

Research report MSc Thesis

Learning behaviour of South Korean pig farmers:

Exploring the role of social competence and social interdependence attitudes



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This MSc. thesis is written as part of the program Management, Economics and Consumer Studies at Wageningen University and Research. The influence learning behaviour on farm performance got my attention because I am a son of a Dutch pig farmer myself. Within this highly competitive industry the impact of learning the best practices to improve the farm performance is substantial. Finding causes for differences between farmers is always therefore interesting. This report tries to find causes for these differences by studying the personal characteristics and learning behaviour of farmers. Despite the fact that no direct relation could be proven, it has become even more evident to me that if you want to be a farmer that is future proof cooperative learning is essential.

I would like to thank a number of people that supported me throughout writing my thesis. The three supervisors; Valentina Materia, Thomas Lans, and Gerben van der Velde for their expertise and guidance during the writing of my thesis. My student house to which I could endlessly complain, all the people I drank coffee with, and my parents that enabled me to fully focus on my thesis. This accomplishment would not have been possible without them. Thank you.

I hope you enjoy reading this report,

Stefan Krol

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Abstract

Cooperative learning could be a useful mechanism for learning between farmers, as cooperative learning has already been proven successful for learning among students worldwide (David W Johnson & Johnson, 2009). This study contributes to the understanding of learning of farms, by quantifying the role of specific personal characteristics and (cooperative) learning activities and farm performance. To achieve this goal a qualitative study is performed on a dataset of 199 South Korean pig farmers. This study introduces the newly created social interdependence scales adapted for farmers by T Lans, C Wagenberg, and R Horste (2017), and uses three social competences related to interaction with people. Hierarchical regression models and a clustering technique have been used to analyse the differences between farmers learning behaviour and farm performance. It is proven that the social interdependence attitude of a person influences the learning activities it undertakes. Cooperative attitude is an enhancer for learning activities that involve other people, but this high involvement in cooperative learning activities does not translate one-on-one to higher farm performance. The participation of experts on the farm is the only indicator for increased farm performance. The degree of trust is a positive moderating factor when farmers undertake learning activities that involve other farmers. A farmer that is more socially competent and has a cooperative attitude will conduct more learning activities that involve other pig farmers, the social competence improves the involvement in learning activities with other farmers. The social interdependence attitudes can be linked with bigger farms, further research is needed to investigate this relation.

Key words: Social interdependence Theory, Social competences, Cooperative learning, Learning behaviour, Farmers

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Executive summary

Cooperative learning of farmers is seen as one of the key elements of the success of Dutch farmers (Hoste, 2017b). Cooperative learning involves people from similar social groupings who are not professional teachers helping each other to learn and learning themselves by doing so (Scherer, Adams, & Wiebe, 1989). Exchanging information with other farmers about their farm and farm practices in cooperative learning activities widens the frame of reference of these farmers. A boarder frame of reference allows farmers to make more informed decisions about their farm practices (Mezirow, 1997), which might lead to better farm results.

This research contributes to the literature by analysing the effect of personal characteristics and (cooperative) learning activities on farm performance. Understanding of how farmers learn and insights in the learning behaviour of farmers enable tailored support to these farmers. The personal characteristics of farmers might influence the type of learning activities but also the effectiveness of these learning activities (David W. Johnson & Johnson, 2015).

To find the answer the research started by making a literature review of the differences that are recognized in farmer learning. Three perspectives were chosen out of a literature overview of the theories and constructs about farmer learning and styles. These three perspectives served as a basis to understand farmer learning. The perspectives also contributed to the selection of control variables that could influence the performance of the farmers.

A literature review about the influence of social interdependence attitudes and social competence on learning activities was used to develop hypotheses and expected relationships between the personal characteristics, learning activities and farm performance. This resulted in seven hypotheses about the influence of personal characteristics and learning behaviour on farm performance.

A quantitative analysis was used to test the developed hypothesis and relationships. The used dataset included 199 farmers from various regions in South Korea. This dataset was gathered as part of the pig farmer development project of the Wageningen university, the Dutch Top-sector Agri&Food, the South Korean umbrella cooperative NACF and the South Korean government to support the South Korean pig farmers. The statistical analysis tool SPSS was used to analyse the dataset. Several statistical analysis techniques have been performed in the analysis to make the data measurements suitable for analysis. This research was the first to use the social interdependence scales adapted for farmers by T Lans et al. (2017). These have been checked for internal consistency with a Principal Component Analysis. The social interdependence attitudes have also been clustered with a K-means cluster analysis to create groups based upon the social interdependence preference.

Three techniques have been used to analyse the data. Almost all relations have been tested trough a hierarchical regression analysis. The reason to choose for a hierarchical regression analysis is the possibility to spot the influence of the control variables. Several variables had to be tested for their moderation effect, the technique as proposed by R. M. Baron and

Kenny (1986) was used to test for moderation. The last technique was a ANOVA with Post-hoc test to test the difference between the groups formed based on their social interdependence attitudes.

The developed social interdependence scales for farmers included 21 variables, three variables had to be rejected in order to get sufficient internal consistency. For the social competences only self-promotion proved to be a construct with a good external validity for this dataset. The other two constructs social perception and social learning orientation did not fit well with this sample. Several variables had to be rejected to reach internal consistency. These groups based on the social interdependence attitudes were analysed with the ANOVA with Post-hoc test. The three groups could be divided into a cooperative/competitive oriented group, one individualistic group and one undefined. The groups showed observable differences between the farm performance indicators. The performance indicators included two technical performance indicators and one about animal disease and health knowledge. Only one significant difference between the individualistic and undefined group regarding performance was recorded, in which the individualistic achieved higher technical farm performance. The cooperative/competitive group was statistically significant higher on the learning activities that involved other farmers. This engagement in cooperative learning activities did not translate in higher performance, thus the cooperative/competitive farmers cluster has significant bigger farms. Further research to the origin of the differences between the social interdependence groups and farm size might explain why these farmers are bigger.

The social interdependence attitude proved to be an indicator for the degree of learning activities that are undertaken. A cooperative social interdependence attitude can be linked to cooperative learning activities. These are activities that involve other farmers.

This research also proves that trust is an enhancer for cooperative learning activities between farmers. This indicates that the trust between farmers is important to form cooperative learning groups. The degree of trust was of less importance for other learning activities. The level of social competence proves to be an enhancer for learning activities between farmers as well.

This research contributes to literature that the social interdependence attitude of farmers influences the degree to which farmers undertake (cooperative) learning activities. A farmer with a cooperative attitude will undertake more activities with other farmers, regardless of the region in which the farmer is active. The level of social competences combined with the cooperative attitude will more accurately predict the degree to which farmers undertake cooperative learning activities. The ability of farmers to interact with other farmers will stimulate the cooperative learning activities. Farmers that trust the other farmers will have more effective cooperative learning activities. The trust among farmers in cooperative learning will therefore influence the effectiveness of the learning activity.

1. Introduction

1.1 Research background

South Korea is the fourth largest importer of pig meat and that import is growing (USMEF, 2017), this while the pig industry structurally underperforms in technical production compared to their western peers (Hoste, 2017b). For example, the amount of piglets per sow per year, an important indicator to compare sow farms for technical performance, is 40% lower in South Korea compared to their Dutch peers (Hoste, 2017b). Reasons are that the pig sector is struggling with animal diseases, manure surplus and is facing high production prices (FAS/USDA, 2015; Seoul, 2014).

Together with Wageningen University, the Dutch Top-sector Agri&Food and South Korean umbrella cooperative NACF, the South Korean government has started a project to improve pig production. The project aims to improve innovation development, knowledge sharing, and (veterinarian) management practices of pig farmers in South Korea (Lans, 2017). The reason to reach out to the Dutch is that they are among the leading countries when it comes to the technical performance of piglet production (AHDB, 2015). The project wants to achieve improvements in the pig sector by improving the practices of the South Korean pig farmers. Key to the project is 'cooperative learning', a mechanism that is the acquisition of knowledge and skill through active helping and supporting among status equals or matched companions (David W Johnson & Johnson, 2009). For this thesis the current influence of leaning activities among South Korean pig farmers and the role of personal characteristics of the farmers will be analysed.

1.2 Theoretical background

Cooperative learning has already been proven as a successful method for learning among students worldwide (David W Johnson & Johnson, 2009), cooperative learning therefore could be a useful mechanism for learning between farmers. It involves people from similar social groupings who are not professional teachers helping each other to learn and learning themselves by doing so. These could potentially influence the individual performance and personal development, skill, and competency, in addition to behavioural change (Scherer et al., 1989).

Treadmill theory of Cochrane (Cochrane, 1958), explains that in agriculture the firms that do not differentiate must learn the best practices in their industry to survive. Learning for firms is defined by Daft and E. Weick (1984), as a process that develops knowledge about action-outcome relationships between the organization and environment. Learning is essential, regardless of the goal of the owner-manager is growth, independence or any other reason. A level of competence and skill is needed to maintain their business (Down, 1999). Learning in small agricultural firms contributes to the economic performance of the firm (Sue Kilpatrick, 1997), is related to innovation and the ability to manage change within small agricultural firms (Sue Kilpatrick & Johns, 2003). The farm businesses which engage in training are more likely to make changes to their practice which improve, or are expected to improve, long-term profitability (SI Kilpatrick, 1996).

This thesis researches whether the engagement in cooperative learning has explanatory value for the technical performance differences between the pig farms. One example of

cooperative learning that is considered an important aspect for the success of the Dutch pig industry is the engagement in study groups where information is shared with other pig farmers (Hoste, 2017a). Figure 1 is an example of a farmers study group. Pig farmers that engage in these cooperative learning activities are perceived to achieve higher technical farm performance, thus South Korean farmers could help each other to achieve higher technical performance on their pig farms.



Figure 1 Farmers study group (Actueel, 2013)

The agricultural sector has specific characteristics that make firms more similar than within many other industries. The similarities of firms make it possible to study the effect of cooperative learning of these firms. The agricultural production processes have characteristics that are relevant to the individual firm but also to the sector as a whole (Peerlings, 2016). Most firms in the agricultural sector produce a homogeneous product in a market in which the input and output price are roughly known. For example, a pig fattening farm uses piglets, feed, labour, stables and stable inventories and some other inputs like electricity and veterinary services to produce fattened pigs that are ready to be slaughtered (Peerlings, 2016). The farmer cannot change the whole process, only influence how well it is managed which causes a spread in performances among agricultural firms. Figure 2 shows the spread between the profitability of Dutch pig farms from 2001 till 2017. In 2017 the lowest performing firms were making a loss of 13%, but the best farms achieved a profit of 18% for every 100 euros of cost (Agrimatie, 2017). The similarity of the firms and the characteristics of the agricultural sector make it therefore interesting to analyse the role and influence of the individual farmer.

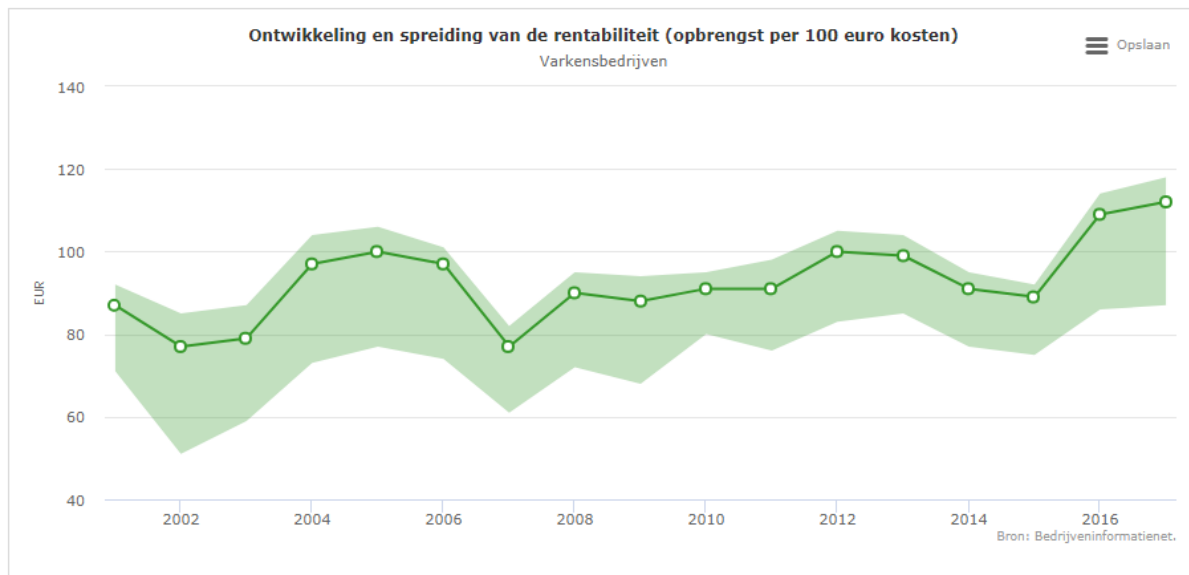


Figure 2 Profitability differences Dutch Pig fattening farms (Agrimatie, 2017)

To understand learning in small firms Down (1999) suggest looking towards the entrepreneurial network of the owner-manager. The owner-manager of the small firm and the small firm cannot be seen separated in context of learning; the owner-managers determine where, when, and how learning takes place. The unit of analysis to analyse learning in a small firm, therefore, should be the entrepreneurial network of the owner-manager. The emphasis should be on understanding the network of association and interaction in which owner-managers engage. This suggestion is in line with Hendry, Jones, and Arthur (1991) reasoning that the development in small-medium firms is closely linked with the entrepreneur's role and behaviour. Perrin (1997) recognized two perspectives to analyse owner-manager networks: 'measuring connections' and 'grounded understanding of process'. The first quantify the type and frequency of the connections. The second is more about the how and why owner-managers engage in networking; it seeks to understand the nature of an owner-manager's interaction as a social process (Down, 1999).

1.3 Research problem and objective

The research problem that this study will address is that few studies have studied the influence of cooperative learning activities outside a school environment. There are studies that study the learning behaviour of farmers that prove there are differences between farmers (Aur lie, Alice, Eduardo, & CIRDES, 2014; SI Kilpatrick, 1996; Sue Kilpatrick & Johns, 2003), but none of them have an emphasis on the effect of cooperative learning.

Diversity in learning behaviour, and the origin for that diversity could contribute to explaining differences in firm performance. The assumption is that the learning behaviour of farmers could have explanatory value for their performance considering their pig production. A better understanding of the reason why farmers conduct various forms of learning activities might provide the opportunity to better support these small firms by adapting the learning activities.

Two theories will be used to gain a better understanding of the nature of farmers interaction and the influence this has on the learning behaviour and performance. The first theory is the Social interdependence theory, this theory could be contributing to understanding differences in interaction patterns of people Deutsch (1949). Social interdependence theory describes how participants' goals are structured, it determines the ways they interact, and the interaction pattern determines the outcome of the situation (Deutsch, 1949). Social interdependence "attitudes" of people have been operationalised by Johnson and Norem-Hebeisen (1979) in the Social interdependence scales (SIS), to provide social scientist a tool to measure interdependence attitudes of people. The second theory is the social competence theory, Social competences are the "social skills" that persons possess and these influence the behaviour of the person. The use of social competence is best described by Robert A Baron and Markman (2000) "the ability to interact effectively with others as based on discrete social skills." The goal is to get a better understanding of the differences between farmers and the influence of personal characteristics and behaviour of those farmers.

1.4 Research questions

The following main research question will be answered to be able to achieve the research objective:

- ❖ *To what extent do specific personal characteristics and learning activities explain farm performance?*

Three sub-research questions are developed to be answered to find the answer to the main research question. The sub-research questions are:

- I. *According to literature, what is the relationship between personal characteristics, learning behaviour and farm performance respectively?*

The first sub-research question will be answered through a literature review. Concerning the personal characteristics, the starting point of this literature review will be Social interdependence and social competence theory to uncover how these theories relate to the learning activities. Furthermore, other studies regarding learning behaviour of farmers will be analyzed. This information will be used to develop a theoretical framework and operationalise social interdependence attitudes and social competencies for the empirical research.

- II. *Based on data analysis, how does the Social interdependence attitude influence the learning activities and (farm) performance?*

- III. *Based on data analysis, what is the relationship between social competences, learning behaviour and farm performance respectively?*

The second and third sub-research questions serve out to find out if there statistical evidence that Social interdependence attitude(s) and social competencies influence learning activities and (farm) performance. Both sub-research questions will make use of the developed theoretical framework from the sub-research question I. The relations will

be tested through empirical research by using the data available from the dataset “Pig farmers household survey”.

