provide deeper information and insight into what is going on in the national garlic farming programme in Temanggung. Elmusharaf (2012) describes that the key informants are characterised by their role in the community, knowledge, and their ability to clearly communicate unbiased information. Semi-structured questions are provided to help the researcher discuss certain issues with the informants. The individual in-depth interview in case study research is a kind of guided conversation rather than structured query, so that the actual flow of questions should be fluid rather than rigid (Yin, 2009). All of the interviews are recorded with the permission of the informants for further analysis. There are 33 individual in-depth interviews that have been done, consisting of 4 interviews with both the national and local government, 12 interviews with farmers who agree to cultivate garlic (Wonosari Village), 12 interviews with farmers who refuse to cultivate garlic (Bansari Village), 2 interviews with agricultural extension agents (who are responsible for the Wonosari and Bansari villages), and 3 interviews with market representatives (local trader, input supplier, and importer).

The FGD is also frequently used as a qualitative research technique to get a deep understanding of particular social issues. It is beneficial to use FGDs together with the individual in-depth interview method in a qualitative research approach because FGDs provide access to information that are not obtained in the personal interviews (Morgan, 1997). In this research, two FGDs with farmers and agricultural extension agents are arranged with 5-7 participants. The first FDG was held in Wonosari Village with five farmers and one agricultural extension agent. The second FGD was held in Bansari Village with four farmers and one agricultural extension agent. The farmer participants are randomly selected based on the key informant recommendations and their time availability. The FGDs mainly focus on exploring constraints faced by farmers during the implementation of the national garlic farming programme in Temanggung.

The specific data collection methods used to analyse the concepts and variables of the research are described in Table 2.

Table 2 Data collection methods based on the variables and concepts of research

Concepts	Variables	Data collection methods	Locations
Feasibility studies	Technical feasibility Economic feasibility Legal feasibility Operational feasibility Schedule feasibility	1. Literature study (scientific and policy papers) 2. In-depth interview with the government, farmers, and agricultural extension agents 3. Focus group discussion with farmers and agricultural extension agents	1. Wonosari Village (farmers implementing national garlic farming

Concepts	Variables	Data collection methods	Locations
System failures analysis	Infrastructural failure Institutional failure Interaction failure Capability failure	1. Focus group discussion with farmers and agricultural extension agents 2. In-depth interview with the government, farmers, and agricultural extension agents	programme since 2016) 2. Bansari Village (farmers refusing national garlic farming programme)
Communication space between actors in the garlic value chain	How different actors in the garlic value chain communicate with each other	1. In-depth interview with the government 2. In-depth interview with farmers 3. In-depth interview with agricultural extension agents	

4.3. Data analysis

This research uses the methodological triangulation method to analyse the data obtained from three different data collection methods mentioned in the previous sub-chapter and depicted in Figure 5. The use of the methodological triangulation method aims to corroborate the same fact or phenomenon found during the field work (Yin, 2009). The triangulation method is also used to address the construct validity problem (that is frequently found when research relies on only a single source of information) due to the fact that multiple data collection methods provide different measurements of the same phenomenon (Yin, 2009).

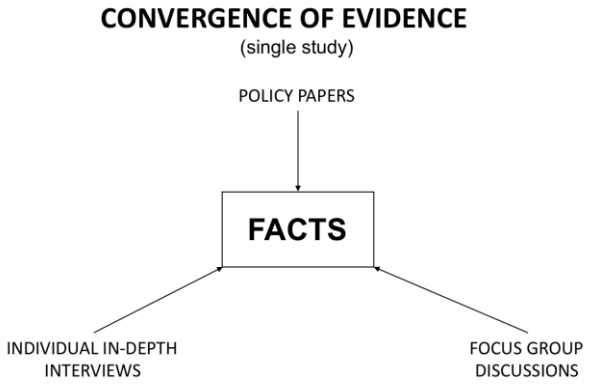

Figure 6 Convergence of multiple sources of facts applied in research (adjusted from Yin, 2009)

To analyse the data, this research uses the pattern-matching logic strategy which is one of the most popular techniques for case study analysis (Yin, 2009). This research uses Microsoft Excel software to code all of the information obtained from literature studies, individual in-depth interviews, and FGDs, and to categorise similar phenomena or facts into the same group. Information obtained from the government, farmers with garlic, farmers without garlic, and agricultural extension agents are coded as GOVT (GOVT 1 and 2 are more into technical officer; GOVT 3 and 4 are policy makers), FWG (FWG 1 to 12), FWOG (FWOG 1 to 12), and AEA (AEA 1 is working in Bansari and AEA 2 is working in Wonosari), respectively.

5. FEASIBILITY OF GARLIC FARMING IN TEMANGGUNG

This chapter is written based on the farming system analysis conducted with the farmers (both who want and do not want to cultivate garlic), the government, and agricultural extension agents. This section describes each stakeholder's perspective on technical, economic, legal, operational, and scheduling feasibilities.

5.1. Technical feasibility

Government's perspective

The government of Indonesia realised that Temanggung Regency is a good place to run a mass production of garlic because of its soil and climate conditions. Based on the Indonesian Ministry of Agriculture (2017), garlic can be optimally grown in well-drained fertile soils. The best soil pH for garlic is around 5.6 to 6.8. Garlic grows best at a temperature between 13 and 24°C which is mostly found in the upland area above 900m above sea level. These temperatures are needed at the bulb formation and enlargement stages of garlic. Enough water from rainfall or irrigation is required because dry soil will lead to irregularly shaped bulbs.

Conditions which are favourable for growing garlic can be found in the upland areas of Temanggung, especially in the areas depicted in Figure 1 as the garlic farming location. Those areas are mainly composed of regosolic soils which are formed by the volcanic material of Mount Sumbing and Mount Sindoro. The government argues that volcanic soils are highly desirable for a wide range of agriculture because of the excellent physical properties of the soil. Furthermore, since the areas of garlic farming in Temanggung are located in the upland area more than 1,000m above the sea level, the temperature in those areas is between 20-23°C, which is suitable for garlic growth.

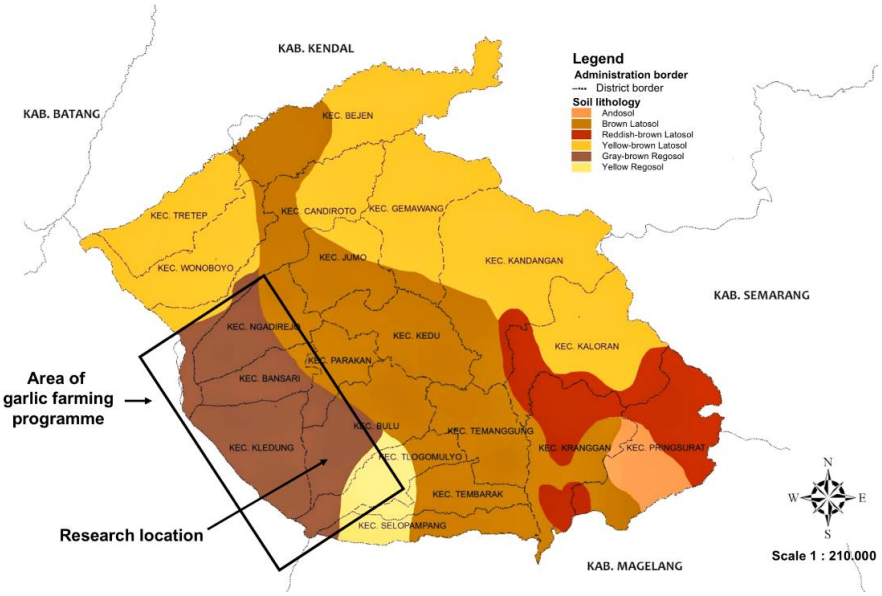

Figure 7 Soil lithology and garlic farming location in Temanggung Regency, Central Java, Indonesia (adjusted from Regional Development Planning Agency of Temanggung, 2011)

"We choose Temanggung as the main location of the national garlic farming programme towards national garlic self-sufficiency in 2021 because, in the past, people were cultivating garlic there. We would like to encourage the farmers to return the glory of garlic like in the 1990s [….] The natural conditions in Temanggung are very suitable for garlic farming. We have conducted research on the potential of garlic farming in Mount Sumbing and Sindoro (which are located in Temanggung), and the result shows that the potential production of garlic there is the biggest compared to other locations in Indonesia. The soil is perfect because Temanggung has volcanic soils. Moreover, garlic needs a cold temperature between 13-24℃ to grow, and it can be found in Temanggung". (individual in-depth interview with GOVT3)

The Ministry of Agriculture has made a guidebook for garlic farming which provides good agricultural practices and describes all kind of pests and diseases related to garlic farming along with the possible solutions. Farmers can access the guidebook through the agricultural extension workers or the local agricultural office. The government also gives farmers various kind of pest controls for free as a part of the subsidies.

"There are some types of support given by the government for farmers who participate in the programme. For each hectare, farmers receive a total amount of 20 million IDR in subsidies. Subsidies are applied in the form of agricultural inputs such as fertilisers, plastic mulches, environmentally friendly pest controls, cultivators, water sprayers, and other agricultural tools. Besides subsidies, farmers get intensive mentoring and monitoring by agricultural extension agents every week." (individual in-depth interview with GOVT2)

In terms of labour, the government believes that there is enough labour to cultivate garlic because it requires less labour when compared to other commodities like tobacco and chili peppers. During the dry season, farmers in Temanggung are usually cultivating tobacco as the main crop. This crop is capital- and labour-intensive. Farmers in Temanggung can handle the labour requirement of tobacco, which is twice as much as the labour needed for garlic, by organising activities such a team effort managed by the farmers' association to help each other with maintaining their farms. The government assumes that this labour cooperation, called *Gerakan*, is also helping farmers to get labour when they cultivate garlic (see the farmers' perspective section for further information about the mechanism). Moreover, the government says that, in the past, the farmers were successful in producing garlic. There was no problem with labour, so it is logical that they will not face any problem related to labour requirements today.

"[….] Farmers are able to deal with the labour requirements of tobacco farming in the dry season, which is double what is needed for garlic farming. So, it is logical to assume that there will be no labour requirement issue for garlic farming. Farmers have their own mechanism to get labour through the farmers' association. They are helping each other." (individual in-depth interview with GOVT2)

"In the past, farmers were successful in cultivating garlic without any issue. There was no issue with the land and climate conditions. Farmers were capable and had good knowledge of garlic farming. They didn't face any difficulty to get capital and

labour to cultivate garlic. I think that this condition remains the same today. The only problem that they (farmers) face is the price of local garlic in the market." (individual in-depth interview with GOVT1)

The government claims that there is no significant issue regarding the way farmers access the agricultural inputs to do garlic farming. The government provides most of the agricultural inputs for farmers who are willing to take part in the national garlic farming programme. Based on the government's report, for one hectare, farmers will receive a subsidy equal to 20 million IDR (± 1,212 EUR) for agricultural inputs, namely 10 rolls of plastic mulches, 750 kg NPK fertiliser, 150 kg ZK fertiliser, 1,320 kg dolomite, 10 litres decomposer, and 20 litres POC as described in the introduction part. Farmers also receive a subsidy for environmentally friendly pest control and other technical devices such as cultivators, water pumps, and hand sprayers, managed by farmer associations.

Farmers only need to provide garlic seeds, labour, and land. The government says that the price of garlic seeds is a bit high compared to the past, but it is not a problem because farmers already get subsidies for other agricultural inputs. The government also says the primary challenge to get the seeds is its limited stock in the market. To deal with this challenge, since 2016, the national government has developed public-private partnerships with some private parties for seedling raising in various locations to fulfil the farmers' need of seeds. The government argues that there will be no issues of scarcity and expensive prices of garlic seeds by 2018.

"The government provides subsidies for almost all agricultural inputs needed in garlic farming except for the seeds." (individual in-depth interview with GOVT2)

"I think the price of seeds is not a big issue for farmers since they already get subsidies for almost all agricultural inputs which cover more than half of the capital needed. They can still buy the seeds even though it is a bit more expensive than in the past. The problem is only the stock. It has been many years since garlic has not been bred. To deal with it, the national government has developed public-private partnerships for garlic seed production. Our goal is that in 2018, there will be no issue regarding the stock." (individual in-depth interview with GOVT3)

Farmers will not face any difficulty to access capital because they already receive a significant amount of subsidy. Based on the individual in-depth interview with GOVT3 above, the government claims that the amount of subsidy given to each farmer covers more than half of the capital needed to run garlic farming, and that is enough to support farmers. Similar statements were also expressed by other government actors interviewed.

"There is no capital issue [….]. Farmers get enough subsidies." (individual in-depth interview with GOVT1)

"The subsidies given by the national government help farmers a lot to get agricultural inputs. At least there will be no capital issue at the beginning of the cultivation period. However, we don't know about the future. The idea of giving subsidies is only to attract farmers to cultivate garlic again like in the past. This

programme will be successful not because of the amount of subsidies, but because of how big the rate of return is that will be obtained by farmers." (individual in-depth interview with GOVT4)

Farmers' perspective

Both farmers from Wonosari and Bansari Village acknowledge that their farmlands are suitable for garlic farming due to the soil and climate conditions. They argue that they were garlic farmers in the past, and they could produce a good quality and quantity of garlic in their areas because of the excellent fertility of the soil and cold climate conditions. Some farmers from both villages believe that their soil is fertile and suitable for almost all horticulture crops (including garlic) because the soil has been formed from the volcanic activity since hundreds of years ago. Other farmers believe that the application of organic fertilisers influences the soil fertility. The cold temperature conditions that help the growth of garlic are caused by the farms' locations which are mainly more than 1,000 meters above the sea level.

"I was a garlic farmer in the past. I could produce good-quality garlic because the soil and weather in Mount Sumbing was very good." (individual in-depth interview with FWOG13)

"The soil in Mount Sumbing is very good for agriculture because there was an eruption in the past from the volcano. And our area located more than 1,000 metres above the sea level. It makes the climate perfect for garlic." (individual in-depth interview with FWOG12)

"The soil in Mount Sumbing is very good for many crops. We should prepare the soil first by tilling the soil and using organic fertilisers to get the maximum production of garlic." (individual in-depth interview with FWG11)

Farmers realise that garlic is also vulnerable to pests and plant diseases. Based on the farmers' experiences, the main enemies of garlic are soil-borne pests like the black cutworm (*Agrotis ipsilon)* and the white grub (*Lepidiota stigma*). The black cutworm threatens many agricultural crop species, including garlic. The larvae are active from the late afternoon until evening. In the case of garlic, instead of moving to the surface to feed, the larvae will chew into the crop just below the soil surface. Similar to the black cutworm, the white grub will chew into the garlic roots and bulbs. Loss of crops because of the black cutworm and the white grub will vary from 10 to 80 percent. As a preventative measure, farmers should till the soil to kill the pupae and larvae before planting garlic.

Pest extermination can also be done by using natural enemies such as ladybugs (*Coccinella repanda*). Besides soil pest attacks, garlic may be attacked by fungi like *Fusarium oxysporum* which leads to withered leaves and *Pithoptora porri* which causes top leaf death or dieback. Farmers in Wonosari said that the environmentally friendly pesticides given by the government help them to face the pest and fungi attacks. Furthermore, frequent monitoring and mentoring activities by the agricultural extension agents in their area are very worthwhile.

"Garlic is very vulnerable to soil pest attacks, for instance, uret (Javanese word for white grub) and jontrot (Javanese word for black cutworm). We can handle it with

good soil management and good agricultural practices. The agricultural extension worker told us about it." (individual in-depth interview with FWG7)

"Pesticides from the government are very effective for dealing with pests and fungi." (individual in-depth interview with FWG1)

Farmers perceive that garlic farming requires quite a lot of labour compared to other crops in the wet season, but the amount of labour needed is not a problem for farmers in Temanggung. They can find labour easily through the farmers' association in which they can become members. Farmers' associations in the upland areas of Temanggung will help their members to find labourers by means of the '*Gerakan'* mechanism. *Gerakan*, which can literally be translated as 'movement,' is a rotational mechanism of labour from one farmland to another. During the soil and land preparation, the farmers' association will gather small-holder farmers who already finished their own land preparation to help farmers with larger farmlands. The mechanism of *Gerakan* labour flow by the farmers' association is visualised in Figure 8.

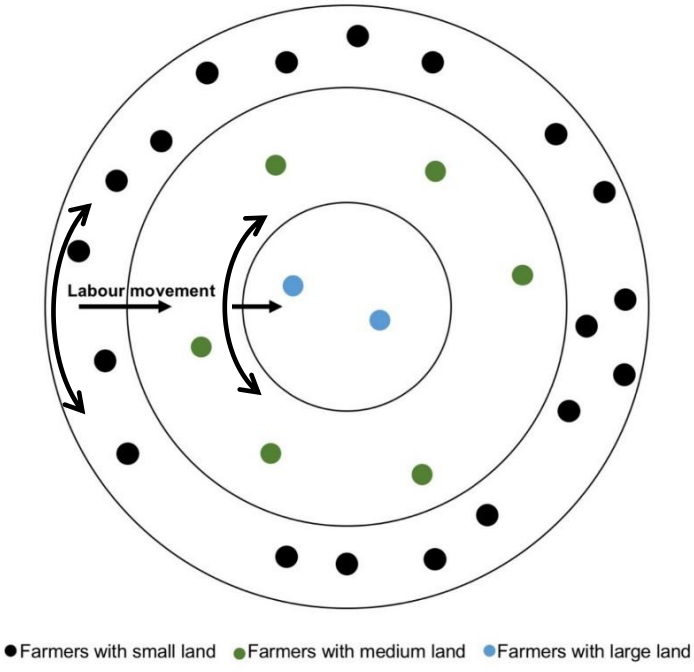

Figure 8 Visualisation of the 'Gerakan' labour flow mechanism by the farmers' association

After finishing the land preparation in their farmlands, farmers with small farmlands will be gathered by the farmers' association to help farmers holding medium-sized farmlands in preparing their land. Once the land preparation of farmers with medium-sized land has been finished, both farmers with small- and medium-sized land will help farmers with large farmlands to prepare their farmland. Both farmers from Wonosari and Bansari admitted that this mechanism is very beneficial for farming activities no matter which crops they cultivated. *Gerakan* is a form of solidarity called *tepa-salira* in Javanese culture. Everyone in a village is considered as relatives by others since they live close to each other. They will help others voluntarily since people want everyone to be happy.

"The labour requirement for garlic is a bit higher than for other wet season crops. However, we can handle this by Gerakan. We use Gerakan not only for garlic but also for other labour-intensive crops like tobacco and chili peppers." (individual in-depth interview with FWG7).

"We believe that Gerakan is a form of tepa-salira (solidarity) in which we help each other to reach our life goals. We live close to each other. When people are feeling happy, they will share their happiness with each other. (individual in-depth interview with FWOG9)

This *Gerakan* mechanism is also used for other farming activities such as weeding and harvesting. Farmers who use *Gerakan* should pay their peers who help them (labourers). They also have to pay a certain amount of money to the farmers' association. The farmers' payments to the association will be used for organisational activities such as member gathering, input subsidy, and soft loans for members. By the *Gerakan* mechanism, farmers argue that finding labour is not a problem for agricultural activities in Temanggung. Furthermore, this mechanism is beneficial for all actors. Farmers who help other farmers will get money as additional income for living expenses. On the other hand, farmers who get help from their peers will finish their agricultural activities faster.

How does Gerakan work during the land preparation of garlic farming?

The Javanese culture believes that there are only four good days in a month to cultivate garlic, corresponding to day 7, day 10, day 13, and day 16 in the Javanese calendar. The Gerakan mechanism usually starts on day 3 of a Javanese month. The farmers' association, which consists of farmers with small-, medium-, and large-sized land, lets everyone work on his or her farm first. Normally, farmers with a small farmland area will finish land preparation within 2-3 days, and they will cultivate garlic on day 7. After the small-holder farmers have finished with their own farmland, the farmers' association will ask them to help medium-holder farmers. Getting help from small-holder farmers, medium-holder farmers can finish the land preparation and cultivate the garlic seeds either on day 10 or 13. The last phase is helping large-holder farmers. After day 10 and 13, both small- and medium-holder farmers will help large-holder farmers to reduce the amount of time needed so that they are able to cultivate garlic on day 16. Everyone is satisfied with this mechanism because he or she can cultivate garlic on time corresponding to the "good old days" of Javanese culture. Every person who helps with someone else's land will be paid 50,000 IDR (±3 EUR) each day, and they will get food and drinks. (based on the individual in-depth interviews with FWG3, FWG7, and FWG12)

In getting access to agricultural inputs, farmers in Wonosari mention that they receive subsidies from the government. The government provide subsidies in the form of goods, not cash. They feel greatly helped by the support of the government. On the other hand, farmers in Bansari get nothing because they do not participate in the national garlic farming programme.

> *"We get agricultural inputs from the government. They gave subsidies in the form of goods, so we don't need to buy the inputs on the market." (individual in-depth interview with FWG5)*

However, farmers in Wonosari who cultivate garlic face a problem in the stock of garlic seeds. Garlic seeds are limited and difficult to find on the market. Moreover, the price of garlic seeds is very high, at about 60,000 IDR (±3.6 EUR) per kg or three times higher than the price of garlic they produced (on average, markets buy their garlic production for 20,000 to 25,000 IDR per kg or ±1.2 to 1.5 EUR per kg). For the farmers, this price of seeds is not reasonable and too high. At this time, they may be able to afford the price of garlic seeds because they do not need to pay for the other agricultural inputs, but they say it will be a big problem if they do not

get any subsidy again in the future. Farmers realise that there is a public-private partnership (PPP) between the government and private sector on garlic seeds production, but this effort has failed to provide more seeds for them. Although the PPP has been established since 2016, farmers still face seeds stock limitation in the market. However, some farmers are creative; they are willing to try to breed the garlic seeds themselves for next year.

> *"The problem we face now is the garlic seeds. The price is expensive and the stock is limited on the market. I think I will breed the seeds myself for next year." (individual in-depth interview with FWG6)*

Farmers in Bansari use the fact that the price of garlic seeds is costly and not affordable for farmers as a reason why choose not to produce garlic. They argue that if the price of seeds remains high, they will not get a good return based on the total cost of production because the market does not buy local garlic at a good price. Therefore, they prefer to cultivate other crops like chili peppers which give them a higher profit.

> *"One of the reasons why people here don't want to cultivate garlic is because of the price of seeds. It is too expensive. We will not get a good profit by cultivating garlic. We choose other crops like chili peppers which is more profitable." (individual in-depth interview with FWOG6)*

Farmers from both villages argue that access to capital is not a problem for them. They can get a loan from the bank or a middleman if they need more capital to cultivate certain crops. They only need to be sure that the crops they plant will give them significant returns so that they can pay back the loan to the bank or middleman after they harvest the crop yield.

> *"As long as we are sure that certain crops will provide us big profits, capital is not a problem for us. For instance, last year I got loans from the bank to cultivate chili peppers. Chili peppers gave me a good income. I could pay back the loan to the bank, and I still have quite a lot of money left." (individual in-depth interview with FWOG6)*

Agricultural extension agents' perspective

AEAs acknowledge that the soil and climate conditions in Temanggung are very suitable for garlic farming based on the governmental assessment and farmers' experiences. However, from their experiences, there are some main problems regarding the soil and climate that can affect garlic, namely soil nutrient imbalances and extreme seasonal weather. One example of a soil nutrient problem is too-acidic soil. Farmers should raise the soil pH before they start cultivating garlic. The most common way to increase the soil pH is by adding pulverised limestone to the soil which acts as soil acid neutraliser.

AEAs realise that the weather conditions in Temanggung may become a constraint on garlic farming since there are strong winds that can blow from Mount Sumbing which destroy the plastic mulches and dry the garlic leaves. For tackling this extreme weather issue, farmers can use a weather prediction application called SADEWA (satellite-based disaster early warning system) operated by the Indonesian National Institute of Aeronautics and Space. The

SADEWA app informs farmers about the risk of severe weather so that farmers can prevent damage to their garlic farms by strengthening the plastic mulch straps.

In the field, AEAs find that farmers are helping each other to meet the labour requirements for all kind of crops they cultivate. They use the farmers' association to manage the labour with the *Gerakan* mechanism. AEAs perceive that there is no problem with the labour availability. However, they acknowledge that farmers face a problem in getting affordable garlic seeds. AEAs argue that the high price of garlic seeds is caused by a significant demand for garlic seeds and a limited supply.

To deal with this problem, the government has developed a public-private partnership to produce enough garlic seeds for farmers. Their goal in 2018 is to ensure that the supply of garlic seeds for farmers will be enough and they can be purchased at an affordable price, but farmers have doubts. As previously mentioned, some farmers are creatively producing garlic seeds themselves for next year so that they do not need to spend much money for buying the seeds, even though the seeds have not been certified and proven to produce a high quality and quantity of garlic.

> *"We hope the government can help farmers to provide a high quality of seeds with an affordable price." (individual in-depth interview with AEA2)*

The AEAs state that farmers do not face any difficulty in accessing other agricultural inputs needed for garlic farming because almost all inputs have been provided by the government except the seeds. The government gives the agricultural inputs for free as a subsidy for farmers. The government also gives some agricultural tools to support the garlic production such as hand sprayers, hand tractors, and cultivators which are then managed by the farmers' association. Farmers can borrow the tools by making an appointment with their association.

The AEAs also state that there is no capital issue found in the field due to the fact that half of the capital needed is subsided by the government in the form of agricultural inputs. Small-holder farmers are mostly going to middlemen to access cash through loans; meanwhile, medium- and large-holder farmers will obtain cash through bank loans.

5.2. Economic feasibility

Government's perspective

The government argues that garlic is a good cash crop to be cultivated by farmers in Temanggung due to the fact that, in the past, farmers could produce a massive amount of high-quality garlic which gave them a lot of income. Garlic farming is easy to maintain compared to other wet season cash crops like chili peppers and vegetables. Farmers only need to be patient and wait until the harvesting period because garlic takes longer than other crops; usually, garlic is ready to be harvested after three to four months. It means that during the waiting time, farmers do not receive any cash from their farms.

> *"Compared to chili peppers, which is the most popular wet season cash crop among upland farmers in Temanggung at the moment, garlic is easier to maintain.*

However, the harvesting time of garlic is a bit longer, so the farmers should be patient to get the optimum yield. It is only one month longer than chili peppers, and farmers can get a good income from garlic farming." (individual in-depth interview with GOVT1)

The government consistently says in their meetings with farmers or with the media that garlic will give quite high profits for farmers who want to cultivate it, but there is no policy paper or official document that describes the income analysis of garlic farming. During the interviews, all of the informants who work for the government mention garlic as a 'white diamond' which will give good income for farmers. One informant even explains that, in the past, many farmers could buy luxury cars by cultivating garlic.

"Garlic is a 'white diamond' that gives farmers a good income." (individual in-depth interview with GOVT1)

"It is true that garlic was giving a good income in the past, and it was popular as the 'white diamond.'" (individual in-depth interview with GOVT2)

"Garlic was once popular as the 'white diamond.' The profit was huge, and many farmers were able to buy luxury cars. By supporting farmers with subsidies to cultivate garlic, we want the glory of garlic to return to how it was in the past." (individual in-depth interview with GOVT3)

The government admits that they are not able to set a regulation on the minimum price of local garlic due to the presence of a perfectly competitive market where the price is determined by the market. The government also cannot limit the quota of imported garlic in the near future because of a free trade agreement. The only known way that the government can ensure that farmers will not experience any loss is to ask The Indonesian Bureau of Logistics (Bulog) to buy the farmers' production. Bulog will buy the farmers' production if the price of local garlic in the market is lower than 20,000 IDR (±1.2 EUR) per kg. Bulog will buy garlic from the farmers for IDR 20,000 per kg or the amount that is equal to the break-even price. This means that farmers will not experience a loss, but at the same time, they do not get any profit margin from their garlic production.

"From the marketing side, Bulog will also absorb the production. So we hope this programme can improve the economy and the welfare of the garlic farmers here." (individual in-depth interview with GOVT3)

Farmers' perspective

Farmers in the upland area of Temanggung have some alternative crops to be planted during the wet season. During the individual in-depth interviews and FGDs with farmers, it was mentioned that there are four main wet season cash crops, including garlic, chili peppers, shallots, and vegetables (note that they plant many vegetables at the same time, for instance, tomatoes and cabbages). The cropping calendar of those four commodities is depicted in Figure 9. Among other cash crops, garlic has the most prolonged period until harvesting season. Garlic can be harvested only once three to four months after cultivation. The waiting period of garlic is twice as long as for shallots and vegetables, which can also be harvested

only once. Compared to chili peppers, the waiting period for garlic is not much different, but chili peppers can be harvested many times after 2.5 months.

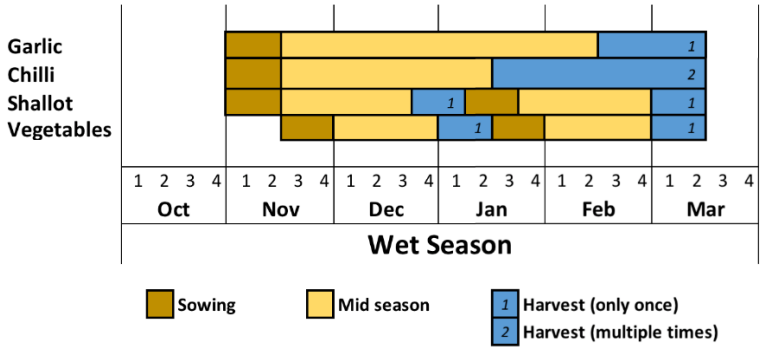

Figure 9 Cropping calendar of the four main wet season commodities in the upland area of Temanggung (based on FGDs)

Farmers in Wonosari Village cultivate garlic using a monoculture farming system due to the corresponding regulation made by the government. The government requires that all of the farmers who get subsidies shall only cultivate garlic in their farmland. The government argues that the monoculture farming system is applied to foster the productivity of garlic. They said that by using a monoculture farming system, farmers can get the maximum quantity of garlic. However, by this regulation, farmers only rely on garlic, and farmers do not have any alternative income sources if they experience a financial loss in garlic farming. Moreover, if farmers solely cultivate garlic, they only get income from February to March (see Figure 10). Based on this fact, a question arises: how do the farmers survive in the previous months (before February) if their savings is used up and they do not have any crops to be harvested? This situation is mentioned by some farmers in Bansari Village and becomes another reason why they do not want to participate in the government's national garlic farming programme.

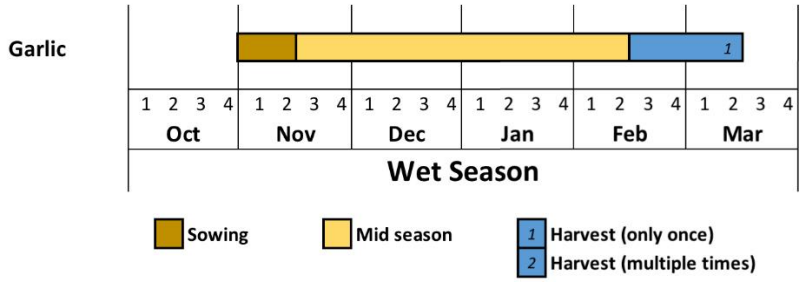

Figure 10 Cropping calendar of monoculture garlic farming (based on FGDs)

> *"The monoculture farming system of garlic is illogical. How we can live before March (the garlic harvesting period) if we don't have another crop to be sold from December to February?" (individual in-depth interview with FWOG7)*

> *"I do not want to rely only on garlic. If it (garlic farming) fails, I will not get any income." (individual in-depth interview with FWOG4)*

Farmers prefer to have inter-cropping rather than monoculture farms. Inter-cropping can give additional income for farmers. Moreover, they always produce their food themselves by inter-

cropping one crop with others. The most favourable inter-cropping among farmers in both two villages is mixing chili peppers and vegetables. Chili peppers are the most popular crop cultivated by farmers since 1996 when they experienced a bad season with garlic. Even though the price of chili peppers also fluctuates in the market, and there is no price intervention by the government due to the perfectly competitive market, but the price of chili peppers remains high. This condition is caused by the high demand for fresh chili peppers in the market, and there is no competition with imported products. According to the trade statistics, chili peppers are imported only in the form of dried chilies which are exclusively used by industry. The fresh chili pepper market is owned only by domestic productions.