1.5 Research framework

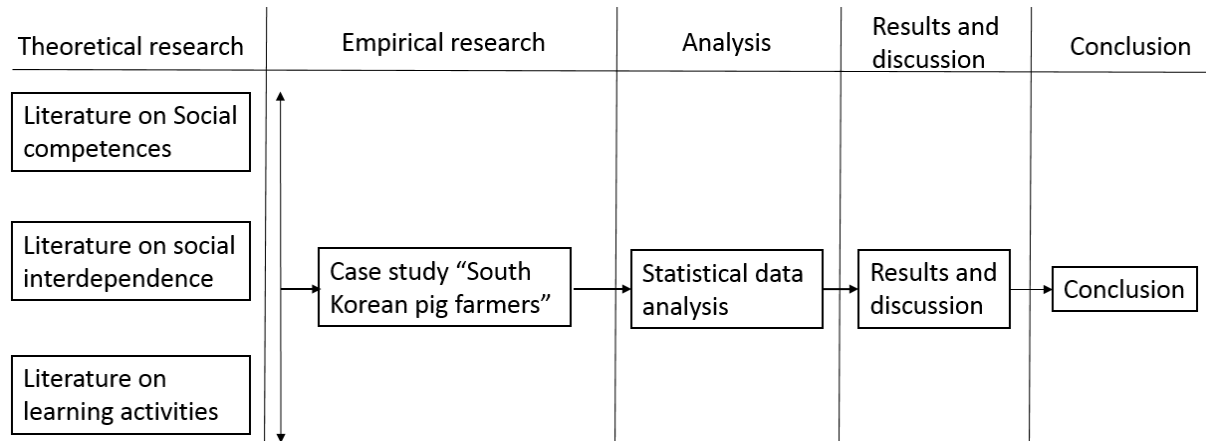


Figure 3 Research framework

The research framework will give an overview of the research activities that will be performed to meet the research objective that is given in paragraph 1.2. As can be seen in figure 3, the research will involve a literature review, empirical research, results and discussion, and conclusions.

The theoretical research will give insights into what is currently known about social competences, Social interdependence attitudes, and learning activities. The goal of this theoretical research is to understand how these influence small firm performance.

A dataset with information of South Korean farmers will be used for the empirical research. This dataset is part of a project of the South Korean government together with Wageningen University, the Dutch Top-sector Agri&Food and South Korean cooperative NACF. The aim of the project is to improve innovation development, knowledge sharing, and (veterinarian) management practices of pig farmers in South Korea (Lans, 2017).

2. Literature review

The research will make use of an existing set of data, for that reason the literature review will only focus on these specific topics. The purpose of this literature review is to develop hypotheses and expected relationships that will be analyzed with the dataset. The literature review will exist out of four paragraphs; it will start with three studies about learning behaviour of farmers to get an understanding what differences there are between farmers. Thereafter the Social interdependence Theory, and the relevant Social competences will be discussed as meaningful antecedents of learning and how they specifically relate to the learning activities. At last the literature review will be combined to develop the theoretical framework.

2.1 Learning behaviour

Three perspectives developed by other researchers related to learning behaviour of farmers, will contribute to the exploration of farmer learning and the influence of the farmer's behaviour and subsequent performance. A short, focused literature review was performed to decide which perspectives will be used. The method used to select these three perspectives was by a short structured literature review of the articles related to farmer learning, farmer learning sources and categorizations of farmers.

The three perspectives that are chosen are; The Learning patterns of Sue Kilpatrick and Johns (2003), the learning regimes of Aurélie et al. (2014), and the farming styles of pig farming by M. A. M. Commandeur (2006). In the end the conclusion of these three perspectives will be used to determine which factors could explain the variance in performance and learning behaviour.

2.1.1 Learning patterns

The learning patterns, developed by Sue Kilpatrick and Johns (2003), were designed to get a better understanding of how farmers learn in order to make strategic and tactical changes. Four patterns emerged from analysing farmers, and these were developed based on the theory of learning styles of individuals (Butler, 1987; Honey & Mumford, 1986). According to Kilpatrick, these patterns could provide a useful way of developing different strategies to assist different groups of farm businesses in upgrading their management and marketing skills (Sue Kilpatrick & Johns, 2003).

The data for these learning patterns was generated out of 85 semi-structured interviews with farm owners and farm managers across a range of agricultural enterprises and states in Australia. The sample was divided into three types of farm businesses; one third of the businesses were managed by husband and wife teams, one third was led by multi-generation teams and one third by family members of the same generation or partners with no family relationship.

In the study, social and business networks were seen as an essential learning source, but also as a support factor when implementing change. The networks prove their importance in the decision-to-change process through interactions with other farmers; they could help the farmer reflect their plans with more information about the outcome. Most farmers make changes based on the influence of a number of learning sources. Innovative and successful

farmers are considered better in gathering information from the appropriate learning sources. Varying skills and levels of formal qualifications, as well as years of farming experience and farm business goals, all influence the learning sources selected by farmers (Sue Kilpatrick, 2000).

The study also pointed out that there is a difference between lower and higher educated farmers. Lower educated farmers prefer informal learning sources because they think farming is better learned on the job, with additional short courses and other informal learning activities. For the farmers, a formal study means that the farmer cannot make money, and it is believed that the available courses do not meet industry standards. Other barriers mentioned for not enrolling in formal training include cost, time, location, childcare, lack of confidence as learners, and lack of training culture amongst farmers.

However, higher educated farmers are more likely to participate in education. These educated farmers are more likely to be innovative and flexible in their response to both internal and external changes affecting the farm business. The level of education has an impact on business outcomes such as productivity and profitability. The leading group tends to be younger, had higher educational levels, was open to new ideas, was better at planning and management generally and was more likely to participate in learning groups. Still, these formal education qualifications alone are an inadequate measure of farmer knowledge and skill; farmers could use informal learning sources to educate themselves.

The study wanted to divide the groups of farmers according to the type of source that was used to learn about change or new practices. These learning activities could be divided into structured learning sources and five forms of informal learning sources (Figure 4). These are the sources that farmers used when they learned for change.

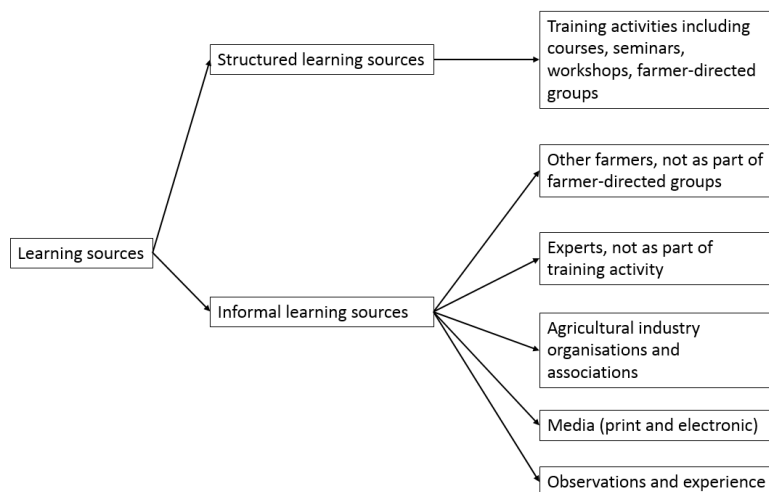


Figure 4 Farmer's learning sources (Sue Kilpatrick & Johns, 2003)

The nature of the change was also taken into account to check for differences in usage of information sources. These were divided into four categories; New enterprise, Other strategic, Record keeping (or management information systems), and Tactical/technical. How the usage of learning sources vary per type of change and can be found in table 1. Farmers mention experts as the most used learning source for all learning activities, what type of expert varies per type of change. Government consultants and agricultural

organizations are mostly used for starting a new enterprise, whereas for tactical/technical change the sellers/suppliers of services and products are used for advice. Other farmers are also a highly used source to learn about tactical/technical change.

Table 1 Sources used to learn about change (Sue Kilpatrick & Johns, 2003)

Learning source % of change using type of learning source	Training	Farmers	Experts	Agricultural organization	Media	Observation/ experience	Number of changes
New enterprise	26.9%	34.6%	61.5%	34.6%	30.8%	50.0%	26
Other strategic	33.3%	40.0%	86.7%	20.0%	33.3%	40.0%	15
Record keeping	53.6%	17.6%	57.1%	7.1%	3.6%	53.6%	28
Tactical/ technical	30.5%	52.5%	57.6%	27.1%	37.3%	33.9%	59
All changes	35.2%	39.8%	61.7%	23.4%	28.1%	42.2%	128

χ^2 13.27* (significant)

Percentages in the table represent the proportion of the changes that used various learning sources. Most changes used more than one source.

The different patterns in learning for change are based on the number and range of sources that the farmers consulted to make these changes. These patterns appear to be related to ongoing learning practices of farm management teams as well as to learning for change. The researcher used the theory of learning styles of individuals developed by Honey and Mumford (1986) and improved by Butler (1987) as a basis to develop the four learning patterns. The description of these four recognized patterns can be found in table 2; Local focussed, People focussed, Outward looking, and Extensive networking.

Table 2 Learning patterns for Australian farmers (Sue Kilpatrick & Johns, 2003)

Learning pattern	Description
Local focussed (LF)	The local focussed group seeks information and advice only from local experts (accountants, government consultants and local suppliers such as rural merchants) and local farmers. They may also observe practices in operation locally and may access the local media. This category also includes those who seek advice from only a single expert (not necessarily local) and who use no other learning sources in a change. The local focussed group does not participate in training, except for field days.
People focussed (PF)	These farm businesses consult two or more people (not all local) and use no more than one other learning source when making changes. This group learns from people either in one-to-one situations or farmer-directed groups. The other sources used by this group in making changes vary widely and may include one of training, media, and observation.
Outward looking (OL)	This group includes farm businesses which use a variety of sources, usually involving at least one of these sources: media, training, or active observation of the potential new practice in operation elsewhere. These sources are usually combined with one-on-one learning from other farmers or experts or agricultural associations/ organizations. Most farm businesses in this category consulted three or more learning sources when making changes.
Extensive networking (EN)	These businesses consult a wide range of sources when learning for change. They use at least four of these source categories: - training (other than field days) - experts (i.e. private consultants, buyers, government consultants, financial advisers, or other experts) - a maximum of two counted - other farmers or farmer-directed groups - agricultural associations/organisations - media (industry magazines, books, technical notes, Internet) - overseas or interstate observation - trials or experiments for research purposes, usually in conjunction with experts.

These groups were then related towards farming styles of Vanclay (1998), five groups were found appropriate to compare these patterns with; Innovative, Progressive, Middle of the

road, Resource-poor, and Traditional. A local focussed was associated with middle of the road, resource-poor, and traditional farming styles. The people focussed learning pattern tends to be associated with progressive or middle of the road farming style. The outward looking pattern is present in all except innovative farming style, and extensive networking is considered as an innovative, progressive and middle of the road style. Due to the small sample size, these findings of learning-pattern groups may not be related to the success or otherwise of the farm business (Sue Kilpatrick & Johns, 2003). But these can be seen as an additional source of information about how farmers 'work', which may be useful for those wanting to intervene and improve farm success. According to Sue Kilpatrick and Johns (2003), all groups had a preference to learn through interactions with others, notable other farmers, and experts.

2.1.2 Learning regimes

The learning regimes create a different perspective of the farmers to improve processes and tools to support the farmers. The learning regimes can become a basis for rethinking the functions of advisory services and systems, by focusing on the farmers' diverse characteristics regarding capacities and skills in a given context.

The authors want to contribute to the design and implementation of sustainable forms of agriculture. The authors recognize that it is no longer a matter of getting farmers to adopt new techniques designed elsewhere, but to help farmers formulate their problems themselves and to seek solutions most appropriate to their situation and issues of sustainability. Still, the learning processes of these farmers are considered to be poorly understood. This study tries to generalize causal links between learning processes and a type of change leading to greater sustainability. By formalizing the diversity of learning mechanisms on farms which lead to technical or managerial changes. These learning regimes could help design advisory approaches tailored to farmers' needs. The study is performed in Burkina-Faso and studied 30 farmers that are considered innovative.

There is a variation among regimes in the way they learn in the transition from 'one level to another.' The study compared the farmers on two aspects: type of learning and control of learning process. The control of the learning process has to do with the attitude of the farmers towards learning. It can be divided into two groups: Controlled by the producer (emancipation) and Controlled by outside (conformism).

The second construct that sets the groups apart is the nature of learning; transformative learning and simple learning. Transformative learners can spell out the rules of decision making that ensure the success of their activities. The transformative learning has affected three domains: expansion of the universe of the possible changes, the transition to a more managerial approach to its farm with a full-time commitment, and anticipation of future problems. The simple regimes did not make systematic changes. The producers did not demonstrate any changes in their frames of reference. The producers mainly seek development and optimization of what they already do, without mastering the rules of adjustment/optimization and without a vision of what the others are doing.

Transformative learning is best defined by Mezirow (1997) as the process of effecting change in a frame of reference. It is seen as the essence of adult education. Adults have

acquired a coherent body of experience frames of reference that define their life world. These frames of reference are the structures of assumptions through which we understand our experience. Transformative learners move toward a frame of reference that is more inclusive, discriminating, self-reflective, and integrative of experience. As Aurélie et al. (2014) place it in a farmer's frame of reference, for example, his understanding and knowledge of practices for managing his farm, or his ability to interact with others and build learning networks. This is an indispensable dimension of learning for adapting to change (Mezirow, 1997). Mezirow (1997) enlisted the factors that facilitate transformative learning. The educators must help learners become aware and critical of their own and others' assumptions. Learners need practice in recognizing frames of reference and using their imaginations to redefine problems from a different perspective. The learners also need to be assisted to participate effectively in discourse. Mezirow (1997) states that learning is a social process, and discourse becomes central to making meaning. New information is considered only a resource in the adult learning process. It only becomes meaningful when the new information is incorporated by the learner into an already well-developed symbolic frame of reference. This can be enhanced by making it learner-centered, participatory, interactive, and it involves group deliberation and group problem-solving. Learning takes place through discovery and the imaginative use of metaphors to solve and redefine problems. The learner's current level of understanding must be taken into account.

In classroom methods associated with transformative education are; learning contracts, group projects, role play, case studies and simulations. All these methods help the learners actively engage the concepts presented in the context of their own lives and collectively critically assess the justification of the knowledge. The focus is on discovering the context of ideas and the belief systems that shape the way we think about sources, nature and consequences, and on imagining alternative perspectives.

Learning regimes

The study grouped these cases into groups based on triggers, styles of learning and nature of changes. Four learning regimes have been defined: Transformer-Observer (TO), Reactive-Networker (RN), Optimizer-Self-reliant (OS), and Imitator-Dependent (ID). The regimes were separated by two criteria (figure 5): the control of the learning process (by the producer himself or from the outside) and the nature of learning (simple, transformative).

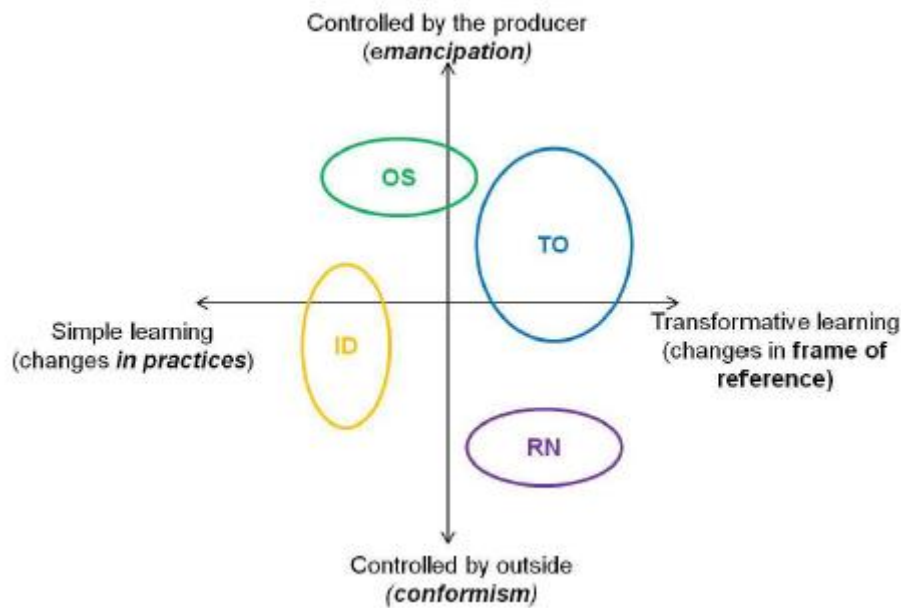


Figure 5 Learning regimes Aurélie et al. (2014)

Table 3 gives an overview of how the four regimes differ from each other.

Table 3 Overview learning regimes Aurélie et al. (2014)

Transformative regimes	Transformer-Observer (TO)	<ul style="list-style-type: none"> Producers mobilize the diversity of information sources available to them in the village (CPG, advisors, peers, projects) as well as outside - 'controlled by the producer.' Learning is triggered by a problematization constructed by the producer himself around projects he wants to undertake to correct deficiencies he has observed in his farm. It is primarily a search for ideas to improve or transform his activities that guide the farmer's search for information, followed by continuous experimentation.
	Reactive-Networker (RN)	<ul style="list-style-type: none"> Producers mobilize the diversity of information sources available to them in the village (CPG, advisors, peers, projects) as well as outside - which tend to be 'controlled by outside.' Learning is triggered by incentives to change originating from the farmers' socio-professional environment, especially from their cotton advisors.
Simple regimes	Optimizer-Self-reliant (OS)	<ul style="list-style-type: none"> The OS regime characterizes producers who, for the main part, rely on running their farms based on endogenous learning. It is the need to help the farm survive which triggers the need to learn. Reasoning and the search for information to modify or improve their activities revolve around agricultural practices without any systemic perspective. Interactions with others are not focused on problems (why) but instead on solutions (how).
	Imitator-Dependent (ID)	<ul style="list-style-type: none"> The ID regime, on the other hand, characterizes producers who manage their farms by relying mainly on learning acquired outside the farm. They find it difficult to explain the underlying rationales of changes they have made. They have a desire to accumulate information without necessarily being a connection with a change to be implemented or a problem to be solved. It is 'shocks' that trigger the change.