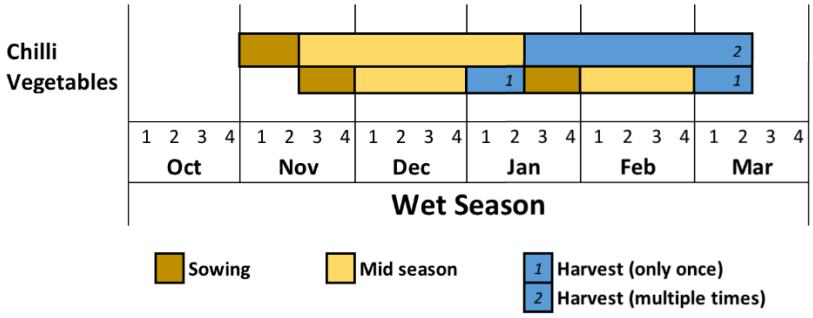

Figure 11 Cropping calendar of the inter-cropping farm between chili peppers and vegetables (based on FGDs)

Figure 11 shows the cropping calendar of the inter-cropping farming between chili peppers and vegetables, which is the most popular system applied by farmers during the wet season in the upland area of Temanggung. Farmers are willing to cultivate chili peppers because it gives them more access to cash and net income. As denoted in Figure 11, chili peppers can be harvested multiple times starting from mid-January until mid- March. Farmers regularly harvest chili peppers every three days; this means that they will get cash every three days for two months. Chili peppers are also able to be inter-cropped with vegetables. Farmers plant vegetables as an inter-cropping plant with chili peppers not only as cash crops but also for family consumption. Even though vegetables can only be harvested once every two months, they are still faster than garlic.

> *“Chili peppers give me more cash. It is easy to get cash with chili peppers because I can harvest them every three days and sell them directly after harvesting to the middleman.” (individual in-depth interview with FWOG1)*

> *"If I don't receive a subsidy for garlic, I will cultivate chili peppers as the main crop, inter-cropped with various vegetables for family consumption. Chili peppers can be harvested multiple times for a period between two to five months." (individual in-depth interview with FWG2).*

Another alternative crop that is popular among farmers in the upland area of Temanggung is shallots. Farmers usually will do an inter-cropping system between shallots and vegetables. As shown in Figure 12, shallots can be harvested after two months. If farmers start to cultivate shallots at the beginning of November, they can harvest at the beginning of January. Farmers can cultivate shallots twice within the same period of one garlic farming cycle. The reason why

farmers inter-crop shallots with vegetables is the same as why they inter-crop between chili peppers and vegetables. Farmers say that vegetables are not only for cash but also for family consumption.

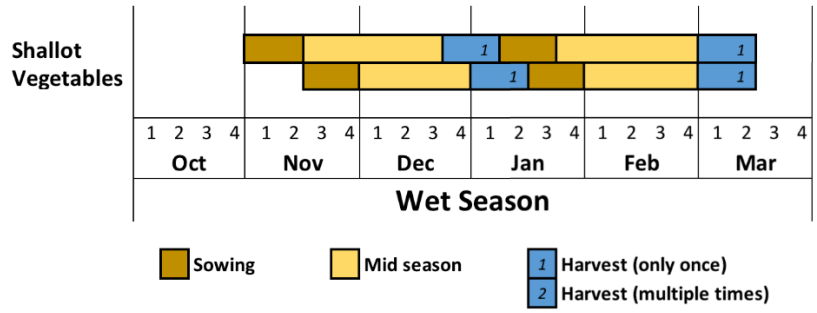

Figure 12 Cropping calendar of the inter-cropping farming between shallots and vegetables (based on FGDs)

Farmers argue that garlic does not provide a good income for them because the price of garlic fluctuates in the market. Compared to other crops, garlic needs more capital but doesn't offer good income in comparison to other wet season crops

> *"The price of garlic fluctuates. Sometimes it drops drastically to below 20,000 IDR (per kg). If this happens, we do not get any benefit." (individual in-depth interview with FWG10)*

Considering the fact that that garlic only gives a small amount of profit for farmers compared to other crops, it is interesting to understand why farmers in Wonosari are still willing to cultivate garlic in regards to the financial aspects. The answer is: because of the subsidy. Farmers say that the subsidy covers about half of the total cost needed. Farmers argue that if there is no subsidy, they will only get a small amount of net income because the amount of investment is huge, but the price of garlic is not that high.

> *"We cultivate garlic because we get the subsidy. If we do not get the subsidy, we only get a low profit because the total cost to cultivate garlic is large, but the price of garlic is not that high." (individual in-depth interview with FWG4)*

When informants in Wonosari are asked whether they would still be willing to cultivate garlic or not if there is no subsidy from the government, most of them say that they would not cultivate garlic on a large scale. They prefer to cultivate chili peppers and shallots which give them a good income. In the absence of a subsidy, they would cultivate garlic for domestic consumption only.

> *“No. I tried to cultivate garlic because I got the subsidy and encouragement from the older farmers who got the subsidy last year.” (individual in-depth interview with FWG3)*

> *“No, I would like to cultivate other crops if I don’t get any subsidy.” (individual in-depth interview with FWG4)*

“I will think twice. I prefer chili peppers to garlic.” (individual in-depth interview with FWG10)

However, some of them are still willing to cultivate garlic without a subsidy only if the price of local garlic in the market is higher than at least 30,000 IDR (± 1.8 EUR) per kg; at this price, farmers would get a good income and a higher return versus the total cost. Farmers argue that when this condition is reached, the subsidy is no longer needed; their only need is that the crops they cultivate will be bought at a good price by the markets and that they will get enough money for living.

“Yes, I will cultivate garlic as long as the price of local garlic is more than 30,000 IDR (± 1.8 EUR) per kg. The subsidy is no longer needed if that condition is reached.” (individual in-depth interview with FWOG8)

Agricultural extension agents’ perspective

AEAs acknowledge that garlic is not the farmers’ most favoured crop regarding the cash availability due to the fact that farmers can only harvest the garlic three to four months after cultivation. This is a long waiting period, because normally, farmers can get cash within two months if they cultivate other crops such as shallots and vegetables. Moreover, the government requires the farmers who get subsidies to cultivate garlic with the mono-cropping system because the government wants to get more yield. The government argues that by implementing the monoculture farming system, farmers will get a higher garlic production. However, it makes the farmers’ access to cash more difficult because farmers should only rely on garlic as their primary cash crop. In other cases, such as when farmers cultivate chili peppers, they use the inter-cropping farming system in which they can harvest other crops to get money for living before their chili peppers can be harvested. Therefore, the AEAs conclude that the garlic farming programme established by the government does not give cash easier compared to other commodities because farmers are only allowed to cultivate garlic if they want to receive subsidies.

"Honestly, garlic is not favourable by farmers because of the low price and long harvesting period. Moreover, when farmers get the subsidy from the government, they have to cultivate garlic solely. They cannot inter-crop garlic with other cash crops. The government believes that by doing a monoculture farming system, the yield of garlic will be higher and the national goal (of garlic self-sufficiency) will be achieved sooner." (individual in-depth interview with AEA2)

The farmers in Bansari Village do not want to be dependent only on garlic. The AEA who works there claims that it is also one of the reasons why people in Bansari Village reject the government's offer for cultivating garlic with the subsidy, a sentiment held especially by the leaders of the farmers’ association. Since the price of garlic is unpredictable in the market and is most likely cheap, farmers do not want to take the risk. It is better for them to cultivate alternative crops which provide faster and higher sources of income. In fact, farmers in Bansari do not mind if the government asks them to cultivate garlic with the subsidy, but they want it to be possible that the garlic can be inter-cropped by other alternative crops to reduce the risk of financial loss.

"The leaders of the farmers' association rejected the government's offer because they don't want to face the risk of financial loss. They don't want their farmers to only rely on garlic because, by receiving the subsidy, farmers must cultivate garlic in the monoculture system. In a monoculture system, if garlic fails, farmers don't have any backup plan to get a living income. It is different when farmers can cultivate other crops at the same time." (individual in-depth interview with AEA1)

Furthermore, the price of local garlic in the market fluctuates and is unpredictable. It is more likely to be very cheap and does not give a good return on investment to farmers. The AEAs from both villages are aware of this fact. Both of them claim that the average price of local garlic in the market remains between 20,000-25,000 IDR per kg (± 1.2 to 1.5 EUR), while the break-even point (BEP) price of garlic is 20,000 IDR per kg (± 1.2 EUR). It means that farmers do not get a good income. Farmers will only get a good income if the price of local garlic reaches 30,000 IDR per kg (± 2 EUR) or more. However, this condition is tough to achieve because the consumers will definitely choose imported garlic from China because of its lower price and bigger size. The imported garlic from China costs no more than 20,000 IDR per kg (± 1.2 EUR) in the market. Compared to the local garlic, 20,000 IDR per kg (± 1.2 EUR) is only the break-even point price. Therefore, it is hard for local garlic to compete with imported garlic if the government does not intervene in the market. AEAs argue that this condition is caused by the lower production cost in China since they have big plantations and good natural conditions. In Indonesia, garlic is cultivated by farmers with smaller farmlands which have higher production costs.

"The price of local garlic is unpredictable [….] imported garlic from China is always cheaper than local garlic. The price of imported garlic is usually below the break-even point price of local garlic. That is why consumers like to purchase imported garlic." (individual in-depth interview with AEA1)

"I think the price of Chinese garlic is a way lower than local garlic because the cost of production is lower. They cultivate garlic in a big plantation, while in Indonesia it is cultivated by small-holder farmers which need higher production costs. The natural conditions (in China) are also good as well […]." (individual in-depth interview with AEA2)

Both of the AEAs who work in Bansari and Wonosari explicitly recognise that garlic is not economically feasible to be cultivated by farmers. It does not generate good income like in the past when there was only local garlic on the market. Before 1996, there was no price competition in the market, so farmers could sell their garlic higher than the break-even price. At that time, it is true that garlic was a so-called 'white diamond' which gave a good income for farmers because there was no market competition. However, since the Chinese garlic came to Indonesia, this condition has no longer happened in the market. Local garlic must now compete with imported garlic which has a market price lower than the local garlic's break-even price. Since then, local farmers have no longer been interested in growing garlic because it has been confirmed that they will experience financial losses since they cannot compete with imported garlic.

Based on the facts above, it is interesting to talk about why farmers in Wonosari are still willing to cultivate garlic. When the AEAs are asked about this question, both of them agree that farmers in Wonosari are willing to cultivate garlic because of the subsidy and the encouragement of their leaders in the farmers' association. Without the subsidy, farmers would not be interested in cultivating garlic because they would see no advantage in it. The subsidy is quite high, covering about half of the total cost. The AEA from Wonosari says that the leaders of the farmers' association encourage people to cultivate garlic because of the significant amount of the subsidy and their willingness to help Indonesia to achieve their national garlic self-sufficiency in the near future.

> *"People in Wonosari are willing to cultivate garlic because they get a large subsidy, which covers half of the total cost [….] their leaders in the farmers' associations also encourage them to help Indonesia to achieve their national garlic self-sufficiency soon. However, farmers would not cultivate garlic if they don't get the subsidy like what they get today." (individual in-depth interview with AEA2)*

5.3. Legal feasibility

Government's perspective

The government argues that they have a big commitment to reach the goal of national self-sufficiency of garlic in the near future. Therefore, the government gives support in the forms of subsidies for inputs, knowledge sharing, and mentoring to farmers who want to cultivate garlic. The government has allocated their national budget to finance their support for garlic farming. There is no information about the exact allocation of the national budget for the national garlic farming programme, but farmers will get a subsidy of about 20,000,000 IDR (± 1,212EUR) per Ha when they agreed to cultivate garlic within the national garlic farming programme. This amount of subsidy will be given to farmers in the forms of agricultural inputs (except seeds) rather than giving the farmers cash money to avoid any fraud in the field. The subsidies and all other kinds of support are distributed by the local agricultural office in Temanggung Regency. The local government then decides who get the support. The main requirements of farmers who are eligible to get the supports for garlic farming are that the farmers are (1) located in the high-land area of Temanggung more than 900 metres above the sea level (because garlic can be effectively cultivated in that area), (2) members of farmers' associations recognised by the local government, and (3) willing to cultivate garlic in a monoculture farming system to increase the yield of garlic per Ha of farmland.

The government requires farmers who get the subsidy to cultivate garlic in a mono-cropping farming system. The national government authorises this regulation on the grounds that the monoculture farming system will increase the garlic production per Ha of farmland so that the goal of national garlic self-sufficiency can be achieved in the near future. The government argues that by cultivating only garlic in the farmland, the farmers can optimise their operations of agricultural inputs, planting, maintenance, and harvesting, which will be uniform across the farmland. Furthermore, the government also supports farmers to do intensive farming by giving them good fertilisers and pesticides (both organic and chemical). Therefore, farmers will get a higher production at a lower cost.

“We require farmers to do mono-cropping because we want them to get more yield. It is beneficial for both farmers and the government. Farmers will get more income because they produce more garlic, and the government will achieve the goal of national self-sufficiency of garlic in the near future.” (individual in-depth interview with GOVT 2)

“The government provides good-quality fertilisers and pesticides because we want the farmers to get a greater yield.” (individual in-depth interview with GOVT 1)

The government acknowledges that the price of local garlic is sometimes unfavourable by farmers because it is approaching or even lower than the break-even price. The government is not able to set the minimum price of local garlic due to the competitive open market mechanism in Indonesia. Garlic is also not a staple food which should be protected by the government. To help farmers when they face the problem of the low price of local garlic, the government through the Indonesian Bureau of Logistics (Bulog) will buy their garlic at a break-even price (20,000 IDR or ± 1.2 EUR per kg). By buying local garlic at a break-even price when the price is very low, at least farmers will not face financial loses.

“Bulog will also buy the farmers’ production when the price of local garlic is very low in the market. “(individual in-depth interview with GOVT 3)

The import quota of garlic is the biggest enemy for the local garlic farmers because they must compete in the market with imported garlic from China, which is more preferable for consumers due to its price and size. The government says that, at the moment, there is no import limitation for garlic from China to enter the Indonesian market. The Ministry of Agriculture, which has the national garlic self-sufficiency programme and serves as the main informant from the governmental side in this research, claims that it is hard to limit the garlic import due to the free trade agreement between the two countries. The Ministry of Agriculture needs to coordinate with other ministries such as the Ministry of Trade, the Ministry of Foreign Affairs, and the Ministry of State Owned Enterprises if they intend to limit the garlic import from China.

“[….] it is hard to limit the import quota (of garlic) from China. We have to coordinate with many stakeholders.” “(individual in-depth interview with GOVT 3)

"What we can do now to achieve the goal of national self-sufficiency of garlic is improve the production of local garlic to supply the domestic demands. " (individual in-depth interview with GOVT 3)

The government says that what they can do now to achieve the goal of national self-sufficiency of garlic is improve the local production through the many forms of government support available to farmers.

Farmers’ perspective

Farmers from both Bansari and Wonosari villages admit that the government gives sufficient support for agricultural inputs needed in garlic production. They see this as one of the government commitments to increase the local garlic production. However, supporting farmers

with agricultural inputs is not enough. Farmers, especially those who come from Bansari Village, argue that if the government truly wants to achieve the national garlic self-sufficiency, they have to improve the local garlic value chain, for instance, by ensuring the price of local garlic in the market is high enough to provide a decent living income for farmers.

> *"[….] if the government really wants us to cultivate garlic, the price of local garlic must be high enough to provide a good income for us." (individual in-depth interview with FWOG 10)*

Farmers see the imported garlic from China is the main enemy for them. The reason why they did not plant garlic in the past was the increasing amount of garlic imports from China that made people switch to consume Chinese garlic, resulting in a decrease in the local garlic consumption and a dramatic price drop. Farmers argue that the government failed to maintain a favourable market situation by allowing imported garlic from China to be in the domestic market. More than half of the farmers interviewed in Bansari Village mention that the subsidy is not a good option to foster the production of local garlic. They argue that the government only needs to limit the quota of imported garlic and ensure that the price of local garlic in the market is high enough. Even without any subsidy, if the price of local garlic is reasonable and can provide decent living income for farmers like in the past, farmers will plant garlic voluntarily.

> *“Imported garlic from China is the biggest enemy for us. I stopped cultivating garlic in the past because local garlic could not compete with the imported garlic.” (individual in-depth interview with FWOG 2)*

> *“Actually, I still want to cultivate garlic because the natural conditions here are suitable for garlic farming, but the price of local garlic needs to be higher to give me a good profit.” (individual in-depth interview with FWOG 8)*

> *"[….] farmers don't need the subsidy. We only need price certainty. If the government can assure that the price of local garlic in the market can provide a decent living income for us, we will plant garlic voluntarily, even without any subsidy." (individual in-depth interview with FWOG 6)*

It is true that the government will help farmers if the price of local garlic is too low during the harvesting period by buying the farmers' production through the Indonesian Bureau of Logistics (Bulog). However, the government will only pay a break-even price. Farmers mention that if Bulog only buys their garlic with a break-even price, they will not get decent income for living. Farmers from Bansari Village assume that if Bulog buys their garlic with a break-even price, there will be no profit left for farmers.

In terms of the monoculture farming system requirement, farmers in Bansari Village mention that it is too risky for farmers to solely cultivate garlic because there is no price assurance in the market. Most of the farmers in Bansari Village are still traumatised from when they experienced big financial losses in the past when they were still cultivating garlic and they had to compete with the imported garlic from China. Some informants claim this mono-cropping requirement as one of the reasons why they decide not to take the governmental offer to cultivate garlic again. Farmers do not want to rely only on one crop. They are willing to mix

their crops so that they can avoid a significant financial loss if the price of their commodity is low in the market.

In Wonosari Village, the requirement of mono-cropping farming is also unfavourable for the farmers. Over a half of all informants in Wonosari Village complain that they are required to only plant garlic. Actually, people in Wonosari Village want to plant garlic intercropped with other commodities like what they would typically do otherwise. They believe that inter-cropping is a part of their culture because they prefer to fulfil their family's food needs using their own farmland.

Agricultural extension agents' perspective

AEAs from both Bansari and Wonosari Village state that the government of Indonesia has a strong commitment to achieving their goal of national garlic self-sufficiency in the near future. The government allocates a lot of the national budget to fund the programme, including for providing subsidies for farmers and paying for the agricultural extension agents who are responsible for mentoring and monitoring the garlic farming programme at the farmer level and facilitating the knowledge exchange between garlic farmers and the official research institutions.

> *"The government allocates a lot of the budget to help this programme succeed." (individual in-depth interview with AEA 1)*

> *"The government has a strong commitment. That is why they pay me to train and monitor the farmers." (individual in-depth interview with AEA 2)*

The two AEAs interviewed for this research confirm that the local garlic product still needs to compete with the imported garlic, which is cheaper. However, even though there are no regulations to limit imported garlic from China—which dominates the Indonesian market—and to set the minimum market price of local garlic, the government has a special mechanism to protect the local farmers from financial losses. The government commits to buy farmers' productions through Bulog if the price of local garlic is under the break-even price of around 20,000 IDR per kg (± 1.2 EUR). The government will purchase the local garlic production at the break-even price so that farmers will not experience a financial loss.

> *"Local garlic needs to compete with imported garlic. However, farmers will not experience a financial loss because Bulog will buy their products if the market price is below the break-even price." (individual in-depth interview with AEA 1)*

> *"The government has not limited the quota of imported garlic, and we also don't have a regulation on the minimum price of local garlic. However, Bulog will buy the farmers' productions at the break-even price if the price in the market is very low. Farmers will not lose with this mechanism." (individual in-depth interview with AEA 2)*

Although the two extension agents declare that the government has made significant efforts to ensure that the garlic farming programme is successful, both of them agreed that the requirement to do monoculture farming system should be re-evaluated. The AEA who works

in Bansari Village claims that this regulation is one of the reasons why farmers are not willing to join the government's garlic farming programme. People think that the mono-cropping system is too risky because they would only rely on one crop rather than many crops which will minimise the risk of financial loss when the single crop is not sold. In Wonosari Village, the AEA also says that it is hard for farmers to cultivate garlic with the mono-cropping system. He argues that people are not used to do mono-cropping because they also produce their own food in their farmland.

> *"People in Bansari are not willing to rely on garlic alone. They are afraid to face a financial loss if the price of garlic is not good in the market. They prefer to cultivate many crops in their farmland so that if there is a financial loss in one commodity, they still have other commodities to be sold to make their living." (individual in-depth interview with AEA 1)*

> *"People in Wonosari are not used to doing mono-cropping because they also produce their own food in their farmland. It is hard for them. I hope the government will consider excluding this constraint from the requirements list." (individual in-depth interview with AEA 2)*

5.4. Operational feasibility

Government's perspective

The government believes that all of the farmers in the high-land area of Temanggung are capable of cultivating garlic in their area since they were garlic farmers in the past. This is the reason behind the choice of Temanggung as the main location of the national garlic farming programme by the Indonesian Ministry of Agriculture. The government assumes that if farmers in Temanggung could produce garlic of a good quality in the past without any support from the government, they are also able to produce garlic with at least the same quality as before—or even higher—because they get a lot of government support.

> *"I believe that farmers in (the upland area of) Temanggung have sufficient knowledge and skill to cultivate garlic." (individual in-depth interview with GOVT 2)*

> *"[….] Temanggung has been selected as the main location of the national garlic farming programme because, in the past, the farmers were used to planting garlic for their cash crop in the wet season. We assume that they still have a good knowledge of garlic production" (individual in-depth interview with GOVT 3)*

The government has also provided an agricultural extension agent in each village to support the people's agricultural activities, including garlic farming. The agricultural extension agents are responsible for providing counselling for farmers so that the knowledge, skills, and attitudes of farmers in managing their farmland become better in order to improve their livelihood. The extension agents will help farmers solve their agricultural problems.

"We have sent one extension agent for each village in Temanggung to help farmers if they face technical difficulties with cultivating garlic." (individual in-depth interview with GOVT 1)

Regarding post-harvest management, the government argues that farmers in Temanggung should also be able to handle their yield as they once did a dozen years ago. Moreover, garlic is easy to store and keep fresh for a long time compared to other horticulture commodities such as vegetables and chili peppers. Garlic does not rot quickly.

"Garlic is easy to store because it does not rot as easily as other types of horticulture such as vegetables and chili peppers." (individual in-depth interview with GOVT 2)

Farmers' perspective

Farmers from both two villages claim that they are able to plant garlic on a mass scale because they were used to it in the past. They still remember how to produce good-quality garlic. Farmers also declare that they are capable of managing every step of post-harvest handling until they can sell their garlic to a middleman or on the market. They describe that handling garlic is easy. They can simply dry the fresh-harvested garlic under the sun for one day if they want to sell it directly on the market. If they want to store it to be sold next time, they have to dry the garlic for more two days. After the garlic is dry, farmers will usually store the garlic by hanging it from the ceiling in their kitchen so that the garlic can last longer because it will be automatically smoked every day when the farmers cook their food.

"Certainly, I am capable enough to cultivate garlic because I was a garlic farmer in the past." (individual in-depth interview with FWG 2)

"Most of the farmers in Bansari know how to plant garlic. Only young farmers may not know how to do it." (individual in-depth interview with FWOG 1)

"We usually hang garlic from the kitchen ceiling to make it last longer." (individual in-depth interview with FWG 4)

However, farmers experience one constraint in post-harvest storage. They most likely will lose 20-50% of the garlic's weight after they store it for some months. They say that they have consulted with the agricultural extension agent about this issue, but there is no solution yet to solve the problem.

"After some months hanging from the ceiling, garlic will shrink by up to 50% [….]." (individual in-depth interview with FWG 7)

"We have talked to the extension agent about this (storage issue), but there is no solution yet." (individual in-depth interview with FWG 12)

Farmers in both areas claim that they currently have better transportation infrastructure to and from their farmland compared to the past. Most of the village roads have been paved in the last ten years, and they can ride their cars or motorbikes to access their farmland. This

condition makes it easier for farmers to transport the agricultural inputs and their yields from the farmland to their home or the markets, and vice versa.

> *"[…] the infrastructure is good compared to the past. In the past, we had to walk to transport the inputs and products. Nowadays, we can use a car or motorbike to get to our farmland." (individual in-depth interview with FWG 11)*

> *"The government built good roads around ten years ago to provide good access for farmers to transport agricultural inputs and products." (individual in-depth interview with FWOG 2)*

Agricultural extension agents' perspective

The AEAs from both villages admit that all of the farmers in the high-land area of Temanggung are very capable of cultivating garlic. The AEAs only need to provide recent information about new technical knowledge since people were not planting garlic on a large scale a dozen years ago. Farmers also have basic knowledge of post-harvest handling methods for garlic. They only need improvement on the storage technique so the garlic weight will not shrink too much.

> *"Most of the farmers are knowledgeable in cultivating garlic. I think they only need a minor improvement since they have not planted garlic on a large scale since 1998." (individual in-depth interview with AEA 1)*

> *"Post-harvest storage has become an issue for farmers. I am still looking for another (storing) technique to reduce the depreciation of garlic weight." (individual in-depth interview with AEA 2)*

5.5. Scheduling feasibility

Government's perspective

The government argues that garlic farming will not interfere with the cultivation of tobacco in Temanggung as the main crop production by the farmers, and vice versa. Tobacco is usually cultivated starting from April or the beginning of May, while garlic farming is finished in March. Tobacco farming is usually finished at the beginning of October, and after that, farmers can start to cultivate garlic from the beginning of November.

The government also argues that garlic needs more water to grow, so it is only suitable in the wet season. On the other hand, tobacco does not need much water, and it is suitable for the dry season. In fact, the government claims that those two crops will not disrupt the planting period of one another.

Farmers' perspective

In line with what the government says, farmers from both villages confirm that garlic fits with the rotational schedule of tobacco which is the main crop in Temanggung in the dry season. During the FGDs, farmers and AEAs made a cropping calendar as depicted in Figure 9. Garlic

can be cultivated only in the wet season, ranging from November to March. Meanwhile, tobacco is cultivated from April to October.

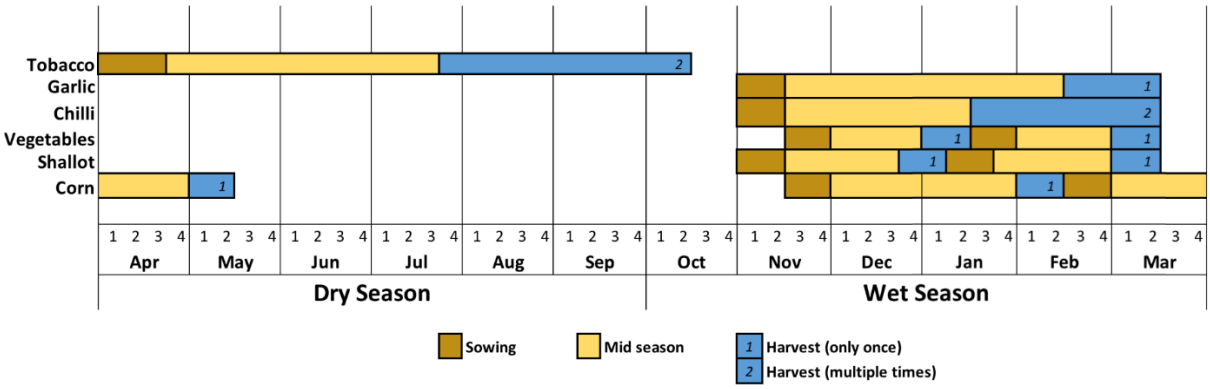

Figure 13 Cropping calendar of the upland farming system in Temanggung based on the season (based on FGD)

The only crop that may disturb tobacco farming is corn. Besides rice, corn is a staple food for farmers in the upland area of Temanggung. Farmers who want to cultivate corn may do so during the wet season because corn also needs water to grow. Farmers will harvest the corn at the beginning of February. In a rare case, farmers will cultivate corn again after they harvest it. When they cultivate corn by February, they will harvest the corn at the beginning of May, which is already the time to cultivate tobacco.

Agricultural extension agents' perspective

AEAs give the same information as the government and farmers. They mention that in the field, they do not find any problem with the rotational schedule for garlic. In fact, they also came to the FGDs and made a cropping calendar (Figure 9) with the farmers.

6. FAILURE OF THE GARLIC FARMING PROGRAMME IN TEMANGGUNG

This chapter is written based on the system failure framework analysis conducted with the government, farmers (both those who want and those do not want to cultivate garlic), and agricultural extension agents. This section describes each stakeholder's perspective in the infrastructural, institutional, interaction, and capabilities failures of the national garlic farming programme in Temanggung Regency.

6.1. Government's point of view

The government mentions that there are five system failures of the national garlic farming programme conducted in Temanggung Regency towards the garlic self-sufficiency goal in Indonesia. The failures are found in the soft-institutional, interaction, and capability dimensions as elaborated hereafter.

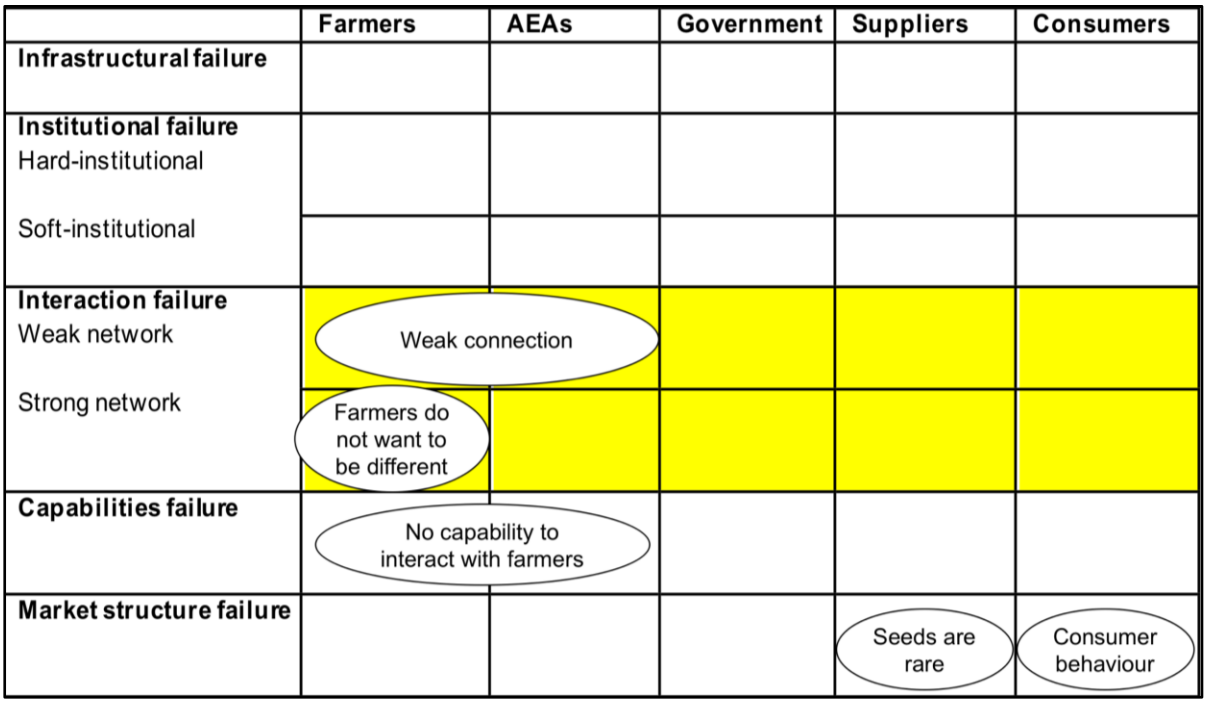

Figure 14 System failures of the national garlic farming programme in Temanggung based on the government's point of view

The government found that there is a weak network between farmers and extension agents in their national garlic farming programme. The government argues that one of the reasons behind the farmers' refusal to participate in this programme is the lack of communication between farmers and extension agents. The government found out that some agricultural extension agents are not capable of interacting with farmers since they do not have a good network with farmers.