2.1.3 Diversity of pig farming styles

The third perspective that is used to analyse farmer learning is the diversity of pig farming styles from M. A. M. Commandeur (2006), this one is chosen to get a better insight in what influences the learning of pig farmers. Their research goal was to gain an understanding

of styles of pig farming about the structure of their space of information has benefits for farmers and related actors (M. A. M. Commandeur, 2006). The research tried to illustrate the styles of pig farmers by surveying 70 farmers in the Dutch region "De Achterhoek." According to Commandeur farmers tend to have different approaches to changes in the farmer's environment, understanding the styles of pig farmers can contribute to the development of farmers for the long term. It can lead to specific farm management support measures that are appropriate to various styles of pig farming.

Structural features and communications dominate the space of information in which farmers operate (M. A. M. Commandeur, 2006). M. A. M. Commandeur (2006) recognizes three structural features that influence the farmer and constraint the farmer in its options.

- The techno-ecological features (genetic material, climate)
- Economic infrastructures (supply and sales markets, transport infrastructure and investment opportunities), which could influence the farmer in its decisions through constraining the available options
- Institutional infrastructures (farmers' unions and co-operatives, various government levels, institutes for research, education, extension, and management support, and animal health stations)

Variation in these structural features is caused by intensity (productivity per unit of resource) and scale (amount of resource per unit of labor and input). Intensity and scale can explain interregional differences in production circumstances for farming (Hayami & Ruttan, 1985). Still, within the same region with equal access to these structural features, a diversity of patterns has been recognized. Styles of farming are cultural repertoires (or patterns) in farming practices. Regions are comparable if technical structures like environmental conditions, infrastructure, accessibility of institutional structures, and networks are more or less similar.

Farming is the process of interactions between farm and farmer (M. A. M. Commandeur, 2006). Each farmer has a different style, the interactions between these personal styles (since different forms of personal interactions may lead to different farm developments). The term farmer in studies of styles of farming is described by (Monica Alida Maria Commandeur, 2003) as "Farmer refers to the group of people who shape the practices on a particular farm, or in a particular style of farming. In other words, regarding styles of farming, the 'Farmer' is an abstract notion of the 'acting agent'".

Two techno-sociological dimensions dominate the farmers' logic for attaining this aim, and that differentiate between the different farming styles: the function of the herd and the role of the business (in this case labor and investments). M. A. M. Commandeur (2006) defined the styles of farming as: "Characterizations of the diversity in passions for farming, represented by the farmers' dominant logic, expressed in what farmers say and do, and identified through analysis of clustered contrasts and differences in the practices of farmers, in reference to a framework of relevant dimensions within a given information space."

Three metaphors of farming styles are used to understand the logic patterns of the farmers. This methodology is considered to be valuable to be able to improve the interaction with farmers and representatives of the surrounding institutions and enterprises. The styles do not answer which one is more economical or profitable but illustrate the farmers' rationales reflected in styles of farming. These styles could also be linked to farm results, expressed by technical indicators. The three metaphors as described by Commandeur were the entrepreneur, craftsman and stockman.

- Entrepreneur: wants to achieve profit through production efficiency, with a passion for optimization of farm management control. The entrepreneur is specialized, efficient and highly market integrated into global chains.
- Craftsman: wants to gain profit through high productivity levels, wants to maximize the productivity from their sources. Technically professional labor and integrated into quality market chains.
- Stockman: wants to gain a livelihood from pig farming at the farm location, wants to keep the farm as it is. The stockman intends to keep investments low and is passionate about the labor for pig farming.

The farm styles have different qualities and different capacities for adapting to changing circumstances. The farmers will react differently to future events. For example, the craftsman and entrepreneur have a higher desire for larger litters than the stockman (see table 4). The research also compared the three styles on technical indicators. The research used five technical indicators, divided into two subgroups. Per litter, the number of piglets born alive and the number of weaned piglets were measured. Per sow per year the farrow index, weaners, and feeder pigs were measured. There were statistically significant differences between the performances of the three styles compared to the mean of the population. The most prominent differences were observed between the craftsman and stockman, the craftsman performed best on all technical indicators, whereas the stockman underperformed on all technical indicators. The entrepreneur had values all above the population average, but they were only significant for the number of weaners and feeder piglets. M. A. M. Commandeur (2006) concludes that the data reflects the results of the dominant logic that the farmers apply. Vice versa, the dominant philosophy of the farmers can predict the technical data.

Table 4 Combinations of contrasting aims of three styles of farming with respect to management of litter size and piglet growth M. A. M. Commandeur (2006)

Aim for piglet survival	Aim for large litters		
	High	Medium	Low
High	Craftsman	Entrepreneur	(illogical)
Medium	(not discussed)	Population average	(not discussed)
Low	(illogical)	(not discussed)	Stockman

2.1.4 Conclusions learning behaviour

Several things can be learned by studying these three perspectives. At first the three perspectives show that there are differences between learning behaviour and goals of farmers. The study of Kilpatrick points out that farmers could be divided based upon their characteristics and learning behaviour. The four learning patterns that Kilpatrick developed show that farmers differ in their learning behaviour, it is therefore expected that farmers vary in the degree they undertake learning activities. M. A. M. Commandeur (2006) points out that farmers vary in style, and these different styles have predictive value for the technical performance of the farm. These styles might also influence in the method that the farmer uses to achieve this result. The craftsman, for example, differs from the entrepreneur by having a higher degree of specialization instead of focusing on expansion of the farm, but both achieve better performances than the stockman. The learning regimes of Aurélie et al. (2014) point out that even within a particular type of learning there are differences in how farmers approach situations and how well they can transform this information into knowledge, not every farmer will benefit equally from undertaking learning activities.

Two of the three perspectives recognized learning sources that bring in knowledge from other farmers as important for change in practices. As the study of Aurélie et al. (2014) points out, that frame of reference is considered to play a crucial role for the learning practices of a farmer; a farmer that has a broader frame of reference will be able to understand more practices. The activities that are linked to transformative learning involve other peers, with whom they can interact. As stated transformative learning is enhanced if it is learner-centered, participatory, interactive, and it involves group deliberation and group solving. The organized activities with other farmers could be the best learning activity for farmers. This is in line with the findings that social and business networks prove their importance in the decision-to-change process through interactions with other farmers; they could help the farmers reflect their plans with more information about the outcome (Sue Kilpatrick & Johns, 2003). When learning for technical changes the farmers used experts in the related field and other farmers as their learning sources (Sue Kilpatrick & Johns, 2003).

At last the studies also point out a number of factors that could influence the performance of the farms that should be taken into account when analysing the effect of learning activities. Education level and years of experience might prove to be indicators of the learning activities that the farmers undertake (Sue Kilpatrick & Johns, 2003). There are also barriers that prevent farmers to conduct learning activities, the availability of the learning activity on the location of the farmer could prevent farmers to conduct these activities (Sue Kilpatrick & Johns, 2003). This is in line with the finding of M. A. M. Commandeur (2006): due to the structural features of the regions, it is expected to find performance differences between the regions. Farmers are dependent on their region for the availability of learning activities, differences between regions could explain the degree in which farmers undertake specific learning activities. The intensity and scale of the farm can explain differences between the performance of regions and farmers. The farm size could be an influencer of the performance of the farm (Hayami & Ruttan, 1985). This is related to time as a barrier for learning of farmers, a farmer who has nobody to replace

him at the time of the learning activity is less likely to undertake learning activities (Sue Kilpatrick & Johns, 2003).

2.2 Social interdependence theory

Social interdependence theory is the foundation of modern collaborative and cooperative practice in business, science and education (David W. Johnson & Johnson, 2015). Social interdependence theory could contribute to understanding differences in interaction patterns of people (Deutsch, 1949). Social interdependence exists when the outcomes of individuals are affected by their own and others' actions (D. W. Johnson & R. Johnson, 1989). Social interdependence theory could be used to implement cooperative learning procedures, which has been validated into schools, businesses, and other settings throughout various regions and countries.

Social interdependence theory has its roots in Gestalt Psychology, Kurt Koffka proposed in the 1900's that interdependence was essential for a group to become a dynamic whole and recognized that interdependence will vary from one individual to another within a group (David W. Johnson & Johnson, 2015). The Social interdependence theory is mostly researched in school settings, where the theory has been influential by using the insights to improving learning of students, especially with relation to cooperative learning (David W Johnson & Johnson, 2009). The general tendency according to a meta-analysis of all cooperative learning studies until 2009 is that cooperative learning activities score higher than individualistic learning activities in performance of students (David W Johnson & Johnson, 2009).

There are two types of social interdependence: positive interdependence and negative interdependence. Positive interdependence exists when the actions of individuals promote the achievement of joint goals, the individuals support each other's efforts to achieve the goals (David W Johnson, Johnson, & Smith, 2007), individuals perceive that they only attain their goals if the other individuals with whom they are cooperatively linked attain their goal. Positive interdependence results in promotive interaction, this is a situation in which individuals are encouraging and facilitating others to reach the group goals. Negative interdependence exists when the actions of individuals obstruct the achievement of each other's goals, the individuals perceive that they can only reach their goals if others that are competitively linked fail to obtain their goals (David W Johnson et al., 2007). Negative interdependence results in oppositional or contrient interaction, individuals will obstruct each other's effort to achieve the tasks. A situation with no interdependence exists when there is no correlation between the goals of individuals, individuals perceive that their goal is unrelated to the goal of others (David W Johnson et al., 2007). Deutsch (1949) states that the state of interdependence influences the psychological processes. Typically, cooperation tends to promote greater efforts to achieve, more positive relationships, and greater psychological health than do competitive and individualistic efforts.

Three types of cooperative learning for school situations may be derived from social interdependence theory (David W. Johnson & Johnson, 2015): formal cooperative learning, informal cooperative learning, and cooperative base groups.

- Formal cooperative learning consists of students working together, for a certain period of time, to achieve shared learning goals and jointly complete specific tasks and assignments.
- Informal cooperative learning consists of having students work together to achieve a joint learning goal in temporary, ad-hoc groups that last a short amount of time.
- Cooperative base groups are long-term, heterogeneous cooperative learning groups with stable membership whose primary responsibilities are to provide support, encouragement and assistance to make academic progress and to develop cognitively and socially in healthy ways as well as holding each other accountable for striving to learn (Johnson et al., 2008). Typically, cooperative base groups are heterogeneous in membership, meet regularly and last for a longer period.

Not all group efforts are cooperative, there are five basic elements that need to be structured in order to achieve cooperative learning (David W. Johnson & Johnson, 2015). Structuring these elements could enable cooperative learning. The five elements as described by David W. Johnson and Johnson (2015) are:

1. There must be a state of positive interdependence between the individuals. These ways of structuring interdependence may be subsumed into three categories: outcome, means and boundary (D. W. Johnson & R. Johnson, 1989, 2005a). Outcome interdependence includes goals and rewards, structuring positive outcome interdependence tends to result in increased achievement and productivity. Means interdependence includes resource, role and task interdependence. These methods are overlapping and are not independent of each other. The last category is the boundaries between individuals and groups, which can define who is interdependent with whom, to know to what the person relates to. The group membership in and of itself is not sufficient to produce higher achievement and productivity; positive interdependence is also required.
2. Individual accountability, assessing the performance of each individual participant and giving the results to the individual and the group.
3. Promotive interaction, participants helping, assisting, and supporting each other's efforts to learn. Characteristics mentioned for promotive interaction that could contribute to successful cooperation; acting in trusting and trustworthy ways (Deutsch, 1962), providing efficient and effective help and assistance to group mates (E. Rosenbaum et al., 1980), being motivated to strive for mutual benefit (Deutsch, 1949), providing group mates with feedback in order to improve their subsequent performance of assigned tasks and responsibilities (Pittman, E. Davey, A. Alafat, V. Wetherill, & A. Kramer, 1980), challenging each other's reasoning and conclusions in order to promote higher quality decision making and greater creativity (David W Johnson & Norem-Hebeisen, 1979), and taking the perspectives of others more accurately and thus being better able to explore different points of view (Carsrud & Johnson, 1989).
4. Social skills, unskilled group members cannot cooperate effectively. Effective cooperation is based on skilled teamwork as well as on task work. To coordinate efforts to achieve mutual goals, participants must get to know and trust each other, communicate accurately and unambiguously, accept and support each other, and resolve conflicts constructively (David W Johnson & Johnson, 2009). This will be further discussed in the second paragraph of social competences.
5. Group processing, group members discussing how well they are achieving their goals and maintaining effective working relationships. The purpose of group

processing is to clarify and improve the effectiveness with which members carry out the processes necessary to achieve the group's goals.

Social interdependence theory in practice

Social interdependence outside structured settings could also explain behaviour through goal interdependence; goal interdependence refers to situational conditions, behaviours or dispositions that create perceptions of goal interconnectedness between or among individuals (Grisham, 1991). Within goal interdependence, there are three attitudes; competitive, cooperative and individualistic. The behaviour is influenced by whether or not there is mutual control over the outcome or not. Cooperation results in a positive relation, competition in a negative relation and individualism in a zero correlation. I.e., if it is possible for both parties to achieve a goal, they could cooperate.

The social interdependence attitude of a person is intangible, but David W Johnson and Norem-Hebeisen (1979) developed the social interdependence scales (SIS) to provide Social scientist a tool to measure the interdependence attitudes. The SIS measures the attitude of the person in relation to the other persons in the group. It gives a score for cooperative, competitive and individualism attitude. A person that scores high on questions related to cooperative behaviour will in general be more cooperative oriented.

Social interdependence and learning activities of South Korean farmers

Social interdependence theory could contribute to understanding why farmers undertake different types of learning activities, and the success achieved with these activities. People with a cooperative interdependence attitude towards other farmers are more likely to work together. These farmers do not consider their peers as an obstruct to achieve their own goals, but as a possible partner to interact with and to reach higher goals. A positive interaction pattern could lead to more knowledge sharing with other farmers. This knowledge sharing is vital for farmers because farms rely mainly on family labor and technological change in agriculture is done by supplying firms or agricultural agencies (Peerlings, 2016). This cooperation among farmers might result in transformative learning, which widens the frame of reference for farmers (Aur lie et al., 2014).

It could be an obstruct for farmers to work together if they see each other as competitors, this would prevent positive interdependence. It is assumed that the South Korean farmers, who produce piglets for the mass market, have no negative interdependence. For that reason it is not likely that South Korean farmers consider their peers as competitors. The farmers either have a cooperative goal interdependence, in which they cooperate with each other, or they consider it as an individualistic goal interdependence in which there is no correlation between the goals of the farmers.

Three hypotheses have been developed to find out if social interdependence attitudes could contribute to the understanding of the learning behaviour and performance differences in firms. The first hypothesis will test the relation between the social interdependence attitude and the learning activities a person undertakes. The social interdependence attitude influences the learning behaviour, the attitude of a person might influence the preferred

learning activities. If a person has a high cooperative attitude, the farmer is more likely to undertake learning activities with other farmers.

Hypothesis 1a: The degree to which farmers engage in learning activities with others (i.e. cooperative learning) can be explained by their social interdependence attitude.

The second hypothesis is that it is useful to group the farmers according to their social interdependence attitudes. Farmers that score high on cooperative attitudes will search each other to cooperate. This will result in transformative learning. They might even form base groups, that are similar to the study groups of the Dutch farmers (Hoste, 2017a). The farmers in these group could stimulate each other to achieve their goals through promotive interaction. Grouping farmers based upon their social interdependence attitudes might provide the opportunity to recognize behaviour that is linked to a certain attitude. This is the first time that the SIS scales adapted for farmers by Thomas Lans, Coen Wagenberg, and Robert Horste (2017) will be used to analyse the learning behaviour and farm performance of farmers. For that reason, two hypotheses surrounding this groups based on social interdependence attitudes are tested, one related to learning behaviour, and one related to the farm performance.

Hypothesis 1b: There is a difference in learning behaviour when farmers are grouped based upon their social interdependence attitudes.

Hypothesis 1c: There is a difference in the farm performance when farmers are grouped based upon their social interdependence attitudes.

2.3 Social competences

Social competences can also explain differences between social interactions of people (Riggio, 1986). Farmers can have a cooperative attitude, but without the social skills necessary (e.g. change perspective), the farmers will not be able to engage in successful cooperative learning. Social competence can be seen as an organizing construct, with transactional, context-dependent, and goal-specific characteristic. An element that is recognized in most explanations of social competence is "effectiveness in interaction" (Rose-Krasnor, 1997). In 2005, Wageningen Economic Research researched the role of agricultural entrepreneurship in the Dutch agriculture. De Lauwere concluded that farmers are distinguishable by analysing the personal characteristics, farmers with more positive characteristics had a higher family income and better future expectations (De Lauwere, 2005). Understanding the various aspects of social competence can explain differences between people's behaviour. Breaking up the complex behaviour pattern into more basic social skill components can help to understand social phenomena (Riggio, 1986).

Social competences are intangible but can be measured by combining questions about the social competence. Riggio (1986) was one of the first to develop a list of items to measure differences in social competences between people. Riggio (1986) designed the Social skills inventory (SSI), this SSI tried to make non-verbal skills tangible by combining various questions about the skill. A list of 105 items was developed, which people had to fill in by self-assessment, to measure seven basic dimensions of social skills. The scores for the dimensions were compared to observations of researchers and proved to be consistent.

I.e., individuals who gave themselves a higher rating on the expressive skills were indeed evaluated more positively by observers in initial encounters. The three social competences are measured similarly.

In the dataset three social competences were measured; social-perception, self-promotion and social learning orientation. These social competences and how these might influence the learning activities and performance will be discussed. Other social competences will not be addressed because these are not measured in the dataset.

2.3.1 Social perception

Social perception is the accuracy in perceiving others (e.g., their traits, intentions, and motives) (Zebrowitz & Collins, 1997). Being able to better perceive others is useful in many aspects of running a company, for example in negotiations it is useful to have a better feeling if the opponent offers his best offer or to understand if people genuinely want to help the organization. In a study of Robert A. Baron and Markman (2003), the skill social perception was found positively related to financial success in two different industries. The study included 230 entrepreneurs, 159 in cosmetics and 71 high-tech entrepreneurs. In both groups, most of them were founders of their company. Without an accurate social perception, it is hard to understand if the people they interact with could contribute to more successful practices. Social perception could help the farmers to understand the intentions of the people they communicate with. The skill might help the farmers in choosing the right partners to work with; this could contribute to better choices of advisers which will lead to higher performance.

2.3.2 Self-promotion

The second social competence is self-promotion. This is presenting one's skills and past accomplishments in a positive light (Bolino & Turnley, 1999). Self-promotion is a basic social skill that is considered part of impression management – the capacity to make a good initial impression on others (Robert A. Baron & Tang, 2009). Impression management is often seen as involving two parts, self-promotion, and ingratiation – efforts to induce a high degree of liking in acceptance in others (Bolino & Turnley, 1999). People scoring high on impression management tend to have a more positive outcome in an organizational context (Kacmar, Delery, & Ferris, 1992). Scoring high on self-promotion can help the entrepreneur to make a favorable impression on key partners (Robert A. Baron & Tang, 2009). It increases the success if you can present yourself better, for example in a conversation with a banker to get a loan. Self-promotion was positively and significantly related to new venture performance (Robert A. Baron & Tang, 2009). Still, self-promotion could be perceived as conceited by people (Bolino & Turnley, 1999). If a person can set himself in a positive light, it could help to convince others that it is useful to listen and cooperate with that person. This skill could open up possibilities to learn.

2.3.3 Social learning orientation

The third social competence is social learning orientation; a social learning orientation welcomes questioning, criticism and reflection from others (Lans, Verhees, & Verstegen, 2016). In their study Lans et al. (2016), developed the measurement instrument for measuring social learning orientation, which was inspired by the other methods measuring social skills. Entrepreneurs that score high on social learning orientation tend to engage

more in dialogue and use it as a tool for learning and development. A person with a high score on social learning orientation will more likely be open towards others with the intent to learn. A person who scores high on social learning orientation is expected to engage more in learning activities than people scoring low on social learning orientation. For that reason, it is assumed that farmers scoring high on social learning orientation will undertake more learning activities.

Three hypotheses have been developed that involve the social competences. At first the direct relation with the performance indicators will be tested, two of the three had a positive influence on the performance of firms (Robert A. Baron & Markman, 2003; Robert A. Baron & Tang, 2009), and one is related to more successful interaction with others (Lans et al., 2016). It is assumed that people who score high on these social skills are more effective in communicating and therefore achieve a higher performance compared to other farmers.

Hypothesis 2a: the level of social competence has a positive influence on the performance indicators.

Unskilled group members cannot cooperate effectively (David W. Johnson & Johnson, 2015), the level of social competence could therefore have a moderate effect on the learning activity. A moderator variable is a qualitative or quantitative variable that affects the direction and/or strength of the relation between an independent or predictor variable and a dependent or criterion variable (R. M. Baron & Kenny, 1986). All these three social competences are related to interaction with other people. The people high on these social competences are more likely to successfully undertake learning activities with other people. It is assumed that people high on these social competences should yield better results when learning activities are undertaken.

Hypothesis 2b: the level of social competence is a moderator for the effect of the learning activity on performance.

Social interdependence attitudes could explain the interaction pattern of people, the level of social competence could moderate the degree of interaction. A higher level of social competence will strengthen the prediction for learning activities that are undertaken, especially for cooperative attitudes.

Hypothesis 2c: people with a cooperative attitude combined with a high level of social competence will undertake more learning activities related to other people.

2.4 Trust

Trust has been found to be an enhancing variable for cooperative learning activities (D. Johnson & T. Johnson, 2006). The higher the trust among group members, the more effective their cooperative efforts tend to be (D. Johnson & T. Johnson, 2006). Relationships are critical to knowledge creation and transfer, trust has been found to be necessary for the receipt of knowledge (Levin & Cross, 2004). The more trust there was between ties, the better the transfer of useful knowledge (Levin & Cross, 2004). Trust also has extrinsic, instrumental value in helping to reduce the risks and transaction costs of relationships (Bogenrieder & Nooteboom, 2004).

Trust mentioned as one of the characteristics that could contribute to successful (cooperative) learning. For that reason, it is assumed that trust has a positive contribution to the learning activities.

Hypothesis 3: Trust is a moderator for the effect of the learning activity.

2.5 Summary hypotheses & expected relationships

Based on the literature review seven relations will be tested. Figure 6 shows the relations that involve social interdependence. Social interdependence attitude does not directly influence the performance. The reasoning is that social interdependence attitude influences the type of learning activities that the respondents undertake. The relation has to be controlled for the region in which the farmer is active, due to differences in the availability for farmers to undertake the learning activities. The relation between learning activities and performance will be the region, farm size, education and education level.

Hypothesis 1a, b and c will be tested through three tests. At first, the relation between social interdependence attitude and learning activities will be analyzed. Then the influence of the learning activities on performance will be studied to gain insight in which learning activities contribute to the farm performance indicators. At last the farmers will be grouped based upon their social interdependence attitude to observe if there are differences in behaviour and performance.

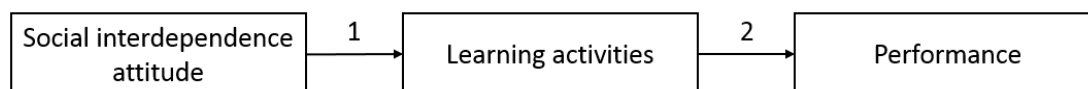


Figure 6 Theoretical framework Social interdependence

For the social competence there are also three tests that will be performed that are related to the hypotheses. The variables will be combined to one variable that describes the level of social competence of that respondent. One will directly test the effect of the combined social competences on the performance indicators, this will be done with the control variables region and farm size. It will be tested if there is a moderator effect of social competence on learning activities (figure 7). The assumption is that the level of social competences has explanatory value for the effect of the learning activities.



Figure 7 Theoretical framework Social competences (1)

The third test regarding social competence will be the moderation effect for social competences on social interdependence attitude when predicting farm performance (figure 8). The assumption is that the level of social competence combined with the social interdependence attitude is a better predictor for the learning activities that involve other people.

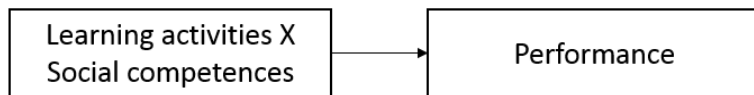


Figure 8 Theoretical framework Social competences (2)

The second relation that will be studied is that of the effect of trust as an moderator for learning activities (figure 9), to test hypothesis 2. When respondents have more trust in the people related to the learning activity, they are more willing to undertake this activity and have a better knowledge transfer. I.e., if a farmer trusts the other farmers in his region, he is more willing to share information with those farmers. To test if trust is a moderator for the relationship between learning activities and performance. Only the learning activities that involve another person or entity will be analyzed. No control variables will be used for this relation.

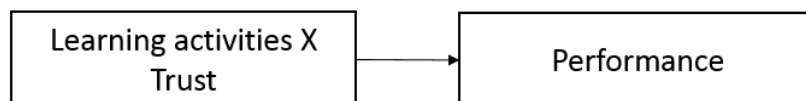


Figure 9 Theoretical framework trust

3. Methodology

This chapter will explain the data that is used for the analysis. The research is a quantitative study with an explorative nature. The research tries to contribute to the understanding learning of family farms by analysing specific personal characteristics of farmers. The dataset "Pig farmers household survey" was used as a starting point for this research. Because the dataset became available after the research had started, the researcher had chosen to take a deductive approach. The literature review contributed to the development of the theoretical framework and the development of hypotheses.

At first the descriptive and performance indicators will be explained. The performance indicators will be used as the dependent variable and are considered the result of the input variable. The descriptive variables will be used as control variable. Four control variables will be used as independent variables in the analysis. The four control variables are farm size, region, years of experience as pig producer and highest education level.

The input variables are the learning activities and personal characteristics. As the literature review showed the use of a quantitative approach towards learning of farmers is not new, but adjusted measurements instruments will be analyzed for the first time on this type of population and this purpose. The measurement instruments have to be internally validated before they can be used for the analysis. To be able to conduct the statistical data analysis, the constructs Social interdependence attitude and Social competences have reduced into factors.

3.1 Descriptive

The dataset existed out of 199 respondents from South Korea. The data is gathered by the umbrella cooperation NACF, which had 2.800 pig producers as member. The instructions for the NACF to select the respondents were as follows; they are family businesses, >50% of their income is coming from pig farming, The pig producer must have at least 5 years' experience in pig farming, Representative regional distribution, a bias towards younger farmers, that will be likely to remain pig farming in the next 10 years. An instruction manual was provided to the representatives on how the questionnaire should be conducted.

3.1.1 Farm size

The farm size exists of two separate variables "number of sows" and "number of fattening pigs." The reason to divide the farm size into these two groups is that a farmer can sell his pigs after weaning or at the weight of 25 kilograms. In that case, the farmer is only a breeder. A reason can be that the farmer specializes in breeding or that he does not have enough land or capital to keep the fattening pigs.

The farm sizes are both measured on a 6-point Likert scale. The average sow farm size was 150-199 sows ($r(199)=4,10$). The exact average number of sows cannot be determined because there was no exact information about the size of these farms with >300 sows. The average number of fattening pigs was between 1000-1499 fattening pigs ($r(194)=4,48$). Again the exact average number of fattening pigs cannot be determined due to the farms with >2500 pigs. Five farms had only sows and no fattening pigs. The correlation of the farm sizes of the number of sows and fattening pigs is significant and

positive with a correlation of $r(194)=.654$, $p<.001$. In the lowest categories (<50 sows and <200 fattening pigs) there were respectively 1 and 3 respondents. The respondent with <50 sows also had <200 fattening pigs, the other two farmers with <200 fattening pigs had 50 to 99 sows. The four respondents will not be rejected to create a better fit for the model, because that would be data manipulation. The impact on the rest of the data will be minimal because of the large sample size.

3.1.2 Region

The data is collected from five different cooperatives (Figure 10): Dodram Pig farming Cooperative (1), Daejeon-Chungnam Pig farming Cooperative (2), Paju-Yeoncheon Livestock Cooperative (3), Bookyoung Pig farming Cooperative (4) and Jeju Pig farming Cooperative (5). The data from the cooperatives is almost identical in proportions to the data from the regions, only the cooperative membership has less missing values. For that reason, the researcher has chosen to use the question about cooperative membership to compare on regions. Based upon table 5 it can be observed that there are differences between the regions, Jeju Pig farming cooperative is on average the lowest performing cooperative, and Dodram pig farming Cooperative the best performing cooperative. None of the values were outside the standard deviation of the total sample. The average number of pigs per farmer in the region is also mentioned in the table, this was based on data supplied by the NACF. Of all the respondents, 81% came out the three regions that have the most piglets, whereas these regions present only 59% of the total memberships. There is a slight bias to certain regions towards the larger pig farmers in the sample.



Figure 10 Region South Korea (Korea, 2018)

Table 5 Technical performance and farm size regions

Region (N)	No. of sows	No. of fattening pigs	Piglets per sow per year	Marketed piglets per sow per year	Region average pigs (NACF, 2017)	Total number of members
Dodram Pig farming Cooperative (19)	4.95	4.19	4.39	3.47	2.835	625
Daejeon-Chungnam Pig farming Cooperative (60)	4.02	4.64	4.00	2.98	2.743	362
Paju-Yeoncheon Livestock Cooperative (19)	3.74	3.63	3.22	2.84	1.757	411
Bookyoung Pig farming Cooperative (70)	4.03	4.87	4.77	3.20	2.543	368
Jeju Pig farming Cooperative (31)	4.13	3.93	3.1	2.27	1.099	514
All regions (199)	4.1	4.48	4.11	2.98	2.195	2280

3.1.3 Age and years of being a pig producer

The analysis will use the years of being a pig producer as a control variable, because this is proven to be an indicator for the research of Sue Kilpatrick (2000). The histogram was highly skewed towards >15 years (Appendix I), but the effect of experience could be

influential. The age of the farmer and the years of being a pig producer are correlated ($p=.634$, $\text{sig.}=.000$). The average age was between 50-59 ($r(199)=4.86$).

3.1.4 Highest education level

This variable is about the level of education of the respondent. The respondent had to fill in the highest achieved level of education. This was measured on a 5-point Likert scale (Elementary school/Middle (or Junior High) school/High School/Junior College (2–3 years)/University). The distribution at education level is not normal, 45,7% had “High School” as the highest level of education. Only 20 respondents scored lower than “High School”, these were divided into Elementary school ($n = 6$), Middle (or Junior High) school ($n = 13$) (Appendix I).

3.1.5 Dummy variables

All the independent control variables are measured as an ordinal value by using a Likert scale. The variables years of being a pig producer, education level, farm size, and region are for that reason all ordinal values. The differences between these variables are not evenly distributed, i.e., it hard to say if the difference between the sow farm size “150-199” and “200-299” is the same as the difference than between “200-299” and “>300”. For that reason, dummy variables will be created for all four control variables to be able to use these variables in the regression analysis.

3.2 Performance indicators

Firm performance is a complex and multidimensional construct (Chandler & Hanks, 1993). Therefore, the use of multiple indicators has been recommended by researchers (Zahra, Neubaum, & El-Hagrassey, 2002). The dataset contains three indicators that are suited to compare the farm performance of the respondents. The dataset includes two technical performance indicators, and one about the knowledge of the farmer about diseases and treatment. These will be used as dependent variables in the analysis.

3.2.1 Technical farm performance

A technical farm performance measurement is a useful indicator of the actual performance of the farm in agriculture. It is common practice to compare farms based upon these technical farm performance measurements in pig farming. Technical farm performance indicators are especially useful when comparing farms without full knowledge of all input and output. Financial performance indicators could be a misrepresentation of the actual performance of the farm, a farmer could, for example, have a lot of land, which could lead to a reduced cost for feed and manure. This could be used to compensate for lower performance in the stables.

The two indicators in the dataset for technical farm performance indicators are "piglets per sow per year" and "marketed pigs per sow per year." Piglets per sow per year are measured by the question "Average number of piglets per sow (PYS) last two years". The number is calculated by dividing the number of piglets that were weaned by the average number of sows on the farm over the last year. Marketed pigs per sow per year are calculated by dividing the number of pigs that are delivered to the slaughterhouse by the average number of sows in one year. The work and farmer knowledge that is related to the production of sows is different in comparison to fattening pigs, which explains why they are measured separately.

These indicators of performance cannot be influenced by fixed factors but are only influenced by the quality of management. The management influences these indicators by selecting the right inputs, but also by performing the right actions at the right times in the stable. The technical performance indicators are influenced by, for example, the right moment of insemination, feeding management and the practices applied in the farrowing shed. Improving this technical firm performance can be due to deductive reasoning, but are mainly learned through observing best practices of others. All of this management related knowledge could be learned through observation and experience, yet most information that will improve the technical performance will come from outside the farm.

These two technical farm performances do not show the entire picture of technical farm performance. Still, these two indicators are commonly used to compare pig farms and give a good indication of how well a farm is managed. A pig with an average PSY between 20-21.9 could financially outperform a farm with a PSY of >25, even though this is unlikely. There is no additional information available about the technical performance of the farm. Therefore these two indicators will be used to determine the technical farm performance.

Both questions have six answer possibilities, which are developed based upon previous data about farm sizes of pig farms in South Korea. The answer possibilities vary on a 6-

point Likert scale, for the PSY between <17 and >25, for the MSY between <15 and >23. This number is lower due to piglet mortality during the life on the farm. The variables could be considered continuous because South Korean farmers rarely come outside these ranges.

The average PSY of the respondents was a between above 21-22.9 ($r(199)=4.11$), the average MSY was slightly below 17-18.9 ($r(199)=2.89$). Both technical performance indicators show a good fit of the normal distribution and the SD was 1.245 for PSY and 1.128 for MSY.

3.2.2 Knowledge about diseases and treatment

Measuring the knowledge of the respondents about pig farming is difficult due to the practical nature of pig farming. The survey attempted to measure a specific part of the knowledge about pig farming, the knowledge of the farmer about diseases and the treatment or prevention of that disease. Even though it is only one element of the farmer's knowledge about pig farming, the knowledge about diseases and treatment is an element that the farmer can learn. If a farmer can recognize diseases and apply the right treatment or even prevent it from happening, it shows that he has learned it somewhere.

Three questions were developed to measure the knowledge. Each question exists of two parts, one part in which the farmer has to recognize the disease and one part in which the respondent has to answer which treatment or prevention measures could be applied. An example question can be found in figure 11. The answer to question 20a part one "Which of the following pathogens might be involved?" is "E. coli" and "Rotavirus". If the respondent checks both boxes he will receive five points. For each right checkbox, the farmer gets awarded one point. The farmers could score a total of 30 points. The score will indicate the respondent's knowledge about diseases. If a respondent did not check any box, the answer would be rejected. Otherwise, the respondent could achieve a score of 12 without filling in any answer. For that reason questions with multiple good answers have been chosen, so that respondents could distinguish themselves by giving all good answers.