The government got several reports and complaints from farmers stating that they did not get good services from the agricultural extension agents. Furthermore, some of the agricultural

extension agents never even visited their respective village to get to know the farmers. The government, through the local agricultural office, will evaluate the performance of the agricultural extension workers who are placed in the target area of garlic farming in Temanggung. The government thinks that the farmers may refuse to participate in garlic farming programme because they do not get sufficient information from the extension agents about the programme and the advantages that can be obtained if they join the programme.

> *"We got some complaints from farmers that the extension agents we sent to their community are not doing a good job. They never even visited the village to get to know the farmers. We will evaluate their performance, because maybe farmers refuse to change because they didn't get sufficient information about the programme from the extension agents." (individual in-depth interview with GOVT 1)*

The government also found that there is another interaction failure that occurs between the farmers. The agricultural extension agents have informed the government that farmers do not want to be different from their peers. On the one hand, this strong network is good to attract more farmers to cultivate garlic by influencing peers. However, on the other hand, farmers in one area will not join the programme if others are not willing to join. The government says that the most important actors to be influenced are the opinion leaders in the farmers' associations. They are the key persons who decide whether farmers will join the garlic farming programme or not.

> *“I got the idea from our extension agent that people avoid being different from their neighbours. They like to be uniform with their peers in the village (each village has one farmers’ association). When the leader of the farmers’ association through the general meeting decides not to participate in this garlic farming programme, all of the farmers will follow the decision even though some of them are interested in getting the subsidy." (individual in-depth interview with GOVT 2)*

Farmers in Wonosari are willing to cultivate garlic because the government, through their extension agent, succeeded in convincing the leaders of the farmers' association about the advantages of the garlic farming programme for farmers. In the general meeting with members, the leaders convinced the farmers that this programme is good for them. At the same time, the agricultural extension agent in Bansari Village failed to communicate with the farmers' association leaders. Therefore, they decided not to participate in garlic farming programme. The government knows that there are some farmers in Bansari who are interested in cultivating garlic because they got informed by their relatives who live in Wonosari. However, because they do not want to be different from their peers in Bansari Village, they decided to cultivate other crops.

The government realises that consumer behaviour becomes the biggest bottleneck in the local garlic value chain in Indonesia. Changes in consumer behaviour to purchase imported garlic rather than local products caused the domestic farmers to suffer considerable losses in the 90s. The consumers prefer to purchase imported garlic because of its lower price and larger size compared to local garlic. The consumers can buy imported garlic from China for less than 20,000 IDR (±1.2 EUR) per kg in the market. On the other hand, the price of local garlic at the market level is always higher than imported garlic because domestic farmers have higher

production costs to plant garlic. Farmers cannot sell their garlic at the same price as imported garlic, otherwise they will experience financial losses. On average, the market price of local garlic is 2 to 3 times higher than imported garlic.

> *"The price there (in China) is 5,000 to 6,000 IDR (± 0.31-0.37 EUR) per kg. When it (garlic) gets here, price in the port is 8,000 to 10,000 IDR (± 0.50-0.62 EUR) per kg, the most expensive is 11,000 IDR (± 0.69 EUR) per kg. In the market, the normal price is no more than 20,000 IDR (± 1.2 EUR) per kg [….] imported garlic from China is cheaper because they plant garlic in a big plantation which requires a lower production cost." (individual in-depth interview with GOVT 2)*

> *"People prefer imported garlic because it is relatively cheap. My wife also prefers to buy imported garlic because it is cheaper [….]" (individual in-depth interview with GOVT 4)*

Figure 15 Size comparison between imported garlic (left) and local garlic (right)

The government says that local garlic has different cultivar from Chinese garlic because it is impossible to cultivate the same variety in Indonesia due to the climate conditions. It has a big difference in appearance; imported garlic from China is superior in size. Figure 15 shows the size comparison between Chinese garlic and local garlic produced in Temanggung. Imported garlic from China is 2-2.5 times bigger than local garlic. With its bigger size, imported garlic is easier to peel. Imported garlic also has a more attractive appearance than local garlic, which looks duller. The lower price, bigger size and better appearance of imported garlic make the consumers in Indonesia prefer to buy Chinese garlic rather than local garlic, even though the local garlic is better in quality.

> *"My wife also prefers to buy imported garlic because it is cheaper, bigger (so easier to be peeled by his wife), and more attractive (the colour is more white than local garlic so it looks cleaner)" (individual in-depth interview with GOVT 4)*

When the consumers prefer to purchase imported garlic, there is no market for local garlic. The government has to think about how to change the consumers' behaviour so that they are

willing to pay more for local garlic. If the local garlic becomes more favourable in the market, the government believes that there will be more farmers who want to cultivate garlic.

6.2. Farmers' point of view

Based on the farmers' perspective, there are at least nine system failures detected in the planning and implementation processes of the national garlic farming programme in Temanggung. The failures are shown in Figure 16 below.

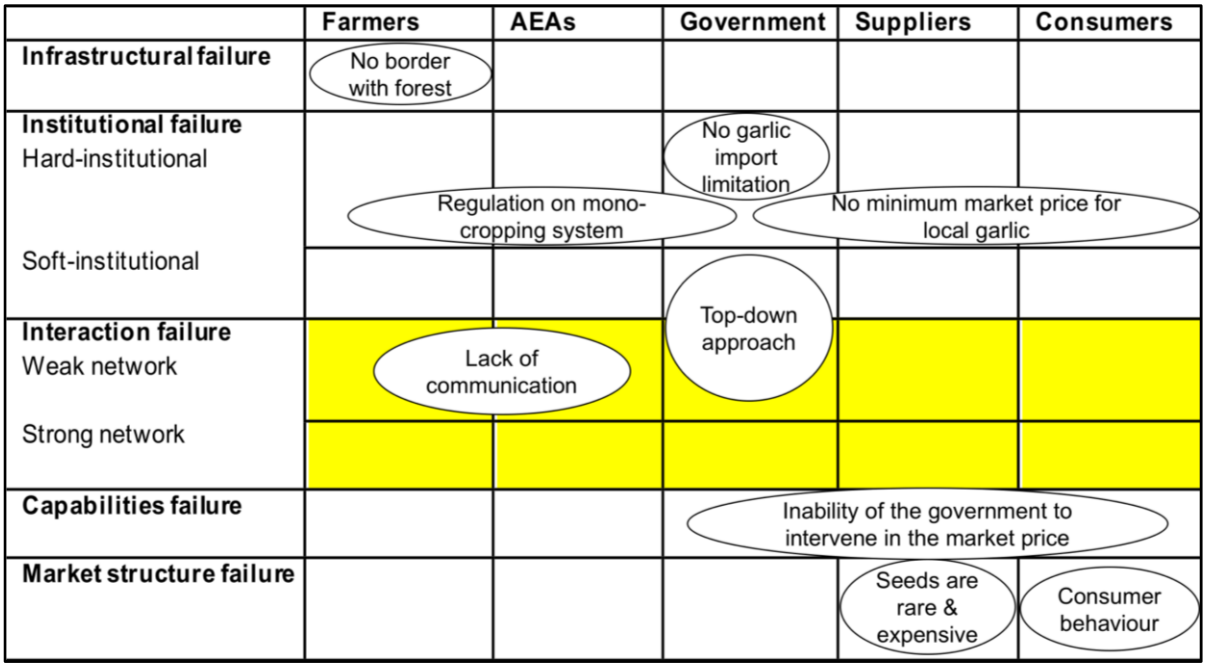

Figure 16 System failures of the national garlic farming programme in Temanggung based on the farmers' point of view

In the infrastructure domain, farmers say that there is only one failure that may hinder the implementation of garlic farming in Temanggung: namely, the absence of a border between forests and farmlands. There have been many cases of attacks by wild animals such as monkeys and wild boars in farmlands located in Bansari and Wonosari because the farmlands are directly adjacent to protected forests. This issue does not only occur in garlic farming, but also in other commodities. Farmers argue that they have to make a border in the near future by planting fruits as a natural border in order to provide enough food for wild animals so that they will not invade the farmers' lands to find food.

> *"The problem we face (not only in garlic farming) is wild animal attacks because our farmlands are located just next to the protected forests. The animals try to find food." (individual in-depth interview with FWG 7)*

> *"[…] just simply make a border between forests and farmlands with fruit plants. I believe that it can solve the problem because then animals would already find enough food before reaching the farmland." (individual in-depth interview with FWG 11)*

During the interviews, farmers strongly emphasised that there are a lot of institutional failures made by the government which make farmers doubt or choose not to grow garlic. Firstly, the government failed to limit the amount of imported garlic, mainly from China, from entering the domestic market. Farmers argue that the biggest enemy of local garlic production is the imported garlic; they stopped cultivating garlic in the past because they experienced huge financial losses since they were not able to compete with imported garlic which is preferred by consumers due to its lower price and better appearance.

Farmers want to feel safe from the risk of loss when they grow garlic by knowing that the government, who encourages them to cultivate garlic, will ensure that the price of local garlic is good during the harvesting time. Farmers from both villages argue that they only need to be sure that their products will be sold at a good price if the government wants them to grow garlic. Farmers claim that they will flock to grow garlic even if the government does not provide subsidies as long as the government ensures that the price of local garlic in the market will be high. However, the government failed to do that; it is not able to intervene in the market to provide a good price for local garlic because the trade of garlic in Indonesia is a perfectly competitive market. The market defines the price of local garlic based on its competitiveness with imported garlic.

Farmers also regret that the government requires farmers to plant garlic with a monoculture farming system. This regulation makes farmers feel that it is too risky for them to cultivate garlic without any backup cash crops. The mono-cropping technique is not the way that they usually manage their farms. Farmers, especially from Bansari, do not want to rely only on one cash crop. They argue that the inter-cropping technique is better because, if they face a financial loss in one commodity, they still have other crops to be sold. Moreover, farmers have a habit of producing their own food in their farmlands; this is not possible if farmers would only be able eat garlic if they obey the government.

During the planning process, farmers claim that they were not involved. The government planned the programme of national garlic self-sufficiency at the national level without considering farmers' aspirations. Farmers only become objects of the programme. They are not able to adjust the programme in accordance with their needs because the national government does not give them a space to express their aspirations. Therefore, in some cases, this programme is not in line with the farmers' needs.

> *"They (the government) made the programme in Jakarta (the capital of Indonesia) and brought it here." (individual in-depth interview with FWG 3)*

> *"The government planned this programme themselves. They did not consider what we need and what we want. They said if we don't like their regulations, just don't join this programme." (individual in-depth interview with FWOG 8)*

Furthermore, in Bansari Village, there is a lack of communication between farmers and the extension agent. Farmers acknowledge that the government has assigned an extension agent to help them in solving their agricultural problem. However, the extension agent has not come to the village in one and a half years. When the farmers are asked the name of the extension agent, most of them do not know the answer.

“I don’t know who is the extension agent assigned in my village (Bansari).” (individual in-depth interview with FWOG 3)

“[….] I don’t know his (the extension agent’s) name.” (individual in-depth interview with FWOG 4)

"He (the extension agent) never comes here (to Bansari village). The last time I saw him was one and a half years ago when he explained the procedure of Kartu Tani (farmers ID card). After that, I never met him." (individual in-depth interview with FWOG 11)

For farmers, communication has an important role in their lives. Farmers will believe people who are already known and have pleasant communication with them. They will not be convinced by strangers who bring a totally new idea to their community, as what happened when the agricultural extension agent who never visits them suddenly came to Bansari village and asked them to cultivate garlic, which is not the farmers’ idea. At that moment, farmers did not trust the agricultural extension agent because he is an outsider. This is different from the extension agent in Wonosari who visits the village frequently, at least once a month. Farmers in Wonosari know him very well. Since he is an insider, people are more open to the idea of the garlic farming programme that he brought from the government.

“We believe him (the extension agent in Wonosari) because he has helped us a lot if we face difficulties in our agriculture. He regularly visits us at least once a month. With this garlic farming programme, he comes once or twice a week. We believe he will not kill us. We know him well. Every crop always has its risks, so that is why we follow him to cultivate garlic.” (individual in-depth interview with FWG 7)

In the market structure dimension, farmers claim that the consumers' behaviour becomes the most significant bottleneck of this programme. If the consumers consistently decide that buying local products is better than imported products even though the price of local products is a bit higher, farmers will not hesitate to plant garlic. However, Indonesian consumers prefer to buy cheaper products without considering the quality. Farmers comment that although the quality of local garlic is better than imported garlic, consumers still buy the imported garlic because it is cheaper than local garlic.

“It is hard to compete with imported garlic from China because it is cheaper. Indonesians usually decide to buy an item by considering price rather than quality.” (individual in-depth interview with FWOG 6)

6.3. Agricultural extension agents’ point of view

From the perspective of agricultural extension agents, there are six system imperfections that have been recognised during the data analysis. The failures are ranging from the institutional, interaction, and capabilities domains as elaborated hereafter in Figure 17. There are two hard-institutional failures recognised by the AEAs which are made by the government. The AEAs cite the inability of the government to limit the quantity of imported garlic as the first failure of

the government. It is hard for the government to stop the importation of garlic from China since it has a risk to harm the bilateral relationship between the two countries because of the free trade agreement.

> *"[….] the shortcoming of our government is that we are not able to cut the importation of garlic from China because of the trade agreement." (individual in-depth interview with AEA 2)*

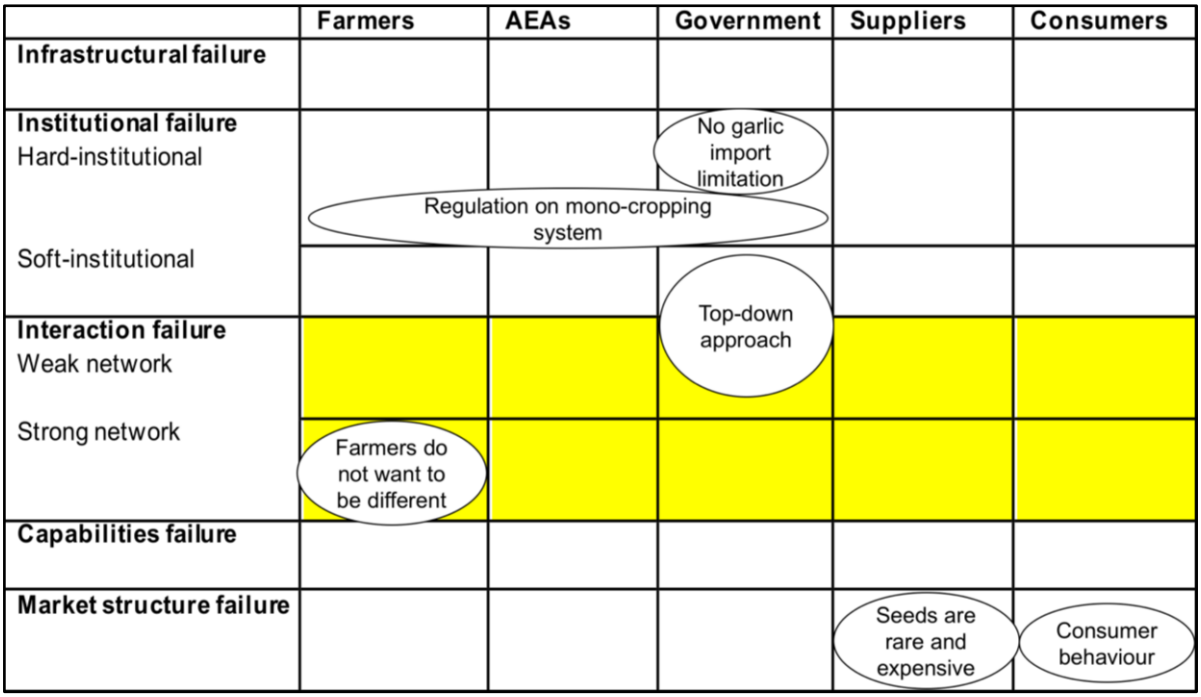

Figure 17 System failures of the national garlic farming programme in Temanggung based on the agricultural extension agents' point of view

The second hard-institutional failure is the regulation regarding the mono-cropping system for garlic farming which creates a big disadvantage for farmers. The aim of mono-cropping is to increase the amount of production. However, it is unfavourable for farmers because they have to rely solely on garlic, and they cannot produce their own food in their farmlands. Farmers in Temanggung have a culture which seeks to try and fulfil their food needs independently; they avoid buying something that they can produce themselves.