20. Diseases and treatment

- a. On the picture you see 1-day-old piglets suffering from diarrhea.
- Which of the following pathogens could **cause** neonatal diarrhea?
 - How can you **prevent** neonatal diarrhea?

Tick the correct answer(s), more than 1 answer can be correct


	Which of the following pathogens might be involved?		Which of the following preventive measures could you take?	
	E. coli	<input type="checkbox"/>	By vaccinating the piglets	<input type="checkbox"/>
	Scabies	<input type="checkbox"/>	By vaccinating the sow	<input type="checkbox"/>
	Worms	<input type="checkbox"/>	By improving the feed intake of the sow	<input type="checkbox"/>
	Rota virus	<input type="checkbox"/>	By improving the colostrum intake of the piglets	<input type="checkbox"/>
	Mycotoxins	<input type="checkbox"/>	By preventing chilling of the piglets	<input type="checkbox"/>

Figure 11 Example question about animal health

The average score for the knowledge about diseases and treatment, from now on shortened as ADHK (Animal Disease and Health Knowledge), is 18.33. There was, of course, a risk that the representative from the cooperative helped the respondent by giving

hints about the questions, but this cannot be controlled. Table 6 shows the average scores of the cooperatives, all scores fall between the standard deviation of the average score. Therefore this score will be accepted as the indicator of the farmer's knowledge.

Table 6 Average scores ADHK

Cooperative	Mean	SD	N
Dodram Pig farming Cooperative	16.86	2.07	19
Daejeon-Chungnam Pig farming Cooperative	18.00	1.94	60
Bookyoung Pig farming Cooperative	18.78	1.59	70
Jeju Pig farming Cooperative	16.96	2.30	31
Paju-Yeoncheon Livestock Cooperative	19.47	1.62	19
Average	18.33	2.00	40

3.3 Learning activities

Nine learning activities have been asked in the survey. These learning activities gave an image of the learning preferences of the farmers. The survey tried to formulate the questions in such a way that the respondent has to show what they did. The question was "To what degree have you undertaken each of the following learning activities during the last three years (2015~2017) to improve your performance as pig farmer?". The respondent had to fill in an answer on a 6-point Likert scale, the scale with two questions can be found in table 7. The assumption is that the higher degree the respondents answered, the more they undertook that learning activity. If farmers did not undertake the learning activity, they had to check the answer option "Not applicable." It is unknown why respondents checked this box, it could be because the respondent did not undertake this activity, but it could also be i.e. that the respondent has no direct colleagues in his environment to compare his practices. Therefore the "Not applicable" is marked as missing.

Table 7 Two questions with answer possibilities for learning activities

29.To what degree have you undertaken each of the following learning activities during the last 3 years (2015~2017) to improve your performance as pig farmer?

		Not applicable	very low degree	low degree	medium level degree	high degree	very high degree
1	Comparing my practices with other pig farmers in my region	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Consulting other pig farmers for personal feedback	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The activities that involve other people from outside the farm will be considered as cooperative learning activities. Attending a course or training is the only formal learning activity, all others are considered non-formal. Table 8 shows the descriptive statistics of the learning activities. Almost all scores are between 3-4, which means that the respondents undertake learning activities between a medium level degree and a high degree. The lowest score is achieved for "Experimenting by doing things differently" ($r(110) = 2.76$), of this group 45% filled in the answer option "Not applicable." This could indicate that these farmers do not experiment on their farm by doing things differently, or that they did not know what experimenting by doing things differently means. The highest score was for "Joining a pig farmer cooperation" ($r(185) = 3.98$), but this variable could

be biased because a representative of the cooperative was there when the survey was filled in. This variable also showed a skewed distribution on the histogram, all others were quite normally distributed.

Table 8 Descriptive learning activities

Learning activities	N	Missing	Mean	SD
Comparing my practices with other pig farmers in my region	184	15	3.14	.89
Consulting other pig farmers for personal feedback	187	12	3.29	.84
Consulting family members for personal feedback	173	26	2.92	.96
Consulting an expert to identify new opportunities	192	7	3.58	.87
Experimenting by doing things differently	110	89	2.76	1.08
Attending a course/training	188	11	3.33	.91
Looking for information in agricultural magazines, in books, or on the internet	192	7	3.32	.82
Exchanging information with pig farmers during informal meetings	183	16	3.05	.94
Joining a pig farmer cooperation	185	14	3.98	1.05

3.4 Personal characteristics

Two personal characteristics will be used for the analysis phase. These personal characteristics are intangible, but by combining several questions, it is possible to make these constructs tangible (Riggio, 1986). To validate the constructs for internal consistency of this data sample, a Principal Component Analysis will be conducted.

3.4.1 Social interdependence attitude

The Social interdependence attitude of a person is intangible, but David W Johnson and Norem-Hebeisen (1979) developed the social interdependence scales (SIS) to provide Social scientist a tool to measure the interdependence attitudes of people. The SIS was developed to measure attitudes between oneself and others in educational settings. The scales were developed through analysing six studies involving 6000 students from kindergarten through college over a period of three years. It should be noted that the scales were developed for the American society, imply differences with other cultures.

In this dataset, the SIS is used to measure the social interdependence attitude of the South Korean farmers. To make the SIS applicable for South Korean pig farmers, the questions have been altered by Thomas Lans et al. (2017). The full set of questions can be found in Appendix II. An example of a change is "Competing with other students is a good way to work" (David W Johnson & Norem-Hebeisen, 1979) into "Competing with other pig farmers is a good way to work" (Thomas Lans et al., 2017). It is unknown if the variables have good internal validity, making it necessary to test the components for internal validity before using them in the analysis.

A principal component analysis was conducted on the 21 items to control the variables for internal validity. The principal component analysis is a method of factor extraction, PCA is used to reduce the number of variables while retaining as much of the original variance as possible (Conway & Huffcutt, 2003). The variables were forced into three factors, which each should represent a social interdependence attitude. It is allowed for the factors to be not orthogonal. Therefore the Direct Oblimin rotation was used to rotate the variables to maximize the component loadings. The variables had to load more than .4 on the factor (Field, 2009), and preferably without cross-loading to maximize the differences between the social interdependence attitudes.

After conducting the factor analysis, three variables did not reach a factor loading of .4 on the related factor and are therefore rejected from the PCA. The excluded variables were "I try to share my ideas and equipment with other pig farmers when I think it will help them" and "I like to work with other pig farmers", which were related to cooperative attitude. One question was related to the individualistic attitude "Working in small groups is better than working alone". Without these three variables, the same procedure was followed to create the new components. The results from the factor analysis are shown in table 9, in Appendix III the factor analysis before rejection of the variables can be found.

The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis, KMO = .80 ('Meritorious' according to (Hutcheson & Sofroniou, 1999)), and all KMO values for individual items were greater than .67, which is well above the acceptable limit of .5 (Field, 2009). The three factors had an eigenvalue over Kaiser's criterion of 1 and in combination explained 50.71% of the variance. Factor one is individualistic attitude, factor two is competitive attitude, and factor three is the cooperative attitude. Cronbach's alpha was used to measure the internal consistency; it is considered to be a measure of scale reliability. A value of .7 or .8 is an acceptable value for Cronbach's alpha, but in early stages of research, value of .5 is acceptable (Field, 2009). The social interdependence attitudes all had a quite good internal consistency with the lowest Cronbach's Alpha = .67. It should be noted that it is below .7, but is not a reason to stop the research. The newly created variables will be used during the further analysis because the variables are standardized.

Table 9 Summary of PCA results for social interdependence scales (N = 193)

Item	Pattern matrix		
	Competitive	Individualistic	Cooperative
Cooperative attitude			
1. I try to share my ideas and equipment with other pig farmers when I think it will help them.	-	-	-
2. It is a good idea for pig farmers to help each other improve.	-0.03	-0.035	0.67
3. Pig farmers learn lots of things from each other.	-0.072	-0.276	0.604
4. I like to work with other pig farmers.	-	-	-
5. I can learn important things from other pig farmers.	-0.062	-0.242	0.579
6. I like to help other pig farmers to improve.	0.01	0.136	0.691
7. I like to share my ideas and equipment with other pig farmers.	0.162	0.055	0.572
Competitive attitude			
1. I like to compete with other pig farmers to see who can perform the best	0.501	-0.093	0.273
2. I like to be the best performing pig farmer of my region	0.701	-0.011	0.102
3. I don't like to be second	0.721	0.057	-0.085
4. I like the challenge of seeing who is best	0.781	-0.061	-0.172
5. I am the happiest when I am competing with other pig farmers	0.82	-0.12	-0.14
6. I work to get better business results than other pig farmers	0.458	0.064	0.327
7. I like to perform better than other pig farmers	0.436	0.323	0.362
8. Competing with other pig farmers is a good way to work.	0.683	-0.149	0.067
Individualistic attitude			
1. It bothers me when I have to work with other pig farmers.	0.039	0.527	-0.23
2. I like my work better when I do it all myself.	-0.208	0.818	0.095
3. I don't like working with other pig farmers.	-0.038	0.548	-0.001
4. Working in small groups is better than working alone.	-	-	-
5. I would rather work on my pig farm alone than with staff or other pig farmers.	-0.104	0.822	0.069
6. I do better work when I work alone.	0.061	0.77	-0.116
Eigenvalue	4.5	2.61	1.84
% of variance	24.98%	14.49%	10.24%
Cronbach's alpha	0.82	0.67	0.78

Note: Factor loadings over .40 appear in bold

3.4.2 Social competences

The influence of social competence will also be analyzed. To determine the level of social competence, three relevant social competences will be measured. These three social competences will be combined to create a composite variable that indicates the level of social competence for that respondent. To ensure that the variables have a good internal validity, the social competences will be analyzed using a PCA. This PCA will also test if the constructs hold under a different population and cultural background.

Social perception, self-promotion, and social learning orientation were available in the dataset. Table 10 is a part of the survey to show how the level of social skills is measured. In total, the respondent had to fill in 15 questions, the level is determined by self-assessment. The questions, and who developed them, can be found in table 11. Four questions to measure social perception are marked with an asterisk, these are the original constructs as validated in the research of Robert A. Baron and Markman (2003).

Table 10 Example social competence questions farmer household survey(T Lans et al., 2017)

35.To what extent do you agree with the following statements?		strongly disagree	disagree	undecided	agree	strongly agree
1	I am a good judge of other people	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	I make people aware of my accomplishments	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

To check the social competences on internal validity, a principal component analysis was conducted on the 15 items of social competence. To get a better loading on the factors the Direct Oblimin rotation was used. It is not necessary to get the maximum amount of differences between the competencies because respondents could score high on all competences. The variables were forced into three factors, which each should represent a competence. The variables had to load more than .4 on the factor (Field, 2009), cross-loading is not marked as a problem because a respondent can be high on all social skills. Three variables of social perception are rejected because they loaded lower than .3 on social perception. One of the three rejected variables, is from the original measurement questions of social perception developed by Robert A. Baron and Markman (2003). The other two were developed by another researcher that expanded the construct. After a new factor analysis without the three variables, the social learning orientation question "I am very aware of my own strong and weak points" loaded less than .3 on the construct. For that reason, the variable is also rejected. After that rejection, two variables loaded only - .333, and .336 on two social competences. These are accepted, which should be noted before the constructs are used for further research. The factor analysis can be found in table 11, in appendix IV the factor analysis before rejection of the variables can be found.

The research assumptions after rejecting the four variables were accepted. The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis, KMO = .79 ('Middling' according to (Hutcheson & Sofroniou, 1999)), which is well above the acceptable limit of .5 (Field, 2009). The three factors had an eigenvalue over Kaiser's criterion of 1 and in combination explained 56.58% of the variance. Factor one is social perception, factor 2 is self-promotion, and factor 3 is social learning orientation. Not all social competences had good reliabilities, social perception (0.70), and self-promotion (0.66) were good, social learning orientation had a Cronbach alpha of only 0.406.

The researcher has chosen to create a composite variable for the social competences. This variable explains the level of competence for each respondent. Because of the explorative nature of this research not every individual social competence will be analyzed for this analysis.

Table 11 Summary of PCA results for Social competences (N = 193)

Item	Structure matrix		
	1	2	3
Social perception (Robert A. Baron & Markman, 2003; Lans et al., 2016)			
1. I am a good judge of other people*	.711	-.089	-.230
2. I know where to find relevant information	-	-	-
3. I can usually recognize others' traits accurately by observing their behaviour*	.759	-.002	.054
4. I can easily assess the wishes of others in my audience	.782	.111	.132
5. I have a clear idea about how my enterprise performs in relation to other enterprises in the sector	-	-	-
6. I can tell why people have acted the way they have in most situations*	.522	-.126	.161
7. I generally know when it is the right time to ask someone for a favor*	-	-	-
Self-promotion (Robert A. Baron & Tang, 2009)			
1. I make people aware of my accomplishments	.258	-.671	-.148
2. I let others know that I have a reputation for being competent in a particular area	.369	-.333	.293
3. I make other people aware of my talents or qualifications	.151	-.752	-.064
4. I talk proudly about my experience or education	-.097	-.817	-.042
Social learning orientation (Lans et al., 2016)			
1. I am very aware of my own strong and weak points	-	-	-
2. I am open to criticism from others (colleagues, employees, etc.)	.261	.142	.623
3. I am open to suggestions of others	-.078	-.111	.847
4. I try to incorporate feedback from others on my practices in my management	-.156	-.639	.336
Eigenvalue	3.472	1.538	1.214
% of variance	31.57%	13.98%	11.03%
Cronbach's Alpha	0.697	0.662	0.406

*Original constructs

Note: Factor loadings over .40 appear in bold

4. Results

First, the research assumptions that need to be controlled for this research will be discussed. Then the results related to the first theoretical framework of Social interdependence will be discussed, after that the frameworks of social competence and trust.

4.1 Research assumptions

These research assumptions tell if the model is a good fit and if the model could be generalizable to other models. Generalization is an additional step, if the model is not generalizable, the conclusions must be restricted based on the sample used (Field, 2009). For each model five assumptions will be checked that are considered relevant for regression analysis based upon Gelman and Hill (2006) analysis; Regression diagnostic, Additivity and linearity, Independence of errors, Normality of variance, and Multicollinearity. When the assumptions are met, it means that on average, the likelihood is increased that the model from the sample is the same as the population model (Field, 2009).

For each regression analysis at least five statistics will be noted; the F-value, significance level, degrees of freedom, sample size, and explained variance by the model in r^2 . Other values will only be noted when the research assumption is violated.

4.1.1 Regression diagnostic

The regression diagnostic will be checked first, to find observations that are poorly represented in the model or that have a relatively large effect on the model's predictions. A model can be influenced by a small number of cases. Outliers and influential cases could give a misrepresentation of the data. An outlier is a case that differs substantially from the main trend of the data, an outlier could increase the beta and misrepresent the data (Field, 2009).

To spot these outliers the data will be plotted. It will also be checked statistically with Cook's distance. Cook's distance is a measure of the overall influence of a case on the model, a value greater than one may be cause for concern Cook and Weisberg (Cook & Weisberg, 1982). These will not be used to justify the removal of data points to effect some desirable change in the regression parameters. If a point is a significant outlier, but its Cook's distance < 1 , there is no real need to delete that point since it does not have a large effect on the regression analysis. It should still be studied to understand why they do not fit the model (Field, 2009).

4.1.2 Linearity and homogeneity of variance

The outcome variable should be linearly related to any predictors and, with several predictors, their combined effect is best described by adding the effects together (Field, 2009). The process needs to be described as a linear model, if this assumption isn't met, then the model is invalid. The homogeneity of variance refers to whether the residuals are equally distributed (Field, 2009). The data should be homoscedastic, this could be checked by plotting the predicted values and residuals on a scatterplot. If linearity and heteroscedasticity hold true, then there should be no systematic relationship between the

errors in the model and what the model predicts. The dots should be scattered across the field, and no patterns of linearity or heteroscedasticity should be shown.

The models are checked for linearity, all of the tests met the assumption. Only the tests that violated the assumptions will be shown in the appendix. Otherwise, the assumption is met, and no systematic relationship has been observed.

4.1.3 Independent errors

The residual terms should be uncorrelated if this assumption of independence is violated then the confidence intervals and significance test will be invalid (Field, 2009). To test this assumption the Durbin-Watson test, which test for serial correlations between errors, will be used. A value of 2 means that the residuals are uncorrelated. A value greater than 2 indicates a negative correlation, and below 2 indicates a positive correlation, a rule of thumb is that test statistic values in the range of 1.5 to 2.5 are relatively normal. Values less than 1 or greater than 3 are definitely cause for concern (Field, 2009).

4.1.4 Normality of variance

In order to make valid inferences from the regression, the residuals should be random and normally distributed (Field, 2009). The residuals are the error terms, or the differences between the observed value and the dependent variable and the predicted value (Rachel, 2018). The residuals are normally distributed if they will conform the diagonal normality line indicated in the plot (Rachel, 2018).

If these assumptions are not met, the data can still be used. In large samples normality of variance will not invalidate confidence intervals and significance test due to Central limit theorem, this means that we can assume normality regardless of the shape of our sample data. Central limit theorem states that regardless of the shape of the population, parameters estimates of that population will have a normal distribution provided the samples are 'big enough' (Field, 2009). The outer limit that field recommends for central limit theorem, if the distribution is heavy-tailed is 160 (Field, 2009). This is below the sample size that is used in the test, for that reason central limit theorem can be accepted for this dataset.