The AEAs from both villages acknowledge that the government did not involve farmers during the planning period of the garlic farming programme. Farmers did not have a chance to give their aspirations. Similar to farmers, the AEAs consider this top-down approach as a weak connection between the government and farmers. On the other hand, farmers have a very strong connection among their peers. This strong connection can be either good or bad. It will be good if farmers are willing to cultivate garlic and their peers also want to do the same. However, it will be bad if farmers' associations reject cultivating garlic and people do not want to be different from them. This case happened in Bansari Village when the farmers' association decided not to participate in the garlic farming programme, and all farmers in the village followed the decision. The AEAs argue that this strong network is part of Javanese culture which is already institutionalised in Temanggung. In Javanese, the term of '*mangan ora*

mangan kumpul' (whether you have food or not, the most important thing is togetherness) is one of the principles of life. The AEAs explain that with this life principle, farmers will always want to gather in uniformity.

> *"Farmers do not want to be different from their community. This is the embodiment of 'mangan ora mangan kumpul'; farmers want to gather in uniformity. They will follow what their neighbours do. They don't want to be different. This is one of the reasons why farmers in Bansari do not want to cultivate garlic: because their neighbours don't. I think they follow what the farmers' association has decided." (individual in-depth interview with AEA 1)*

Similar to the government and farmers, the AEAs recognise two failures in the market structure dimension which happen at the supplier and consumer level. At the input supplier level, the rareness of garlic seeds in the market makes it is expensive to buy and not affordable for farmers. At the consumer level, the consumers' preference to purchase imported garlic over local garlic becomes a failure in this garlic farming programme. The preference of consumers is to buy cheaper goods; moreover, the appearance of imported garlic is better than local garlic. It is bigger in size and seems cleaner than local garlic.

> *"Input suppliers are not able to provide enough garlic seeds for farmers. In the markets, the seed becomes very expensive and unaffordable by farmers." (individual in-depth interview with AEA 2)*

> *"The price of local garlic is unpredictable [….] imported garlic from China is always cheaper than local garlic. The price of imported garlic is usually below the break-even point price of local garlic. That is why consumers like to consume imported garlic." (individual in-depth interview with AEA1)*

7. ANALYSIS AND DISCUSSION

In this chapter, the research results are analysed and discussed in order to answer the research questions. This research uses the concept of framing during the data collection and analysis to acknowledge the divergence of perspectives among stakeholders on the feasibility of garlic production at the farmer level as well as the bottlenecks and the opportunities in the envisioned garlic value chain. I interviewed each stakeholder separately, analysed each stakeholder's perspective, and elaborated their perspectives to understand the issues in the garlic value chain. The concept of framing is useful for understanding how different people look at the reality in this ongoing issue, and it is essential to give a more comprehensive understanding of an issue rather than using a single perspective (Aarts & van Woerkum, 2005). Therefore, you will find that the three perspectives of the government, farmers, and agricultural extension agents are discussed and combined in this research.

Answering the specific research question 1 (Is garlic perceived by the government, farmers, and extension agents as a feasible and desirable alternative crop to be cultivated in the wet season within the farming system?), this research refers to Chapter 5, which gives the results of the feasibility study. This research uses the farming system analysis to identify the feasibility of garlic value chains from the government's, farmers', and agricultural extension agents' perspectives. The application of farming system analysis for a feasibility study provides a more explicit focus on the farmers' situation as well as internal possibilities and considerations. It is recognised that this approach is beneficial to look at the technical problems in detail. Table 3 provides the analysis of the divergence of perspectives on to what extent the garlic production is feasible and desirable. The grey cells show the contested aspects related to the feasibility and desirability of garlic production in Temanggung.

Table 3 Analysis on the divergence of perspectives on feasibility and desirability of garlic production in Temanggung (grey cells show the contested aspects)

Variable	Govts' Perspective	Farmers' Perspective	AEAs' Perspective
Technical Feasibility			
Soil and land use management	Based on the government's technical assessment, nature and soil conditions in Temanggung are considered suitable for garlic farming. The government found that potential garlic production in Temanggung is the biggest among other locations in Indonesia.	Based on past experiences, farmers from both Wonosari and Bansari indicate that the soil and weather conditions in their farmlands during the wet season are suitable for garlic cultivation.	AEAs argue soil and climate conditions in Temanggung are very suitable for garlic farming. There are some technical issues, such as soil nutrient imbalance and extreme weather, but farmers are able to tackle these problems.
Labour availability	The government believes that there is no issue with labour requirements.	Garlic requires more labour than other horticulture crops. However, there is no issue with labour because farmers can easily get labour through the *Gerakan* mechanism managed by the farmers' association.	AEAs confirm that farmers have sufficient labour and they have the *Gerakan* mechanism if they need more labour.

Variable	Govts' Perspective	Farmers' Perspective	AEAs' Perspective
Input management Contested issue: • seed availability and price	Farmers can get agricultural inputs easily because the government provides for most of their needs. The problem is only the limited stock of garlic seeds. However, since 2016, the national government has developed a public private partnership (PPP) for garlic sees production. There will be no issue with the garlic seed stock by 2018.	Farmers realise that the biggest issue in the input management is the seeds which are rare and expensive. They argue that the government, along with their PPP, failed to provide sufficient stock of cheap seeds for garlic production at the farmer level. The scarcity and high prices of garlic seeds remain the same as in 2016 before the PPP was implemented. Seeds are still very expensive (about three to four times of price of garlic they produce bought on the market, meanwhile one seed can only produce six to eight garlic bulbs). To farmers, the price of garlic seeds is a reason to opt for other crops rather than garlic.	AEAs find that farmers do not have any difficulty in getting agricultural inputs except seeds. AEAs realise that garlic seeds are rare and very expensive for farmers, but the government already developed a PPP to deal with this problem. AEAs find that some farmers are acting in a creative way since they have an idea to produce seeds themselves, even though the seeds have not been certified and proven to produce a good quality and quantity of garlic.
Access to capital	Farmers do not face any difficulty in accessing capital because the government subsidises about a half of capital needed in the form of agricultural inputs.	Farmers acknowledge that the government's subsidy helps them a lot. Farmers argue that access to capital is not a problem for them since they can get bank or middleman loans.	AEAs confirm that there is no capital issue at the farmer level.
Economic Feasibility			
Cash availability Contested issue: • Period to earn cash income from garlic	Farmers earn a cash income from garlic between three to four months after the cultivation period.	Farmers earn a cash income three to four months after cultivation, which is a longer waiting period than other crops (chili peppers after 2.5 months, shallots after two months, vegetables after one month)	Farmers only receive cash income three to four months after the cultivation period because the government requires them to use a monoculture farming system.
Net income Contested issue: • Return on the total cost	Garlic gives a good income for farmers. In the past, it was called the 'white diamond,' and farmers could buy luxury cars with their income.	Local garlic cannot compete with imported garlic. Consumers prefer to buy imported garlic because it is larger and cheaper than local garlic. Price of local garlic in the market is low because of the low price of imported garlic. Farmers argue that the return on the cost of local garlic production is very low when compared to other crops that they typically cultivate during the wet season (chili peppers, shallots, and vegetables). Therefore, they prefer to plant more profitable crops than garlic.	The price of garlic in the market fluctuates. The average price of local garlic is around 20-25K IDR per kg. The break-even price of local garlic is 20K IDR per kg, and the price of imported garlic is under 20K IDR per kg. Local garlic cannot compete with imported garlic in terms of price. When the price of local garlic reaches 30K IDR per kg or more, farmers will get a good income. When the price is lower than 20K IDR per kg, farmers will lose a lot of money.

Variable	Govts' Perspective	Farmers' Perspective	AEAs' Perspective
Legal Feasibility			
Policy and legal commitment Contested issue: • Requirement of the mono-cropping system • Regulation on the minimum price of local garlic • Regulation on the garlic import quota	The government has allocated funds to support the national garlic self-sufficiency programme. They give farmers 20,000,000 IDR (± 1,212 EUR) per Ha for subsidy.	It is true that the government gives financial support to farmers who want to cultivate garlic.	The government commits to giving a subsidy to farmers who want to cultivate garlic. Farmers in Wonosari are interested in cultivating garlic because of the subsidy and the encouragement of their leaders in farmers' associations. Farmers do not want to cultivate garlic for commercial usage if they do not get a subsidy.
	The government requires farmers who get the subsidy to cultivate garlic with the mono-cropping system to get more yield in order to achieve the goal as soon as possible. Monoculture can give farmers more cash at the end of cultivation period.	Farmers do not like the monoculture farming system required by the government for those who want to get the subsidy. Because of the monoculture regulation, farmers cannot get additional cash for living expenses from other crops before they harvest the garlic, and they cannot produce their food for domestic consumption.	The regulation of the monoculture farming system is risky for farmers. It is one of the reasons why farmers in Bansari do not want to cultivate garlic with the subsidy. The monoculture farming system makes the farmers' access to cash more difficult.
	There is no minimum price regulation for local garlic due to the existence of a perfectly competitive market and cash logic rather than food security logic. However, Bulog will buy the local garlic at a break-even price (BEP) when the price of local garlic is very low in the market.	There is no minimum price regulation for local garlic, meaning farmers have a huge risk to experience financial losses. Bulog will buy local garlic from the farmers with the BEP if the price of garlic in the market is very low, which means that the total revenue can only cover the total cost. There will be no revenue margin for farmers. How can the farmers live without any margin?	There is no minimum price regulation for local garlic. But the government will help farmers if the price is too low.
	Limiting the importation of garlic is hard. The Ministry of Agriculture, who established the garlic farming programme, would need to coordinate with other official institutions.	Farmers argue that if the government does not limit the importation of garlic from China, the government is not serious about reaching the goal of national garlic self-sufficiency.	There is no import quota limitation for garlic.
Operational Feasibility			
Farmers' capability & knowledge	The government argues that farmers have a good knowledge of how to cultivate garlic because they were garlic farmers in the past. The government provides an agricultural extension agent in each village to help farmers to	Farmers from both villages declare that they have sufficient knowledge on cultivating garlic because they were used to it in the past.	AEAs admit that all of the farmers in the highland area of Temanggung are very capable of cultivating garlic. AEAs only need to provide recent information about new technical knowledge since people have not planted

Variable	Govts' Perspective	Farmers' Perspective	AEAs' Perspective
	access more recent technical knowledge in garlic farming.		garlic on a large scale for many years.
Post-harvest management	The government sees garlic as easy to stored freshly for a long time compared to other horticulture commodities such as vegetables and chili peppers. The government also developed good transportation infrastructure from the village to the farmlands.	Farmers lose up to 20-50% of the garlic weight if they store the garlic for a long time. Farmers acknowledge that the transportation infrastructure is better than in the past. This condition makes it easier for farmers to transport their yields from the farmland to their home or markets.	Farmers have a basic knowledge of the post-harvest handling method for garlic. Farmers only need improvements on the storage techniques so the garlic weight will not shrink too much.
Scheduling Feasibility			
Cropping system rotation	The government claims that garlic is compatible with a cropping system rotation of tobacco as the main cash crop cultivated by farmers in Temanggung during the dry season.	Farmers from both Wonosari and Bansari acknowledge that garlic is compatible with the cropping calendar of tobacco as their main commodity. Garlic can be cultivated only in the wet season, ranging from November to March. Meanwhile, tobacco is cultivated from April to October.	AEAs give the same information as the government and farmers. They mention that in the field, they do not find any problem with the rotational schedule for garlic.

Overall, all stakeholders agree that garlic production is technically feasible in Temanggung. Even though garlic requires more labour than other alternative crops in the wet season, labour is not a problem for farmers. To know the total labour required for garlic farming, a study by Keyser (2007) is used. The study is about the labour need for various crops in small-holder farming in Central Java (including Temanggung) based on farmers' experiences.

As shown in Table 4, compared to other crops planted in the upland areas of Temanggung, the needs of labour in garlic farming are higher than vegetables and corn, which are 360, 166, and 95 days per hectare, respectively. Meanwhile, the needs of labour for chili peppers and tobacco are higher than garlic. Nevertheless, the amount of labour needed is not a problem for farmers in Temanggung. They can find labour easily through the farmers' association. Farmers' associations in the upland areas of Temanggung will help their members to find labourers by means of the '*Gerakan'* mechanism.

Table 4 Labour requirements for various crops in small-holder farming in Central Java (days/ha)

Crops	Total labour
Tobacco	693
Garlic	360
Chilli peppers	582
Carrots (vegetables)	166
Corn	95

(Adjusted from Keyser, 2007)

The only contested element regarding technical feasibility is the problem of the garlic seed stock in the market. Farmers found that a limited stock of garlic seeds is available, and the

price is very high. Although the government has developed a public private partnership (PPP) with PT Pertani (a private company providing agricultural inputs) since 2016 to provide more garlic seeds for farmers at a lower price, this partnership does not work well. PT Pertani is often out of stock of garlic seeds due to their inability to do mass seed production, so the farmers must look for seeds on the market. The Directorate General of Horticulture at the Ministry of Agriculture noted that the need for garlic seeds is estimated at 72,000 tonnes, while the seed production capacity of PT Pertani is only 26,000 tonnes, because they only have 1,365 hectares of land for the production[3]. The scarcity and high demand for garlic seeds cause the high price of garlic seeds on the market. To farmers, the price of garlic seeds is a reason to opt for other crops rather than garlic. They prefer cultivating other crops whose seeds can be found easily and at more affordable prices than garlic.

While the government perceives garlic as economically feasible for farmers in Temanggung, most farmers argue that garlic is the most unfavourable cash crop which gives very low return on total cost compared to other alternative cash crops during the wet season. Two studies by Keyser (2007) and Rahmadona et al. (2015) describe the return on total cost of some crops in small-holder farming in Central Java (including Temanggung), based on farmers' experiences. Return on total cost measures the return (net profit) that farmers get, relative to the total cost or capital needed to cultivate the specific crop.

Table 5 Indonesia financial indicator for small-holder farmers in Central Java

Crops	Return on Total Cost (%)
Tobacco	76
Garlic	10 (without subsidy) / 60 (with subsidy)
Chili peppers	96
Shallots	110
Carrots/vegetables	66

(adjusted from Keyser, 2007 and Rahmadona et al., 2015)

As demonstrated in Table 5, garlic has the lowest return on total cost compared to other crops. For every rupiah cost that is made, 1.10 IDR is gained in return or 0.1 IDR is left as net income (excluding household labour, because the cost of own labour is most likely not included when calculating net profit). It means that when the garlic needs investments per hectare is 40,000,000 IDR (±2,400 EUR), farmers only earn 44,000,000 IDR (±2,400 EUR) from sales, amounting to 4,000,000 IDR (±240 EUR) of net income after they have been working for four months. Even when farmers get subsidies, the return on total cost remains the lowest among other crops. Garlic farmers with a subsidy will only get 60% of the total cost as the net profit (24,000,000 IDR or ±1,440 EUR). For chili peppers and shallots, a 96% and 110% return on total cost are possible, respectively. During the interviews, some farmers demonstrated a rough calculation of chili pepper and shallot investments. For one hectare of land, farmers will invest around 50,000,000 IDR (±3,000 EUR) for chili peppers and 20,000,000 IDR (±1,200 EUR) for shallots. At the end of the production period, farmers will get a net income amounting to 48,000,000 IDR (±2,880 EUR) for chili peppers in four months and 22,000,000 IDR (±1,320 EUR) for shallots in two months. Therefore, in comparison, the monthly net income received by farmers every month is 1,000,000 IDR (±60 EUR), 12,000,000 (±720 EUR), and 11,000,000

[3] Benih bawang putih: Pertani siapkan lahan 1,365 hektare (Garlic seeds: Pertani prepares 1,365 hectares of land). Retrieved from http://kalimantan.bisnis.com/read/20170621/452/664653/benih-bawang-putih-pertani-siapkan-lahan-1.365-hektare.