4.1.5 Multicollinearity

If the model has more than one predictor, then there should be no perfect linear relationship between two or more predictors (Field, 2009). Still, predictors variable should not correlate too highly, to identify multicollinearity several checks can be performed. The first one is to check the correlation matrix for correlations (Appendix V), the correlations of the predictors should not be above .80 or .90 (Field, 2009). The variance inflation factor (VIF) indicates whether a predictor has a strong linear relationship with other predictors (Field, 2009). VIF should cause for concern if the largest VIF is greater than 10 (Bowerman & O'connell, 1990), or the average VIF is greater than 1, then the regression may be biased (Bowerman & O'connell, 1990). Tolerance is related to VIF and also indicates multicollinearity problems. Values below 0.1 indicate serious problems, a value below 0.2 indicates a potential problem (Menard, 2002).

4.2 Social interdependence attitudes and learning activities.

The first test that will be performed is to explore the relation between the Social interdependence attitudes and learning activities. The hypothesis 1a about the *the degree to which farmers engage in learning activities with others can be explained by their social interdependence attitude* will be analysed through this test.

4.2.1 Relation Social interdependence attitudes and learning activities

To answer this hypothesis the predictor and predicting variables have to be defined. Each learning activity will be predicted in a separate model, and even though the learning activities are measured on a 6-point Likert scale, the variables are considered to be continuous. The predictor variables will be the Social interdependence attitude and regions. The Social interdependence attitudes are standardized due to the PCA performed to reduce the number of variables. The regions are taken into account to analyse the actual influence of region on the learning activities. Field (2009) recommendation to use multiple regression analysis as general linear model for the characteristics of this model is followed. The researcher has chosen to use a hierarchical regression analysis with an enter method. The reason to use a hierarchical structure is to measure the explained variance from the Social interdependence attitudes and regions separately. Bookyoung is the reference region because Bookyoung has the largest N of the sample.

The assumption is that the Social interdependence attitude has a predictive value for the degree in which the respondent undertook a learning activity in the last three years, but that the region also influences the degree of which respondents undertook these learning activities. The contribution to the model will be interpreted as follows: a significant and positive value means that the respondents with a higher score on that SI attitude undertook more of that learning activity. It should be understood that it indicates which SI attitudes have a preference for that learning activity('s), it does not mean that the SI causes that learning activity. Multiple SI attitudes could be related to a single learning activity, this means that the activity is preferred by more than one SI attitude. The control variables region will compensate for regional differences in the model.

Not applicable - As mentioned earlier, the respondents could answer "Not applicable" to the learning activities. To control if the "Not applicable" represents the fact that a respondent does not undertake the learning activity, regression models including "Not applicable" are also made, and the results are compared to table 111. When comparing the results with the regression models that included "Not applicable," it can be concluded that it is good to keep out "Not applicable." The explained variance raises for all variables, except for "Joining a pig farmer cooperation." All SI attitudes maintain the same significance after changing the "Not applicable" to missing, the only exception is that the cooperative attitude does no longer contribute significantly to "attending a course/training."

Table 12 Summary regression analysis for learning activities

	Model 1: Comparing my practices with other pig farmers in my region ¹	Model 2: Consulting other pig farmers for personal feedback ²	Model 3: Consulting family members for personal feedback ³	Model 4: Consulting an expert to identify new opportunities ⁴	Model 5: Experimenting by doing things differently ⁵	Model 6: Attending a course/ training ⁶	Model 7: Looking for information in agricultural magazines, in books, or on the internet ⁷	Model 8: Exchanging information with pig farmers during informal meetings ⁸	Model 9: Joining a pig farmer cooperation ⁹
Constant	3.227**	3.267**	2.814**	3.758**	2.072**	3.194**	3.180**	3.100**	4.751**
Social inter-dependence attitude									
Competitive attitude	.179**	.097	.145^	.080	.204*	.263**	.142*	.240**	-.015
Individualistic attitude	-.114	-.138*	.023	-.062	-.055	-.031	-.029	-.093	.036
Cooperative attitude	.195**	.346**	.109	.317**	.198*+	.138*+	.225**	.242**	.188**
Regions									
Dodram Pig farming Cooperative	.314	.414*	.246	.120	1.353**	.241	.779*	.199	-1.039**
Daejeon-Chungnam Pig farming Cooperative	-.285	.037	.153	-.433**	.521	.226	.244	-.212	-1.290**
Jeju Pig farming Cooperative	-.005	-.053	.295	-.020	1.137**	.375	.232	.072	-1.387**
Paju-Yeoncheon Livestock Cooperative	-.297	-.151	-.084	-.427*	.054	-.207	-.342	-.068	-.917**

* Sig. at level 0.05

** Sig. at level 0.01

Reference variable; Region (Bookyoung Pig farming Cooperative)

^ Lost significance after adding the regions to the regression analysis

+ Became significant after adding the regions to the regression analysis

¹ F=10.126; Sig=.000; df=7; N=171 ; r²=.196 r² change=.042 DW=1.894

² F=10.224; Sig=.000; df=7; N=174 ; r²=.300 r² change=.028 DW=2.307

³ F=1.563; Sig=.150; df=7; N=160 ; r²=.067 r² change=.019 DW=1.937

⁴ F=8.553; Sig=.000; df=7; N=178 ; r²=.259 r² change=.064 DW=1.736

⁵ F=4.634; Sig=.009; df=7; N=97 ; r²=.328 r² change=.213 DW=2.159

⁶ F=8.334; Sig=.000; df=7; N=175 ; r²=.162 r² change=.035 DW=2.249

⁷ F=7.657; Sig=.000; df=7; N=178 ; r²=.239 r² change=.106 DW=2.007

⁸ F=6.888; Sig=.000; df=7; N=169 ; r²=.229 r² change=.018 DW=2.226

⁹ F=15.118; Sig=.000; df=7; N=172 ; r²=.365 r² change=.356 DW=2.081

4.2.2 Results Social interdependence attitudes on learning activities

The research assumptions have been met for eight of the nine regression test, the F-tests of "Consulting other pig farmers for personal feedback" ($F=1.563$, $\text{sig.}=.150$) was not significant, the P-P plot of that model did not show a clear diagonal line (Appendix VI). This indicates that the relationship is not statistically significant, even though the value was close to significance. Furthermore, no abnormalities have been observed in relation to the research assumptions.

The results in table 12 show that the Social interdependence attitudes significant influence the degree of learning activities that the respondents undertook in the last three years. Reasonably high explained variances were achieved, most were between 20-30% variance explained. Only model 3 that failed the F-test explained only 6,7% of the variance.

Social interdependence attitudes can be linked to the learning activities. The competitive attitude had a positive correlation with five learning activities, three of the results were significant at the 0.01 level. The individualistic attitude did not achieve any significant positive contributions at all at the learning activities, it only achieved one significant negative value. It even had a negative predictive value to all activities that involved other people. This might indicate that people high on SI attitude Individualistic undertake less of these learning activities, especially related to learning activities that involve other people. The Cooperative attitude was a significant and positive predictor for eight of the nine learning activities, of which six were significant at the 0.01 level. This indicates that the people with a more competitive and cooperative attitude undertake more learning activities. The two activities to which cooperative attitude was the only significant positive related was: "Consulting an expert to identify new opportunities", and "Joining a pig farmer cooperation." Both activities involve interaction with other people.

Without the regions as a predictor variable, the cooperative and competitive attitude differ on six learning activities instead of two. For two learning activities the Social interdependence attitudes gained significance and one lost significance. This might indicate that both SI attitudes lead to a higher degree of undertook learning activities, but that there are differences in the type of learning activity. Before adding the regions, the competitive attitude was the only one significant positive contributor at "Consulting family members for personal feedback," "Experimenting by doing things differently," and "Attending a course/training." The cooperative attitude was for "Consulting other pig farmers for personal feedback," "Consulting an expert to identify new opportunities," and "Joining a pig farmer cooperation" the only one significant positive contributor. Both SI attitudes also had three learning activities in common, to which they both contributed positively significant.

When looking to the learning activities that the different SI attitudes contributed significant and positive before adding the regions, there can a difference be observed in the type of learning activity. The three learning activities that competitive attitude contributed the most too were more internal learning activities, in which less communication with people was involved. The three learning activities to which cooperative attitude had a high positive contribution to are more external learning sources that involve other people. This could

mean that different SI attitudes lead to different preferences for learning activities. The cooperative attitude could be linked to all cooperative learning activities.

The region proves to be of significant influence in five of the nine models. It was expected that the region influenced the degree of learning activities that were undertaken in the past three years, especially for activities that involved other pig farmers. When looking towards the r^2 change when adding the control predictor variable region, the influence has a limited impact on the explained variance for the models that include other pig farmers. There was a big influence for three of the models; "Experimenting by doing things differently" (r^2 change=21.3%), "Looking for information in agricultural magazines, in books, or on the internet" (r^2 change=10.6%), and "Joining a pig farmer cooperative" (r^2 change=35.6%). The first two learning activities are not related to other farmers, the third "Joining a pig farmer cooperative" is shaped by one province (Bookyoung). This might indicate that the influence of region on the degree pig farmers undertake learning activities with other pig farmers is not heavily influenced by their region. In other words, if farmers want to cooperate he will, regardless of region. There are indeed differences between the regions in the degree the farmers undertake these activities, but the Social interdependence attitude of a farmer has explanatory value why some farmers undertake more learning activities with other farmers.

Hypothesis 1a: The degree to which farmers engage in learning activities with others (i.e. cooperative learning) can be explained by their social interdependence attitude.

This hypothesis is accepted, the level of Social interdependence attitude is a significant predictor for the learning activities. A higher score on cooperative Social interdependence contributes positive to eight of the nine learning activities. It was a strong significant positive contributor to all activities that involved other farmers. The level of cooperative attitude was the best predictor for the three models that are examples of cooperative learning. These models were Model 1: Comparing my practices with other pig farmers in my region, Model 2: Consulting other pig farmers for personal feedback, and Model 8: Exchanging information with pig farmers during informal meetings. The small r^2 change for these variables indicate that this activities are really reliant on the level of cooperative social interdependence of a farmer.

The competitive social interdependence attitude proves to be a significant positive contributor for five learning activities. A competitive attitude can therefore also be related to learning. The individualistic attitude is for none of the activities a positive significant predictor, only negative for Model 2: Consulting other pig farmers for personal feedback. This shows that the individualistic social interdependence attitude only negatively contributes to these learning activities.

4.3 Social interdependence attitude groups

The hypothesis 1b and c state that the different Social interdependence attitudes lead to different preferences in learning activities and performance. This will be tested by grouping the farmers. The respondents will be grouped based upon their Social interdependence attitude, and the results will be compared for groups descriptive, performance indicators, learning activities, and average trust.

4.3.1 Social interdependence cluster analysis and test

To make it possible to see these differences between groups, a K-means cluster analysis is used by using the three Social interdependence attitude. A K-means clustering could be used to define categories or groups, the data points are clustered based on similarities (Trevino, 2018). Three groups have been formed, because of the three types of Social interdependence attitudes.

The three clusters have been created that divided the respondents into three equal groups. The values for Social interdependence attitude are standardized, the values in table 13 show how much the cluster centers deviate from the mean.

- The first group is more Cooperative/competitive oriented (N=61)
- The second group is in-between and does not show a specific profile (N=64)
- The third group is more individualistic oriented (N=61)

Table 13 Final cluster centers K-mean cluster analysis Social interdependence attitudes

Clusters	1	2	3
Competitive	.68647	-.14311	-.53633
Individualistic	-.69264	-.23123	.93524
Cooperative	.85316	-.90620	.09761

To control for the differences between regions, an overview of the distribution among the regions is shown in table 14, it can be observed that the spread is relatively equal for all regions.

Table 14 Distribution clusters among regions

Region	Cluster 1	Cluster 2	Cluster 3
Dodram Pig farming Cooperative	6	6	5
Daejeon-Chungnam Pig farming Cooperative	12	19	23
Bookyoung Pig farming Cooperative	24	20	26
Jeju Pig farming Cooperative	9	14	5
Paju-Yeoncheon Livestock Cooperative	10	5	2
Total	61	64	61

A One-way ANOVA with Post Hoc test will be used to analyse the groups for statistical differences between the groups descriptive, performance indicators, learning activities and average trust. This will test for statistical differences between the group means. The null hypothesis is that there is no difference between the groups if the hypothesis gets rejected ($p < 0,05$).

The main assumptions for an ANOVA with Post Hoc test as mentioned by Consulting (2018) are: The observations should be independent of each other, each case should represent a unique person or another statistical unit. The variables should normally be distributed, once again in larger samples this is not a problem due to central limit theorem. Homogeneity needs to ensure that the population variances are equal, this will be tested through a Levene's test, a score of ($p > 0.05$) means that the variances are equal.

Table 15 Cluster descriptive, including a One-way ANOVA with a Post-hoc test for each variable

	Valid	Cluster 1: Cooperative/ competitive	Cluster 2: Undefined	Cluster 3: Individualistic
Descriptive	N	61	64	61
Age ¹⁰	199	4.8	4.8	4.98
Education level ¹¹	197	3.66	3.57	3.49
Number of sows ¹²	199	4.78(1)*	4.23(1)*	4.52
Number of fattening pigs ¹³	194	4.67(2&3)**	3.89(1)**	3.85(1)**
Number of workers ¹⁴	197	3.38(3)*	2.94	2.74(1)*
Learning activities				
Comparing my practices with other pig farmers in my region ¹⁵	184	3.57(2&3)**	2.97(1)**	2.93(1)**
Consulting other pig farmers for personal feedback ¹⁶	187	3.74(2&3)**	2.90(1)**(3)*	3.27(1)**(2)*
Consulting family members for personal feedback ¹⁷	173	3.11	2.77	2.88
Consulting an expert to identify new opportunities ¹⁸	192	3.98(2&3)**	3.34(1)**	3.51(1)**
Experimenting by doing things differently ¹⁹	110	3.15	2.69	2.59
Attending a course/training ²⁰	188	3.55	3.23	3.20
Looking for information in agricultural magazines, in books, or on the internet ²¹	192	3.59(2)**	3.13(1)**	3.27
Exchanging information with pig farmers during informal meetings ²²	183	3.50(2&3)**	2.82(1)**	2.89(1)**
Joining a pig farmer cooperation ²³	185	4.18(2)*	3.70(1&3)*	4.20(2)*
Performance indicators				
Piglets per sow per year ²⁴	188	4.25	3.89	4.25
Marketed piglets per sow per year ²⁵	188	2.98	2.78	3.18
Score animal disease and health knowledge ²⁶	170	18.22	17.82(3)*	18.74(2)*
Trust²⁷				
Average trust	182	3.81(2&3)**	3.37(1)**	3.53(1)**

(x) is the cluster from which it significantly differs

* Sig. at level 0.05

** Sig. at level 0.01

4.3.2 Results Social interdependence clusters

The results of the descriptive and the outcomes of the ANOVA test can be found in table 15. For each variable, the same procedure has been applied. The Levene's test will be noted as well as the Partial Eta Squared. In the table, the mean of the cluster is noted, and the significant difference will be flagged with either a 1, 2, or 3. These numbers refer to the cluster of which the cluster significantly differs from.

¹⁰ Levene's test=.144, PE²=.007

¹¹ Levene's test=.756, PE²=.005

¹² Levene's test=.332, PE²=.082

¹³ Levene's test=.202, PE²=.032

¹⁴ Levene's test=.497, PE²=.045

¹⁵ Levene's test=.492, PE²=.107

¹⁶ Levene's test=.797, PE²=.175

¹⁷ Levene's test=.200, PE²=.025

¹⁸ Levene's test=.074, PE²=.101

¹⁹ Levene's test=.501, PE²=.052

²⁰ Levene's test=.391, PE²=.030

²¹ Levene's test=.023, PE²=.055

²² Levene's test=.084, PE²=.109

²³ Levene's test=.010, PE²=.051

²⁴ Levene's test=.402, PE²=.020

²⁵ Levene's test=.807, PE²=.022

²⁶ Levene's test=.794, PE²=.036

²⁷ Levene's test=.008, PE²=.127

Hypothesis 1b: There is a difference in learning behaviour when farmers are grouped based upon their social interdependence attitudes.

There are significant differences between the group's degree in which they undertake learning activities. The group that had a more cooperative and competitive Social interdependence attitude achieved a significant positive average on four of the learning activities in comparison to the other groups. All these four learning activities involve interaction with other people and could be seen as cooperative learning activities. This group also scores significantly higher on the average trust, this average trust was measured by taking the mean of all trust related questions combined.

Hypothesis 1c: There is a difference in the farm performance when farmers are grouped based upon their social interdependence attitudes.

There are observational differences between the technical performance indicators of the cluster but no statistically significant differences have been measured. Only the score for animal disease and health knowledge was significantly higher for cluster three in comparison to cluster two. Despite the fact that these clusters cannot be linked to technical performance and score for animal disease and health knowledge, the clusters show differences. For farm size and average number of workers there are significant differences. The cooperative cluster has on average a significant bigger farm than the other two clusters, this explains that these farms have on average more workers. The trust of these farmers in others was on average also higher.

4.4 Results Learning activity on performance

Not all learning activities are considered to be equally effective, learning activities that are related to transformative learning will most likely result in higher farm performance (Aur lie et al., 2014). Therefore the influence of the learning activities on the performance indicators is tested.

4.4.1 Relation learning activities and performance indicators.

An multiple regression analysis was made to get an indication of which learning activities contribute positive to the performance indicators. The predictor variables are the performance indicators; Piglets per sow per year, Marketed piglets per sow per year, and Score on animal disease and health. The predicting variable varies per indicator. For the two technical performance indicators the region and farm size were used as control variables. For ADHK the number of sows, years of experience as pig producer are taken into account. The variable "Highest education level" which was considered to be an indicator for ADHK violated the research assumptions Tolerance and VIF, for that reason it was left out. The scatterplots and P-P plots can be found in appendix VII.

4.4.2 Results relation learning activities and performance indicators

The results are split into two separate tables, one for the technical farm performance indicators and one for the knowledge about animal diseases and health. Table 16 shows the results for the PSY and MSY. Both regression models met all the research assumptions. The earlier results from table 12 show that "Experimenting by doing things differently" was heavily influenced by the region. After adding this variable to the analysis, the number of

respondents dropped to 90. For these two reasons the variable is rejected from this model, after rejecting this variable, the number of respondents used in the model increased to 139.

The model for PSY as shown in table 16 explained for 44,4% of the variance in PSY, region and farm size were responsible for 23,1% of the variance. When analysing the model for PSY the model shows that there is only one learning activity that achieved a significant positive contribution. Consulting an expert proves to be a positive predictor for PSY ($p=.004$, $b=.418$). The other learning activities had a positive contribution but did not achieve significance. Only two learning activities, Exchanging information with pig farmers during informal meetings and Joining a pig farmer cooperation, were negatively related to PSY, but these were not significant. The region proves to be of importance in predicting PSY, in several regions the performance is significantly different from other regions, the regions with higher average farm sizes performed better. The farm size influences the performance as well, all bigger farms performed better than the reference variable 50-99 Sows.

The total model for MSY as shown in table 16 explained 27,0% of the variance in MSY, region and farm size are responsible for 17% of the explained variance. When analysing the model for MSY, it can be observed that once again there is only one learning activity that achieved a significant positive contribution. Consulting an expert proves to be a positive predictor for MSY ($p=.003$, $b=.492$). The other learning activities did not show a clear pattern. The regions that had smaller average farm sizes perform lower on MSY, the regions with an bigger average firm size were positive. In this model the farm size did not influence the MSY significantly, none of the sizes achieved significance, but it seems to be that bigger farms perform better. The reference variable for number of fattening pigs is 200-499, this variable is chosen because the variable <200 violated the Tolerance and VIF values.

Table 16 Regression analysis technical performance indicators (enter method)

Predicting variables	Piglets per sow per year ²⁸			Marketed piglets per sow per year ²⁹		
	B	Std. error	Sig	B	Std. error	Sig
(Constant)	1.537*	.598	.011	1.315	.680	.055
<u>Learning activities</u>						
(1) Comparing my practices with other pig farmers in my region	.159	.136	.245	.008	.147	.957
(2) Consulting other pig farmers for personal feedback	.008	.139	.955	-.061	.148	.683
(3) Consulting family members for personal feedback	.124	.089	.166	.159	.099	.110
(4) Consulting an expert to identify new opportunities	.418**	.143	.004	.492**	.161	.003
(5) Attending a course/training	.022	.105	.838	.082	.115	.479
(6) Looking for information in agricultural magazines, in books, or on the internet	.079	.140	.571	.045	.151	.765
(7) Exchanging information with pig farmers during informal meetings	-.082	.111	.460	-.037	.124	.766
(8) Joining a pig farmer cooperation	-.109	.116	.351	-.158	.125	.208
<u>Region</u>						
Dodram Pig farming Cooperative	-.035	.329	.915	.193	.378	.610
Bookyoung Pig farming Cooperative	.722**	.316	.024	.295	.342	.390
Jeju Pig farming Cooperative	-.841**	.309	.007	-.723*	.343	.037
Paju-Yeoncheon Livestock Cooperative	-.633	.345	.069	-.109	.390	.780
<u>Number of sows</u>						
100-149 Sows	.451	.300	.136			
150-199 Sows	.649*	.294	.029			
200-299 Sows	.268	.313	.393			
>300 Sows	.719*	.315	.024			
<u>Number of fattening pigs</u>						
Less than 200				-.383	-.040	.653
500-999				-.328	-.100	.415
1000-1499				-.312	-.109	.403
1500-2499				.089	.036	.812
More than 2500				.105	.039	.781

Reference variables; Region (Daejeon-Chungnam Pig farming Cooperative), Number of sows (50_99), Number of fattening pigs (200-499)

* Sig. at level 0.05

** Sig. at level 0.01

The model for ADHK explained 22,8% of the variance and can be found in table 17, 15,8% of the variance was explained by the farm size and years of experience as a pig producer. When analysing the model it can be observed that there are two significant predictors for the ADHK score. Consulting an expert to identify new opportunities proves to be a significant positive contributor ($p=.001$, $b=.684$). Attending a course or training is a significant negative contributor to the ADHK score ($p=.017$, $b=-.748$). The other learning activities do not show a clear pattern. The same accounts for the farm size, none of the variables were significant. The years of experience did not achieve significance as well.

²⁸ F=6.149; Sig=.000; df=16; N=139 ; $r^2=.444$ $r^2\text{change}=.231$ DW=2.137

²⁹ F=2.682; Sig=.001; df=17; N=140 ; $r^2=.270$ $r^2\text{change}=.170$ DW=2.144

Table 17 Regression analysis Animal disease and health knowledge score performance indicators (enter method)

Animal disease and health knowledge score ³⁰			
Predicting variables	B	Std. error	Sig
(Constant)	17.595**	1.284	.000
Learning activities			
(1) Comparing my practices with other pig farmers in my region	-.155	.291	.596
(2) Consulting other pig farmers for personal feedback	-.005	.279	.987
(3) Consulting family members for personal feedback	.174	.200	.387
(4) Consulting an expert to identify new opportunities	.684*	.282	.017
(5) Attending a course/training	-.748*	.218	.001
(6) Looking for information in agricultural magazines, in books, or on the internet	-.034	.286	.906
(7) Exchanging information with pig farmers during informal meetings	.105	.245	.667
(8) Joining a pig farmer cooperation	.186	.194	.340
Number of sows			
100-149	-.515	.648	.428
150-199	.617	.624	.325
200-299	-1.091	.660	.101
More than 300	-.333	.668	.619
Years of experience as pig producer			
Less than 5 years	-.241	.827	.772
Between 5-10 years	.508	.634	.425
Between 10-15 years	-.542	.519	.299

Reference variables; Number of sows (50_99), Years of experience (>15 years)

* Sig. at level 0.05

** Sig. at level 0.01

4.5 Social competences and performance indicators

The first relation that will be tested is the direct relation between the social competences and the performance indicators.

4.5.1 Relation social competence and performance indicators

The social competences combined could have a predictive value for the performance indicators. To test the relation between the social competences and performance indicators, a hierarchical regression analysis was made with the including the mean of the social competences, region, farm size, and education level.

4.5.2 Result social competence and performance indicators

Social competences computed do not have direct explanatory value for the three selected performance indicators (Table 28), the Normal P-P plot and scatterplot do not match the desired pattern as well (Appendix VIII).

Hypothesis 2a: The level of social competence has a positive influence on the performance indicators.

The hypothesis 3a will be rejected for these three performance indicators. This does not mean that the social competences do not contribute to the performance of the firm, but

³⁰ F=2.268; Sig=.008; df=15; N=130 ; r²=.228 r²change=.158 DW=1.909

for these specific performance indicators the social competences have no explanatory value.

Table 18 Results regression analysis social competences as predictor for performance

	Piglets per sow per year ³¹		Marketed piglets per sow per year ³²		Score animal disease and health knowledge ³³	
Predicting variables	B	Sig.	B	Sig.	B	Sig.
(Constant)	4.099**	.000	2.967**	.000	18.238**	.000
Social competence	.039	.498	-.030	.561	-.014	.879

4.6 Social competence as a moderator for learning activity

Social competence could be a moderator for learning activities, as the level of social skills were mentioned as a element for cooperative learning (David W. Johnson & Johnson, 2015).

4.6.1 Relation social competence and learning activities

People that score high on the three social competences could possibly achieve more in an learning activity, or be more effective in choosing the right learning activities. It will be tested if there is a moderation effect for social competences in learning activities. To test this relation a moderation model will be used, Fairchild and MacKinnon (2009) described moderation: The moderation model tests whether the prediction of a dependent variable, Y, from an independent variable, X, differs across levels of a third variable, Z (figure 12). Moderator variables affect the strength and/or direction of the relation between a predictor and an outcome: enhancing, reducing, or changing the influence of the predictor. Moderation effects are typically discussed as an interaction between factors or variables, where the effects of one variable depend on levels of the other variable in the analysis.

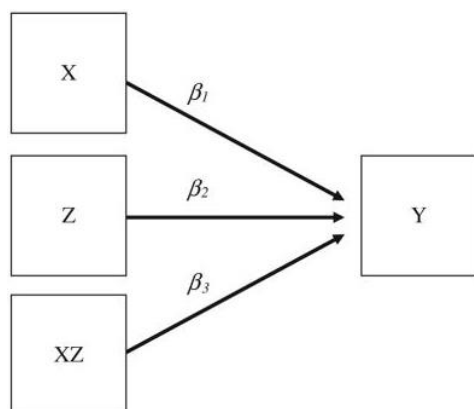


Figure 12 Moderation model (Fairchild & MacKinnon, 2009)³⁴

Five variables that involve other people could be moderated by social competence. These variables are; Comparing my practices with other pig farmers in my region, Consulting

³¹ F=.462; Sig=.498; df=1; N=180 ; r=.003 DW 2.032

³² F=.339; Sig=.561; df=1; N=180 ; r=.002 DW 2.186

³³ F=.023; Sig=.879; df=1; N=167 ; r=.000 DW 1.979

³⁴ Note. X= the independent variable, Y= the dependent variable, Z= the moderator variable, XZ= the product of X and the moderator variable, β_1 = the effect of X on Y, β_2 = the effect of Z on Y, and β_3 = the effect of XZ on Y. This will be used to test if trust is a moderator for the learning activities.

other pig farmers for personal feedback, Consulting an expert to identify new opportunities, Exchanging information with pig farmers during informal meetings, and Joining a pig farmer cooperation. Five new variables have been constructed, that will predict the combined effect of the moderation effect of the level of social competence and learning activities. These variables have been created by taking the combined social competences and multiply these by the learning activities.

4.6.2 Results social competence and learning activities

The results shown in tables 19-23 show that there is only one variable, has a moderation effect. This is the variable "Joining a pig farmers cooperative" (Table 23), but this variable is considered not to be skewed and heavily influenced by one region. The normality of variance assumptions are also violated for this learning activity (Appendix IX). All other learning activities are not mediated by social competences.

Hypothesis 2b: The level of social competence is a moderator for the effect of the learning activity on performance.

This hypotheses will also be rejected, moderation has not been proven for four of the five learning activities, and the fifth is a doubtful learning activity. For the tested learning activities it cannot be proven that social competence has a moderating function for learning activities.

Table 19 Regression analysis to test moderator effect for Comparing my practices with other pig farmers in my region

Predicting variables	Piglets per sow per year ³⁵		
	B	Std. error	Sig.
(Constant)	3.093**	.350	.000
All Social competences	-.186	.229	.419
Comparing my practices with other pig farmers in my region	.307*	.107	.005
Social competence*Comparing Practices	.072	.067	.289

Table 20 Regression analysis to test moderator effect for Consulting other pig farmers for personal feedback

Predicting variables	Piglets per sow per year ³⁶		
	B	Std. error	Sig.
(Constant)	2.931**	.380	.000
All Social competences	-.167	.251	.508
Consulting other pig farmers for personal feedback	.357**	.112	.002
Social competence*Consulting Other farmers	.065	.071	.360

Table 21 Regression analysis to test moderator effect for Consulting an expert to identify new opportunities

Predicting variables	Piglets per sow per year ³⁷		
	B	Std. error	Sig.
(Constant)	2.166**	.384	.000
All Social competences	.027	.266	.920
Consulting an expert to identify new opportunities	.539**	.104	.000
Social competence*Consulting Experts to identify new opportunities	-.008	.068	.902

³⁵ F=3.484; Sig=.017; df=3; N=165 ; r²=.043 r²change=.007 DW=2.005

³⁶ F=4.217; Sig=.007; df=3; N=168 ; r²=.071 r²change=.005 DW=2.016

³⁷ F=9.183; Sig=.000; df=3; N=175 ; r²=.123 r²change=.000 DW=2.103

Table 22 Regression analysis to test moderator effect for Exchanging information with pig farmers during informal meetings

Predicting variables	Piglets per sow per year ³⁸		
	B	Std. error	Sig.
(Constant)	3.956**	.347	.000
All Social competences	-.072	.224	.748
Exchanging information with pig farmers during informal meetings	.052	.108	.635
Social competence*Exchange information with Pig farmers	.033	.063	.594

Table 23 Regression analysis to test moderator effect for Joining a pig farmer cooperation

Predicting variables	Piglets per sow per year ³⁹		
	B	Std. error	Sig.
(Constant)	2.849**	.379	.000
All Social competences	.674*	.325	.040
Joining a pig farmer cooperation	.311**	.092	.001
Social competence*Joining Pig Cooperative	-.144*	.073	.050

4.7 Social competence as a moderator for Social interdependence attitude

The third test that involves social competence is as a moderator effect for the Social interdependence attitudes on learning activities.

4.7.1 Relation social competences moderator for Social interdependence attitude

The social competences could have a moderation effect on the Social interdependence attitudes in predicting the degree of learning activities that are undertaken. The assumption is that the level of social competence has explanatory value for the degree of which they undertake certain learning activities.

To analyse the moderator effect of social competences for Social interdependence attitudes the same procedure as in paragraph 4.6.1 will be used, a moderator variable will be created for each SI attitude and the mean of the social competences. Seven variables will be used in the regression analysis, all three Social interdependence attitudes, the mean of three social competences, and all three Social interdependence attitudes * Social competences. Table 24 shows the mean and standard deviation of the newly created variables. Each newly created variable contained one or two outliers, but according to (Field, 2009) due to the large sample (N=182), this will not influence the overall result. The input variables are both standardized, for that reason all distributions peak at zero.

*Table 24 Mean and SD Social interdependence attitude*Social competences*

Social interdependence attitude*Social competences	Mean	SD
Competitive Social interdependence*Social competences	.30	1.54
Individualistic Social interdependence*Social competences	-.04	2.21
Cooperative Social interdependence*Social competences	.42	1.82

³⁸ F=.356; Sig=.785; df=3; N=165 ; r²=.007 r²change=.002 DW=1.878

³⁹ F=4.944; Sig=.003; df=3; N=171 ; r²=.082 r²change=.022 DW=1.969

4.7.2 Results social competences as a moderator for Social interdependence attitude

The research assumptions were met for all regression analysis, except the test that involves "Joining a pig farmer cooperation". The results shown in table 25 till 29 show a positive moderation effect for three of the five regression analysis. All three moderation effects were achieved by the moderator variable Mean social competences*Cooperative social attitude. The moderated variables were related to interaction with other pig farmers. The change in explained variance was only between 3,5% and 5%, but it proves that the degree of social competence has an enhancing effect for the learning activities. Appendix X shows the scatterplots and normal probability plots.

Hypothesis 2c: people with a cooperative attitude combined with a high level of social competence will undertake more learning activities related to other people.

This hypotheses is partly accepted, only for the learning activities that involve other pig farmers there is a moderation effect for the learning activities. The level of social competence has explanatory value in predicting the learning activities that the farmers undertook, but only when other farmers are involved in that learning activity.

Table 25 Regression analysis to test moderator effect for Comparing my practices with other pig farmers in my region ⁴⁰

Predicting variables	Comparing my practices with other pig farmers in my region ⁴⁰		
	B	Std. error	Sig.
(Constant)	3.145**	.065	.000
Competitive Social interdependence attitude	.171**	.064	.009
Individualistic Social interdependence attitude	-.119	.066	.073
Cooperative Social interdependence attitude	.275**	.067	.000
Mean Social competences	-.069	.045	.122
Mean Social competences*SI Competitive attitude	-.077	.044	.083
Mean Social competences*SI Individualistic attitude	-.036	.044	.407
Mean Social competences*SI Cooperative attitude	.105**	.040	.010

Table 26 Regression analysis to test moderator effect for Consulting other pig farmers for personal feedback ⁴¹

Predicting variables	Consulting other pig farmers for personal feedback ⁴¹		
	B	Std. error	Sig.
(Constant)	3.289**	.055	.000
Competitive Social interdependence attitude	.104	.057	.069
Individualistic Social interdependence attitude	-.133*	.057	.021
Cooperative Social interdependence attitude	.366**	.060	.000
Mean Social competences	-.090*	.038	.020
Mean Social competences*SI Competitive attitude	-.031	.038	.417
Mean Social competences*SI Individualistic attitude	.027	.038	.471
Mean Social competences*SI Cooperative attitude	.083*	.035	.018

⁴⁰ F=7.068; Sig=.000; df=7; N=167 ; r²=.236 R²Change=.050 DW=1.987

⁴¹ F=10.174; Sig=.000; df=7; N=170 ; r²=.304 R²Change=.040 DW=2.251

Table 27 Regression analysis to test moderator effect for Consulting an expert to identify new opportunities

Predicting variables	Consulting an expert to identify new opportunities ⁴²		
	B	Std. error	Sig.
(Constant)	3.615**	.061	.000
Competitive Social interdependence attitude	.061	.063	.338
Individualistic Social interdependence attitude	-.106	.061	.085
Cooperative Social interdependence attitude	.329**	.064	.000
Mean Social competences	.026	.041	.526
Mean Social competences*SI Competitive attitude	-.034	.044	.442
Mean Social competences*SI Individualistic attitude	-.059*	.029	.044
Mean Social competences*SI Cooperative attitude	.006	.039	.873

Table 28 Regression analysis to test moderator effect for Exchanging information with pig farmers during informal meetings

Predicting variables	Exchanging information with pig farmers during informal meetings ⁴³		
	B	Std. error	Sig.
(Constant)	3.036**	.067	.000
Competitive Social interdependence attitude	.227**	.068	.001
Individualistic Social interdependence attitude	-.111	.069	.113
Cooperative Social interdependence attitude	.259**	.071	.000
Mean Social competences	-.066	.047	.163
Mean Social competences*SI Competitive attitude	-.039	.047	.406
Mean Social competences*SI Individualistic attitude	.011	.046	.818
Mean Social competences*SI Cooperative attitude	.111*	.043	.011

Table 29 Regression analysis to test moderator effect for Joining a pig farmer cooperation

Predicting variables	Joining a pig farmer cooperation ⁴⁴		
	B	Std. error	Sig.
(Constant)	3.995**	.080	.000
Competitive Social interdependence attitude	-.093	.081	.256
Individualistic Social interdependence attitude	-.036	.082	.661
Cooperative Social interdependence attitude	.141	.088	.111
Mean Social competences	.014	.052	.785
Mean Social competences*SI Competitive attitude	.029	.055	.607
Mean Social competences*SI Individualistic attitude	-.021	.037	.565
Mean Social competences*SI Cooperative attitude	.068	.050	.171

4.8 Trust & learning activities

This will test if trust moderates the relation between learning activities and the performance indicators. The degree of trust in the person or entity related to the learning activity could make the learning activity more effective (D. Johnson & T. Johnson, 2006).