(±660 EUR) for garlic, chili peppers, and shallots, respectively. This finding demonstrates that garlic is the most unfavourable cash crop for farmers.

Contested elements are also found in the legal feasibility in which the government asserts that they already have a strong commitment to make the national garlic farming programme in Temanggung succeed. The government sets some regulations such as the monoculture requirement and subsidies to foster the amount of garlic production so that farmers can get more profit. However, farmers argue that the regulations are detrimental to them. The mono-cropping requirement causes farmers to not get any additional income for garlic. Farmers see the monoculture farming system as too risky for them because they would only depend on one crop. Moreover, farmers cannot produce their food for domestic consumption if they only cultivate garlic. The agricultural extension agents know this condition, but they can do nothing other than encourage farmers to obey the regulation because the extension agents are working for the government. There is a problem in the role of these agents who are either not allowed to or are not trained to communicate bottom-up, but only top-down. To solve this legal issue, I suggest that the government to rethinks this regulation. Lifting the ban on inter-cropping may be the best solution so that farmers can still produce their own food as well as get an income from other crops.

Farmers argue that giving a subsidy is not enough. They emphasise that it is more important to make a regulation on the minimum price of local garlic and a garlic import quota limitation rather than giving a subsidy to make the garlic production in Temanggung succeed. The Ministry of Agriculture says that regulation of the minimum price of local garlic is not possible due to the competitive open market in Indonesia in which the price formation occurs in the market. Nevertheless, the Ministry of Agriculture through Bulog will help farmers by buying the local garlic at the break-even price if the price is very low. However, farmers say that buying their garlic at the break-even price is absolutely not profitable for farmers. In fact, the very concept of break-even implies that there is no profit left. It means their own labour is delivered at zero rupiah; in fact, the break-even price is not guaranteed as their own labour needs to be paid for. Farmers cannot afford their living costs if there is no profit left.

Besides, the government also asserts that limiting the import quota of garlic from China is also not easy. The Ministry of Agriculture, who runs the garlic farming programme, should coordinate with other official institutions, such as the Ministry of Trade. It is also hard for the government to stop the importation of garlic from China since it has a risk to disrupt the bilateral cooperation between the two countries, especially in the trading partnership. Limiting the importation quota of garlic from China could have reciprocal consequences as the Chinese government may not stay silent if there is an import quota limitation. From the farmers' perspective, it is unfair that they have to compete with imported garlic without any intervention from the government since they stopped cultivating garlic in the past because the government opened the opportunity for garlic to be imported, and local garlic became uncompetitive compared to the imported one. Farmers consider that the domination of imported garlic in the garlic value chain in Indonesia is the fault of the government, and the government must take responsibility without harming the farmers.

Even though limiting the import quota of garlic from China is hard to be done directly, I think there are other solutions which can be considered by the government to limit the import quota in another way, for instance, by implementing a non-tariff barrier. In addition to quotas and

tariffs, requirements such as safety standards, quality restrictions, labelling requirements, and pollution control can be strategies to reduce the importation of garlic. Many importation restrictions aim to protect consumers in the domestic markets, while at the same time, create barriers for foreign products to enter the country. For example, limitations on residue levels in food by the European Union member states and the United States lead to discouraging the importation of foreign goods, but the main intention is to protect consumers from harmful chemicals, not to restrict trade (University of Minnesota, 2016). I found some evidence that garlic from China is not always safe to be consumed. Reuters stated that at the beginning of 2018, Indonesia discovered that more than 200 tonnes of garlic imported from China were contaminated by a microscopic worm which is harmful to consumers[4]. In the USA, where one-third of garlic is imported from China, the food security authority found contamination cases of methyl bromide (a pesticide) in Chinese garlic. As per Chinese law, it is mandatory for farmers to spray pesticides which contain methyl bromide because it helps fight off insects and plant matter[5]. Residues like this can lead to life-threatening illnesses. Those facts, which demonstrate the lack of safety of garlic from China, can be used as a basis to generate non-tariff import barriers.

To sum up, all stakeholders agree that garlic production is technically, operationally, and in terms of scheduling feasible in Temanggung. However, from the farmers' perspective, garlic production is absolutely not economically feasible. Garlic does not provide a good income for farmers compared to other alternative cash crops. The government is also not able to strongly regulate the value chain of garlic in Indonesia due to the competitive open market logic. The government cannot set the minimum price of local garlic, and they are not able to limit the amount of imported garlic coming in to the domestic market.

Answering the specific research question 2 (Do the government, farmers, and agricultural extension agents perceive system failures in the garlic value chain, prohibiting the adoption of garlic production? What are critical issues for the innovation process?) and specific research question 3 (How do the government, farmers, and agricultural extension agents interact with each other in the programme planning and implementation process?), this research refers to Chapter 6 where the results of the system failure analysis are described. Figure 18 below demonstrates the combination of the different perspectives of the government, farmers, and agricultural extension agents in analysing the system failure and where it occurs. Here, I found that there is less contradiction, but some do not identify their own sources of problems, for instance, an AEA will obviously not say that he does not function well.

[4] Infested Chinese garlic imports kick up a stink in Indonesia. Retrieved from https://www.reuters.com/article/us-indonesia-china-garlic/infested-chinese-garlic-imports-kick-up-a-stink-in-indonesia-idUSKCN1GR1DZ.

[5] Garlic danger alert: Reasons why it can be poisonous. Retrieved from https://timesofindia.indiatimes.com/life-style/health-fitness/garlic-danger-alert-reasons-why-it-can-be-poisonous/how-is-garlic-poisonous/photostory/61336739.cms.

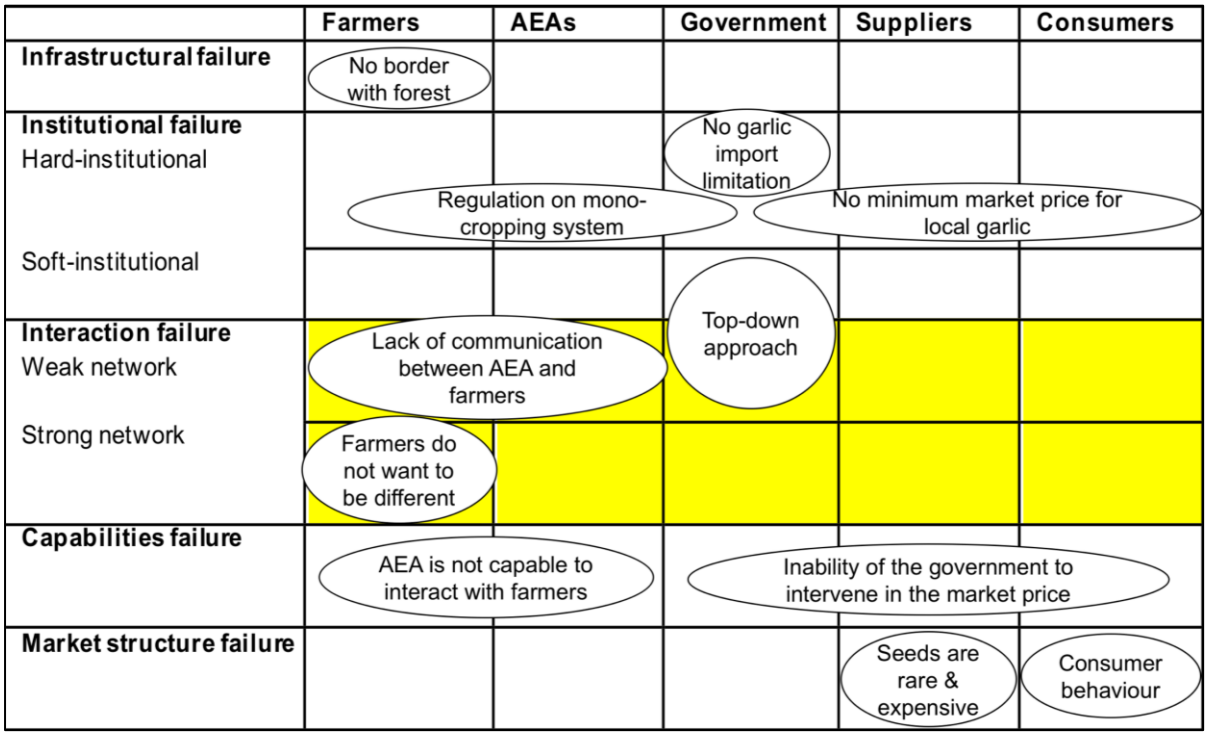

Figure 18 Combination of system failure analysis of the national garlic farming programme in Temanggung based on the government's, farmers', and agricultural extension agents' perspectives

The research results show there are quite a few system imperfections found in the garlic value chain in Indonesia. The most similar understanding between the government, farmers, and agricultural extension agents is found in system failures in the market structure. All three stakeholders agree that there are two market structure imperfections which happen at the level of suppliers and consumers. Firstly, the supplier (PT Pertani) failed to provide sufficient seeds for farmers at an affordable price due to the limited seed production capacity. As mentioned in the technical feasibility analysis, this limited production capacity issue is caused by the limited seed production area owned by PT Pertani. If the production area is the problem, I argue that this issue can be tackled by involving farmers in the seed production. The concept of the farmers' participatory seed production (Singh, et al., 2013) or community seed production (Bishaw & Niane, 2013) may be suitable to be introduced in the garlic seed production in Indonesia. In this production concept, farmers produce seeds in a group under the government and company supervision of the seeds' quality. Involving farmers in the PPP between the government and PT Pertani may be interesting for farmers, since this type of partnership has benefits for farmers such as seed availability and adequate income (Bishaw & Niane, 2013).

Secondly, the consumers still prefer to buy imported garlic rather than local garlic due to its larger size, cheaper price, and cleaner appearance. The local garlic simply fails to reach reasonable consumer demands. This condition occurred after imported garlic from China entered the Indonesian market. The image of local garlic was getting worse even though the quality of local garlic is better than imported garlic. To change the consumer behaviour from consuming imported garlic to preferring local garlic, the government should at least restore the positive image of local garlic. It will be interesting for the next stage of research to use the image restoration theory to list and plan possible strategies which can be used to increase the positive image of local garlic. This theory is also called image repair theory because it

discusses how to improve, restore, or repair the bad image and reputation of something (Benoit, 2015).

Regarding infrastructure, there is only a minor failure, which is the absence of a border between the farmlands and forest that leads to wild animal attacks. The farmers already have an idea to solve the problem by simply planting fruit trees to provide enough food for the wild animals, since the attacks are most likely for food hunting. At the institutional level, all of the failures are found on the government's side. Stakeholders in the garlic value chain, especially farmers, argue that the government fails to limit the amount of imported garlic coming in to Indonesia, regulate the minimum market price for local garlic (as shown in the capability failure as well), and attract farmers with a monoculture farming system.

Regarding interaction, this research found that there are weak networks between farmers, the government, and agricultural extension agents in the innovation process. The Ministry of Agriculture planned the whole programme at the national level without involving farmers and brought the programme to the farmer's level through agricultural extension agents with the hope that farmers will contribute to the programme. In fact, because of the absence of farmer involvement during the planning phase, many farmer's aspirations were not taken into account. During the planning process, the Ministry of Agriculture only focused on the technical feasibility of garlic production. They said that Temanggung has a potential to produce garlic on a mass scale like in the past; they did not consider the present economic conditions of local garlic.

This top-down approach put the government as the key actor formulating and directing the garlic farming programme unilaterally without considering the financial feasibility for the farmers. The agricultural extension agents and local agricultural officers were trained and informed of what they need to do without any space for discussion about the appropriateness of the advice to be given to farmers. They were mainly concerned with executing the plan from the Ministry of Agriculture to reach the garlic production goals. The fact that the government only focused on increasing the productivity of garlic clearly demonstrates that they tried to use the diffusion of innovation approach in which the role of farmers is to be adopters or laggards (Klerkx, van Mierlo, & Leeuwis, 2012), whereas to make a successful garlic farming programme, increasing productivity is not enough. It needs broader institutional changes, such as improvements in the garlic value chain, changing consumers' behaviour, regulating the price of local garlic, and import control. The government should consider farmers as their partners, not only the object of change. In fact, farmers want to be involved in the planning processes so that they can communicate their desires. Thus, rather than using the linear model of innovation, the perspective of the agricultural innovation system (AIS) is the most appropriate approach which allows the garlic farming programme to take off because all stakeholders have the same pressure to reach the common goal they made together. Leeuwis (2003) argues that an agricultural policy is unlikely to be successfully applied unless an adequate effort has been made by the government during the policy design and implementation processes to listen and interact with the actors in the value chain.

According to the AIS perspective, the government should regard farmers as their partners to make institutional changes, and the development of innovation is done through considering multi-stakeholder processes and partnerships (Klerkx, van Mierlo, & Leeuwis, 2012). The AIS framework captures the essence of linkages between all stakeholders in the garlic value chain

and the institutions and policies that denote the enabling environment for innovation. Within this AIS framework, farmers should be considered as important actors in the value chain who are not only assisted by agricultural extension agents and governments to increase their garlic production, but also by other actors in the value chains such as the seed producers that offer useful technical assistance, as well as retailers to comply with the consumers' expectations and to improve the price of local garlic. Therefore, the AIS portrays a network of organisations, enterprises, and individuals that focus on bringing the garlic production into economic use, together with institutions and policies that affect the way different stakeholders behave and interact (Klerkx, van Mierlo, & Leeuwis, 2012).

Interaction between farmers and agricultural extension agents is also being observed in this research. This research found that the closeness of the relationship between farmers and AEAs also determines the extent of the of adoption of garlic production. In Wonosari Village, farmers argue that their relationship with the AEA is very close due to frequently meeting. Therefore, they are more open to adopt garlic production because they regard the AEA as a part of their community. In contrary, farmers in Bansari do not have good bond with the AEA, and the farmers do not even know the name of the AEA because they have never met him before. Farmers see the AEA as an outsider of their group; therefore, farmers do not easily believe what is said by the AEA. As the key person to promote garlic production at the farmer level, the AEA failed to convince farmers to cultivate garlic during the wet season. The bad performance of AEAs may be solved by evaluating and motivating them. Learning from the experience in Kenya, the AEAs are directly supervised by the national government in which they get instruction, guidance, and discipline to fulfil their extension duties and responsibilities (Mwangi & McCaslin, 1995). The AEAs also get some incentives, for instance, in the form of remuneration, housing, and transportation allowances (Mwangi & McCaslin, 1995).

This research also found the presence of a strong network which may lead to the failure of the garlic value chain: the strong network happens at the farmers level, in which farmers do not want to be different from their farmers' association. On one hand, this strong connection may lead to a system failure when the leaders of the farmers' association decide not to cultivate garlic. This causes the farmers to also not want to cultivate garlic because they uphold togetherness and uniformity. The strong network between farmers may lead to groupthink, which is described as an easy and quick way to refer a mode of thinking that people are involved in when they are deeply engaged in a cohesive in-group (Haslam, 2004). Through groupthink, farmers can refuse a reality or view from outside their group which is not in line with their beliefs. The phenomena of groupthink occur with some symptoms, namely illusion of invulnerability, belief in the morality of the in-group, closed-mindedness, collective rationalisation, stereotypical views of out-groups, pressures toward uniformity, self-censorship, an illusion of unanimity, pressures placed on deviants, and mind-guarding (Haslam, 2004). On the other hand, this strong network may become an opportunity to attract more farmers to cultivate garlic. The most important thing is to maintain a good interaction and bond with the farmers' association leaders because they have the power to make decisions in the farmers' association. When the leaders make decisions in the farmers' association, such as participating in garlic production, all farmers in the association will obey the decision.

To use the system failure framework in this research, I interviewed each stakeholder separately, analysed each stakeholder's perspective, and elaborated their perspectives to make a system failure analysis to identify problems for policy advisers. This method for using

the system failure framework is uncommon among the researchers in system innovation studies since most of them use this framework in a workshop situation. This framework is often used to stimulate dialogue and reflection for action amongst value chain actors on failures and opportunities to start or to evaluate a system innovation project (van Mierlo, Arkesteijn, & Leeuwis, 2010). However, this research uses this framework to identify tensions between perspectives and interests of each stakeholders on issues that should be solved before the garlic farming programme can be implemented at the farmer level. In a hierarchical organisational structure, this approach might be more useful than to invite all stakeholders to one workshop. This approach allows the stakeholders to express their opinions without any intervention from other parties—which is most likely to occur in the workshop—and then the researcher can use the information to reduce the bias for comprehensively understanding what exactly is happening in the field.

Anandajayasekeram (2011) argues that activities related to farming systems research have been weak in providing policy feedback from the field level to decision makers. This argument shows a gap that might be visible in this case study by doing an assessment of the farmers' situation using farming system analysis for policy makers. Moreover, some related social issues are not incorporated in the farming system analysis, for instance, how different actors interact with each other. To make up for these shortcomings of farming system analysis, the system failure framework is used by doing an assessment at the garlic value chain level. I argue that the system failure framework and FSA complement each other, since system failure analysis provides a broader analysis on the identification of key actors at the value chain level, while FSA gives a better understanding of day-to-day situations as experienced at the farm level (so, the impact of constraints existing at the value chain level on the farmer level). This multi-level perspective (with the farmers' level as niche and the value chain level as regime) provides a relatively straight-forward way of simplifying and ordering the analysis of complex issues. The use of a multi-level perspective offers advantages in that its main arguments gain relevance, credibility and support in policy debates (Weber & Rohracher, 2012).

In general, the system failure framework is largely used for enabling value chain actors to negotiate and establish innovation for a policy-oriented integration of innovation systems (Weber & Rohracher, 2012). In this research, the final analysis of the system failure framework is also used to give feedback to the government for making policy. This research reveals where the present policy fails and what innovative alternatives or new regulation approaches are possible in order to overcome the bottleneck of the garlic farming programme in Temanggung. This is a new approach for using the system failure framework (Weber & Rohracher, 2012). This extended framework of system failures highlights the importance of innovation policies, not only for economic competitiveness and growth, but also for dealing with other challenges and policy aims (Weber & Rohracher, 2012). This new approach allows for a policy-oriented integration of innovation system concepts with the complementary multi-level-perspective of transitions.

8. CONCLUSION AND RECOMMENDATION

It is clear from the farmers' perspective that garlic production is not a desirable option for them. This research thus concludes that there are three major reasons behind farmers' decision not to participate in the national garlic farming programme in Temanggung. Firstly, farmers see the future of local garlic as unclear due to a huge competition between local garlic and imported garlic because there is no import quota limitation. Farmers think that the imported garlic from China is the biggest enemy of local garlic, so farmers urge the government to limit its importation in order to secure the future of local garlic, which will encourage farmers to cultivate garlic. Farmers do not see the advantages of changing to garlic production because of the economic concerns. The price of local garlic remains too low to make the investment profitable, even though they get a subsidy. The government is not able to regulate the minimum price of local garlic because of the competitive open market mechanism in Indonesia. At the consumer level, consumers also prefer to buy imported garlic because of its cheaper price, larger size, and cleaner appearance compared to local garlic. In the market, local garlic is less competitive than imported garlic. Furthermore, the seeds are rare and not affordable for farmers. The PPP established by the Ministry of Agriculture and PT Pertani is not able to provide sufficient seeds for farmers at the present time due to the limited seed production capacity of PT Pertani. To farmers, the scarcity and the price of garlic seeds are additional reasons to opt for other crops rather than garlic. Moreover, from a farm household perspective, the fact that other alternative crops may be less risky and more remunerative discourages farmers to produce garlic.

Secondly, farmers consider that the change is not their idea since the initiative of the garlic farming programme only comes from the government. The government used a top-down approach during the planning stage in which the government planned the whole programme in Jakarta and brought their decision to Temanggung. The absence of the farmers' involvement during the planning phase caused the farmer's wishes to not be taken into account, for instance, the requirement of monoculture farming that is unfavourable for farmers. Monoculture is not the typical way that farmers manage their farmland; they usually do inter-cropping farming to have food more consistently available from their own farm as well as a more constant cash flow. Therefore, farmers do not like this requirement. Thirdly, farmers do not want to be different to their farmers' association. This is happening in Bansari Village, where farmers prefer to be uniform with their peers in the farmers' association. They believe in the morality of in-group uniformity called *tepa-salira* (solidarity). When the farmers' association chooses not to cultivate garlic, all of the farmers conform to the decision as a form of solidarity with others. In contrast, when the farmers' association decides to cultivate garlic, farmers will follow this collective decision. This research recognises that the decisions in farmers' association are made by their leaders. In the case of Bansari Village, where farmers decided not to implement garlic production, the agricultural extension agent as the representative of the government is seen by the farmers as part of an out-group.

Based on the findings, this research will provide some recommendations for the policy makers to deal with the system failures which lead to the farmers' decision not to join the garlic farming programme. The recommendations are as follows.

1. Involving farmers in the innovation processes

It is clear that farmers want to be involved in the innovation processes in garlic production. Therefore, the government should consider involving farmers by enabling dialogue and discussion between the government and farmers, which can be facilitated by the AEAs. The government should not only regard farmers as the object of change, but also as partners for enabling garlic production as well as dealing with the bottlenecks in the envisioned garlic value chain.

2. Improving AEAs' performances

In some area, such as Bansari Village, the AEAs do not function well. It is essential for the government, especially the Ministry of Agriculture and local agricultural office, to evaluate the performances of AEAs and motivate them to achieve their duties and responsibilities as extension agents. Learning from Kenya, the AEAs performances can be improved through training, supervision, and giving some incentives such as in the form of remuneration, housing, and transportation allowances with which they can achieve their working goals (Mwangi & McCaslin, 1995)

3. Involving farmers in seed production

The scarcity and price of garlic seeds is currently a problem in the garlic value chain. This issue is caused by the limited garlic seed production capacity of PT Pertani. PT Pertani only has 1,365 hectares of land to produce 26,000 tonnes of garlic seeds out of 72,000 tonnes of garlic seeds needed for the national garlic value chain. Involving farmers in the PPP between the Ministry of Agriculture and PT Pertani can increase the production area so that the garlic seed production capacity can be improved. PT Pertani only needs to train farmers in producing good-quality seeds which meet the certification requirements. Involving farmers in the PPP between the government and PT Pertani may be interesting for farmers since this type of partnership has benefits for farmers such as seeds availability and adequate income (Bishaw & Niane, 2013). By involving farmers in this PPP, the stock of garlic seeds will be no longer an issue.

4. Enhancing the positive image of local garlic

The government should enhance the positive image of local garlic to attract consumers in purchasing local garlic, even though they have to pay more. Since only a small amount of garlic is necessary to provide flavour in a dish, the overall amount of garlic used is low, and the additional cost for buying local garlic will not place a large burden on the consumers. It would be interesting to do further research on possible communication strategies to enhance the positive image of local garlic using the Benoit's image restoration theory (Benoit, 2015) or other strategic communication theories. Image restoration theory elaborates strategies that can be used to restore the image of local garlic to what it was before imported garlic began to enter Indonesia in 1998.

5. Lifting the ban on inter-cropping

The ban on inter-cropping practices in the garlic production area is detrimental for farmers. The monoculture farming system has a higher risk for farmers because they are required to rely on only one crop. Moreover, farmers cannot plant their own food for domestic consumption. Lifting the ban on inter-cropping practices would be a wise action that can be taken by the government so that farmers can get additional income as well as produce their own food. Rather than focusing on increasing the garlic production by using a mono-cropping system, it is better to consider the culture of farmers, which usually involves planting various crops in one area since it also secures the farmers' need for food.

6. Implementing an import barrier

Even though it is hard to directly limit the import quota of garlic from China because of the free trade agreement, there are still some ways can be considered by the government to protect local garlic in the market. In addition to quotas and tariffs, requirements such as safety standards, quality restrictions, labelling requirements, and pollution control can be strategies to reduce the importation of garlic. Many import restrictions aim to protect consumers in the domestic markets, but at the same time, create barriers for foreign products to enter the country. For example, limitations on residue levels in food by the European Union member states and the United States lead to discourage the imports of foreign goods, but the main intention is to protect consumers from harmful chemicals, not to restrict trade (University of Minnesota, 2016). The fact that Indonesia discovered that more than 200 tonnes of garlic imported from China in the beginning of 2018 were contaminated by a microscopic worm as well as methyl bromide (pesticide)—which are both harmful to consumers—can be used as a basis to generate non-tariff import barriers.

REFERENCES

Aarts, N., & van Woerkum, C. (2005). Frame construction in interaction. *MOPAN 2005. Multi-Organisational Partnerships, Alliances and Networks. Engagement., 12th MOPAN International Conference*, (pp. 229-237). Pontypridd.

Alder, R., Lookinland, S., Berry, J., & Williams, M. (2003, March). A Systematic Review of the Effectiveness of Garlic as an Anti-Hyperlipidemic Agent. *15*(3).

Amanda, D., Syaukat, Y., & Firdaus, M. (2016). Estimating the market power in the Indonesian garlic industry. *22*(2).

Anandajayasekeram, P. (2011). *The role of agricultural R&D within the agricultural innovation systems framework.* FARA.

Benoit, W. (2015, July 23). Image Restoration Theory. *The International Encyclopedia of Communication*.

Bishaw, Z., & Niane, A. A. (2013). Are Farmer-Based Seed Enterprises Profitable and Sustainable? Experiences of VBSEs from Afghanistan. In C. O. Ojiewo, S. Kugbei, Z. Bishaw, & J. C. Rubyogo, *Community Seed Production* (pp. 55-64). Rome: FAO.

Derpsch, R., Lange, D., Birbaumer, G., & Moriya, K. (2016). Why do medium- and large-scale farmers succeed practicing CA and small-scale farmers often do not? – experiences from Paraguay. *International Journal of Agricultural Sustainability, 14*(3), 269-281.

Directorate General of Horticulture Indonesia. (2017). *Pengembangan bawang putih nasional (national garlic development).* Jakarta: Indonesian Ministry of Agriculture.

Elmusharaf, K. (2012). Qualitative sampling techniques: training course in sexual and reproductive health research.

Elzen, B., & Barbier, M. (2012). *System innovations, knowledge regimes, and design practices towards transitions for sustainable agriculture.* French National Institute for Agricultural Research (INRA).

Entman, R. M. (1993, December). Framing: Toward Clarification of a Fractured Paradigm. *Journal of Communication, 43*(4), 51-58.

Fresco, L. O. (1988). *Farming system analysis: an introduction.* Wageningen: Agricultural University Wageningen.

Gebreyohannes, G., & Gebreyohannes, M. (2013, September). Medicinal values of garlic: A review. *5*(9).

Haslam, S. A. (2004). *Psychology in Organizations: The Social Identity Approach.* London: SAGE Publications Ltd.

Indonesian Ministry of Agriculture. (2017a). *Statistik Konsumsi Pangan 2017 (Food Consumption Statistics 2017).* Jakarta: Indonesian Ministry of Agriculture.

Indonesian Ministry of Agriculture. (2017b, April). Retrieved January 14, 2018, from http://hortikultura.pertanian.go.id/?p=2132

Keyser, J. C. (2007). *Crop substitution and alternative crops for tobacco .* WHO.

Klerkx, L., van Mierlo, B., & Leeuwis, C. (2012). Evolution of systems approaches to agricultural innovation: concepts, analysis and interventions. In I. Damhofer, D. Gibbon, & B. Dedieu, *Farming Systems Research into the 21st Century: The New Dinamic.* Dordrecht: Springer.

Leeuwis, C. (2004). *Communication for Rural Innovation: Rethinking Agricultural Extension.* Oxford: Blackwell Publishing.

Morgan, D. L. (1997). *Focus groups as qualitative research* (Vol. 16). London: SAGE Publications.

Mwangi, J. G., & McCaslin, N. L. (1995). Factors related to the motivation of extension agents in Kenya's Rift Valley Province. *Journal of Agriculture and Extension Education*, 16-25.

Oben, T., & Boukong, A. (2014). *Intergrated soil fertility management: farming system analysis.* Capacity4Food.

Rahmadona, L., Fariyanti, A., & Burhanuddin, B. (2015). Analisis Pendapatan Usahatani Bawang Merah di Kabupaten Majalengka. *Acricultural Socio-Economics Journal, 15*(2).

Roberts, J. O., & Mosey, G. (2014). *Economic and Technical Feasibility Study of Utility-Scale Wind Generation for the New York Buffalo River and South Buffalo Brownfield Opportunity Areas.* Oak Ridge: US Environmental Protection Agency.

Rouzbahani, M. T., Babaei, M., Mehdi, P., Mojarad, B. B., & Yaghoubi, M. (2013). The Feasibility Process of Executive Outsourcing with TELOS Technique from Managers and Experts' Viewpoints. *Journal of Basic and Applied Scientific Research, 3*(7).

Schut, M., Rodenburg, J., Klerkx, L., van Ast, A., & Bastiaans, L. (2014, February). Systems approaches to innovation in crop protection. A systematic literature review. *Crop Protection, 56*, 98-108.

Singh, S. K., Dubey, S. K., Ali, M., Nigam, S. N., Srivastava, R. K., Saxena, K. B., . . . Kumar, A. (2013). Development and Promotion of an Informal and Formal Seed System Through Farmer Participatory Seed Production of Pigeonpea(CajanuscajanL.) in Uttar Pradesh, India. *Agroecology and Sustainable Food Systems, 37*, 531-549.

Syaifullah, S., & Widianto, J. (2014). Studi Kelayakan Sistem Informasi Akademik Berbasis Web Pada Poltekes Kemenkes Riau Dengan Menggunakan Metode Kelayakan TELOS. *Jurnal Sains, Teknologi, dan Industri, 11*(2).

Tittonell, P. (2013). *Farming Systems Ecology: Towards ecological intensification of world agriculture.* Wageningen: Wageningen UR.

Tittonell, P., Muriuki, A., Shepherd, K. D., Mugendi, D., Kaizzi, K. C., Okeyo, J., . . . Van Lauwe, B. (2010, February). The diversity of rural livelihoods and their influence on soil fertility

in agricultural systems of East Africa – A typology of smallholder farms. *Agricultural Systems, 103*(2), 83-97.

University of Minnesota. (2016). *Principle of Economics.* Minneapolis: University of Minnesota Libraries Publishing.

van Mierlo, B., Arkesteijn, M., & Leeuwis, C. (2010). Enhancing the Reflexivity of System Innovation Projects With System Analyses. *American Journal of Evaluation, 31*(2), 143-161.

Weber, K., & Rohracher, H. (2012). Legitimizing research, technology and innovation policies for transformative change: combining insights from innovation systems and multi-level perspective in a comprehensive 'failures' framework. *Research Policy, 41*, 1037-1047.

West, T. (2014). *A requirements analysis with feasibility study for an abstract design of a pervasive kitchen designed for a student demographic.* Cardiff: Cardiff University.

Wicks, R. H. (2005). Message Framing and Constructing Meaning: An Emerging Paradigm in Mass Communication Research. *Annals of the International Communication Association, 29*(1).

Wieczorek, A. J., & Hekkert, M. P. (2012, February 2). Systemic instruments for systemic innovation problems: A framework for policy makers and innovation scholars. *Science and Public Policy, 39*(1), 74-87.

Woolthuis, R., Lankhuizen, M., & Gilsing, V. (2005). A system failure framework for innovation policy design. *Technovation, 25*, 609–619.

Yin, R. K. (2009). *Case study research: design and methods* (Vol. 5). California: SAGE Publications.