4.8.1 Relation trust and learning activities

Trust is seen as an enhancing variable for Social interdependence. A greater trust among each other would lead to better knowledge transfer. The learning activities will be combined with the trust question that is related to learning activity, to check if the degree of trust influences the effect of learning activities. The five learning activities involved other people

⁴² F=6.531; Sig=.000; df=7; N=175 ; r²=.214 R²Change=.023 DW=1.680

⁴³ F=7.176; Sig=.000; df=7; N=166 ; r²=.240 R²Change=.035 DW=2.217

⁴⁴ F=1.419; Sig=.201; df=7; N=169 ; r²=.058 R²Change=.030 DW=2.071

or entities and could be combined with trust questions, these can be found in table 30. Two questions have more than one related trust question, these will be combined by taking the mean of the relevant trust questions. The researcher has chosen to only test the effect for the technical performance indicator "Piglets per sow per year." Earlier results of the effect of learning activities on performance indicators showed that the learning activities showed similar results for the other indicators.

*Table 30 Learning activities*Trust*

Learning activity	Trust question	Mean	SD
Comparing my practices with other pig farmers in my region	I can fully trust my pig farmer colleagues in my region	9.73	5.03
Consulting other pig farmers for personal feedback	I can fully trust my pig farmer colleagues in my region	10.62	5.16
Consulting an expert to identify new opportunities	The mean of: I can fully trust my feed supplier, I can fully trust my veterinary, I can fully trust my pig buyer, and I can fully trust my extension officer	12.14	4.46
Exchanging information with pig farmers during informal meetings	I can fully trust my pig farmer colleagues in my region	9.53	5.13
Joining a pig farmer cooperation	The mean of: I can fully trust my pig cooperative, and I can fully trust NACF as my farmer organization	14.06	6.39

4.8.2 Results trust and learning activities

The results from table 31 till 25 show all five regression analysis for the relation between the learning activities and piglets per sow per year, with trust as a moderator. Only one regression analysis did not meet the research assumptions, "Exchanging information with pig farmers during informal meetings" did not test significant on the F-test (table 34), the scatterplot was not random, and the Normal P-P plot did not follow the diagonal line well (Appendix XI).

Two models there was a moderation effect for trust. In the models for comparing practices with other pig farmers in my region ($p=.010$, $b=.262$) and Exchange information with pig farmers during informal meetings ($p=.045$, $b=.219$), the combined variables explained more than the two separate predictors. Despite violating the normality of variance assumption, the variable exchange information with pig farmers during informal events was significant. The two learning activities to which trust moderated the variable were both activities that are related to other pig farmers. This might indicate that farmers only share knowledge with farmers that they trust. For the other learning activities, the degree of trust is of less importance.

Hypothesis 3: Trust is a moderator for the effect of the learning activity.

The hypothesis related to trust is partly accepted. The degree of trust does enhance learning activities that involve other pig farmers. For the other learning activities, the degree of trust is of less importance.

Table 31 Regression analysis to test moderator effect for Comparing practices with other pig farmers in my region

Predicting variables	Piglets per sow per year ⁴⁵		
	B	Std. error	Sig
(Constant)	5.541**	1.257	.000
Comparing my practices with other pig farmers in my region	-.600	.372	.108
I can fully trust my pig farmer colleagues in my region	-.691*	.345	.047
Comparing Practices*Trust Pig farmers	.262*	.100	.010

Table 32 Regression analysis to test moderator effect for consulting other pig farmers for personal feedback

Predicting variables	Piglets per sow per year ⁴⁶		
	B	Std. error	Sig
(Constant)	4.247**	51.603	.009
Consulting other pig farmers for personal feedback	-.108	.465	.817
I can fully trust my pig farmer colleagues in my region	-.344	.451	.446
Consulting Other farmers *Trust Pig farmers	.126	.128	.324

Table 33 Regression analysis to test moderator effect for consulting experts to identify new opportunities

Predicting variables	Piglets per sow per year ⁴⁷		
	B	Std. error	Sig
(Constant)	4.680*	2.373	.050
Consulting an expert to identify new opportunities	-.184	.624	.769
Mean Trust Experts	-.754	.693	.278
Consulting Expert*Mean trust experts	.218	.181	.230

Table 34 Regression analysis to test moderator effect for Exchange information with pig farmers during informal meetings

Predicting variables	Piglets per sow per year ⁴⁸		
	B	Std. error	Sig
(Constant)	5.867**	1.265	.000
Exchanging information with pig farmers during informal meetings	-.705	.392	.074
I can fully trust my pig farmer colleagues in my region	-.547	.356	.127
Exchange Info*Trust Pig farmers	.219*	.109	.045

Table 35 Regression analysis to test moderator effect for joining a pig farmer cooperative

Predicting variables	Piglets per sow per year ⁴⁹		
	B	Std. error	Sig
(Constant)	1.736	2.327	.457
Joining a pig farmer cooperation	.316	.589	.592
Trust Cooperative	.417	.634	.512
Joining Cooperative*Trust Cooperative	-.030	.157	.849

⁴⁵ F=7.119; Sig=.000; df=3; N=169 ; r²=.114 r²change=.036 DW=1.861

⁴⁶ F=4.485; Sig=.005; df=3; N=172 ; r²=.074 r²change=.005 DW=1.989

⁴⁷ F=11.469; Sig=.000; df=3; N=178 ; r²=.165 r²change=.007 DW=1.989

⁴⁸ F=1.994; Sig=.117; df=3; N=168 ; r²=.035 r²change=.024 DW=1.819

⁴⁹ F=4.180; Sig=.007; df=3; N=171 ; r²=.069 r²change=.000 DW=1.902

5. Conclusion

This study tried to find the answer to the question: *'To what extent do specific personal characteristics and learning activities explain farm performance?'* A quantitative study is used to study the effects of social competences, social interdependence attitudes and learning activities on farm performances of South Korean pig farmers.

Grouping the farmers based on their social interdependence attitude does not explain differences in farm performance. Splitting the farmers into three groups results in a group of farmers high in cooperative and competitive attitudes, one that is undefined, and one individualistic oriented group. Grouping the farmers does have explanatory value for the degree farmers undertook learning activities. The cooperative/competitive oriented cluster scores were higher on almost all learning activities, especially the cooperative learning activities that involve other farmers.

Based on the results the scores for social interdependence attitude of a person can explain differences between the degree of which learning activities are undertaken. When looking towards the attitudes, it can be concluded that the respondents that evaluated themselves with a high score on a cooperative social interdependence attitude scored higher for the degree they undertook learning activities. The effect was the most evident for learning activities that involve other people, which are considered to be cooperative learning activities. The respondents that evaluated themselves with a high score on a competitive social interdependence scored also undertook more learning activities. A high score for individualistic attitude did not show any significant positive relations, and it even contributed negatively to a learning activity. The individualistic attitude had a non-significant negative predictive value for all activities that involve other farmers. Social interdependence attitude has, therefore, an influence on the degree to which farmers undertake learning activities. A cooperative attitude can be linked with learning activities that involve other farmers.

The relation between the learning activities and performance indicators shows that only one predictor improves the performance of the farmers significantly. Consulting an expert to identify new opportunities was a significant positive contributor to all three performance indicators. There are significant regional differences between the technical farm performances, the regions that had a higher average farm size performed better.

The degree of trust is a positive enhancing factor when farmers undertake learning activities that involve other farmers. When taking trust into account, the performance of the farms is better predicted. For other learning activities, the degree of trust was of less importance.

This study found no evidence that social competences are directly related to higher farm performance. The social competences have no moderating value for the learning activities in relation to performance. However, the social competences have explanatory value when these are combined with the social interdependence attitudes of the farmers. The social competences improve the predicted undertook learning activities, especially for the activities that involve other farmers. A farmer who is socially competent and who has a cooperative attitude will undertake more learning activities that involve other pig farmers.

This quantitative research has shown that social interdependence attitude can explain the learning activities that a farmer undertakes. A farmer with a high cooperative social interdependence attitude will undertake more activities with other farmers. Trust and the level of social competence will enhance the relationship between social interdependence attitude and cooperative learning activities. The region in which the farmer is located, has only minor influence on these cooperative learning activities. Consulting an expert is the only activity that is directly linked to higher farm performance. A high involvement in learning activities, in general, does translate one-on-one to higher farm performance but can be linked to bigger farms.

6. Discussion

This study tried to contribute to the understanding of learning of small farms, by quantifying the role of specific personal characteristics on (cooperative) learning activities and farm performance. To achieve this goal a qualitative study is performed on a dataset of 199 South Korean pig farmers.

This research used the social interdependence scales of David W Johnson and Norem-Hebeisen (1979), that were adapted for pig farmers by Thomas Lans et al. (2017). This adapted measurement instrument for social interdependence attitudes will need some further changes because three variables of the 21 variables did not fit the data sample. After rejecting these variables, the factors had a substantial internal consistency which could be prove that these adapted scales could be used to analyse farmers. Based on the results of these tests for internal validity, it could be said that these results are valid.

The research also validated three social competences. Two of the three tested social competences did not show good internal consistency. Only the social competence "self-Promotion" proved to be a good fit for the data sample. For the other two social competences "social perception" and "social learning orientation" the questions should be revised or adapted for pig farmers. Due to the problems with internal consistency it is unlikely that the results related to social competence are repeatable for the population.

The results show that there is a relation between social interdependence attitude and learning activities but that this relation does not result in higher farm performance. The method used to group the farmers only took the social interdependence attitude into account. The groups show similarities to the three style metaphors as used by M. A. M. Commandeur (2006). The first group looks like the Entrepreneur, which has a broad view, is active in learning, and tries to expand his business. The second cluster as the Stockman, which does not have a desire to improve. The third can be seen as the Craftsman which focuses on optimizing the performance of his herd. The difference in focus of the farmers could explain why there are no direct relations with performance. This is supported by the differences in farm size, the cooperative/competitive group has a significant bigger farm.

The relation between the social interdependence attitudes and (cooperative) learning activities can be explained by social interdependence theory. A cooperative attitude towards other farmers results in positive goal interdependence, and farmers will not consider each other as an obstruct in achieving their goal (Grisham, 1991). This positive goal interdependence will cause farmers to cooperate, because they need each other to achieve their goals.

Only one learning activity contributes to the farmers performance indicators. Experts are the only significant positive predictor for the performance indicators. The importance of experts was expected, the research of Sue Kilpatrick and Johns (2003) showed that experts are considered as a source of information. The reason that experts contribute to the learning of farmers could be due to the fact that the experts have a wide frame of reference. This would support the transformative learning theory as defined by Mezirow (1997). The experts visit a lot of different farms and could spread the best practices and help the farmers to make better decisions. The fact that the activities in which farmers

learn from each other does not show a significant positive result could also be explained by the transformative learning theory. That states that the learners need practice in recognizing frames of reference and using their imaginations to redefine problems from a different perspective. The learners also need to be assisted to participate effectively in discourse (Mezirow, 1997). This could mean that the farmers need training in sharing their knowledge with other farmers.

Trust and social competence enhance the cooperative learning activities. These are related to the five basic elements of social interdependence. The group members must be socially skilled to cooperate effectively (David W Johnson & Johnson, 2009) and for promotive interaction the participants must act in a trustworthy way (Deutsch, 1962). The trust and social competence did not moderate for the other learning activities. This once more implicates that if farmers need to cooperate, it is essential to create mutual trust among the farmers and a decent level of social competence.

The region in which the farmer is active proves to be an important indicator for the technical performance of the farm. This supports the theory of M. A. M. Commandeur (2006) that farmers are influenced by the space of information in which farmers operate. This space is influenced by three features; The techno-ecological features, economic infrastructures, and institutional infrastructures. Farmers could be supported by creating a better environment for the farmers in which these features are improved.

6.1 Limitations

This research was reliant on a third party for the collection of data. This brings in several insecurities. At first the researcher cannot be certain that the questions are meticulously filled in to spot the differences between the questions. Even though the survey was translated back-and-forth, and an instruction manual was provided, it is sensitive for sloppiness. A bias towards farms that give a misrepresentation is also a risk that is involved by sourcing out the data collection to representatives of the farmers' cooperatives, these could i.e. select only the best performing farmers of their region. The researcher checked for these limitations by cross validating the constructs by using a PCA analysis, and checked the data on outliers.

The performance questions could be broader and aimed at different parts of the farm. As well as a gradation in the usage of learning sources could give more insights in how farmers use these learning sources. The indicators used in the research only tell a piece of the story, despite being the best general technical performance indicators, there could still be a lot of variance between the show and actual performance. M. A. M. Commandeur (2006) shows that the farmer could have different priorities and gain profit on different factors. Generalizing based on these three performance indicators to other farms, other sectors or countries will be difficult. The indicators piglets per sow per year, and marketed piglets per sow per year are the best available indicators, still it is unknown if they are measured properly by the South Korean farmers. The indicator about animal disease knowledge is focused on one specific part of the knowledge of pig farming, i.e. different employees could be responsible for the care of the sows and then this knowledge would still be available on the farm.

The research involved little to none information about the actual South Korean farmers, or even about the South Korean culture. This is a serious limitation to the generalization of the research, because it is unknown what the normal behaviour of the South Koreans is. This makes it harder to compare results from similar research reports from other countries. The research does include information about the descriptive of the dataset, but there is too little information if this research is a good representation of the South Korean farmers.

The social competences have been computed into one variable. This made sense because all three social competences involved interaction with other people. But only one variable showed a good internal validity that was also completely validated in other research performed by experienced researchers. For that reason it cannot be said with confidence that none of the three social competences influence the learning activities, or performance.

6.2 Suggestions for further research

The research was performed in South Korea, it is unknown how the results will translate to other countries and cultures. Despite the little information about the South Korean farmers the researcher suggest to test the social interdependence scales developed for farmers by Thomas Lans et al. (2017) to see if these farmers show similar behaviour. If the research performed in a different culture shows similar results in regard of preferences for learning activities by people with a cooperative attitudes, it could be suggested to offer cooperative oriented farmers different learning activities. Research in different countries could also be useful to recognize a pattern among farmers, i.e. the bigger farmers might be more cooperative oriented.

A number of continuation studies could be performed on this group of farmers:

- This research was a one-moment record of the farmers. Now the social interdependence attitudes are measured it would be interesting to see how the farmers further develop. The same research could be performed in several years on the same farmers to analyse developments of farmers and to see the actual impact of social interdependence attitudes.
- This could also be a more qualitative longitudinal study on a small number of farmers (i.e. $n=40$). Two groups taken from the cooperative/competitive cluster and the individualistic cluster could give a better representation of the effect of the social interdependence attitudes.
- The possibility to make interventions to see in-group differences is a possibility as well. One of the reasons that could explain why cooperative learning activities did not result in higher farm performance is that the farmers need to practice to share knowledge. Supporting groups of farmers with sharing knowledge and compare these to other groups of farmers could enhance the theory.

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Appendix

Appendix I: Control variables

This appendix shows the distributions of skewed control variables.

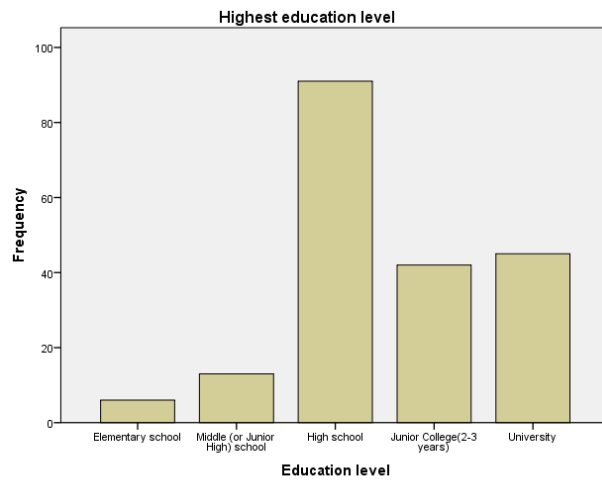


Figure 13 Distribution education level

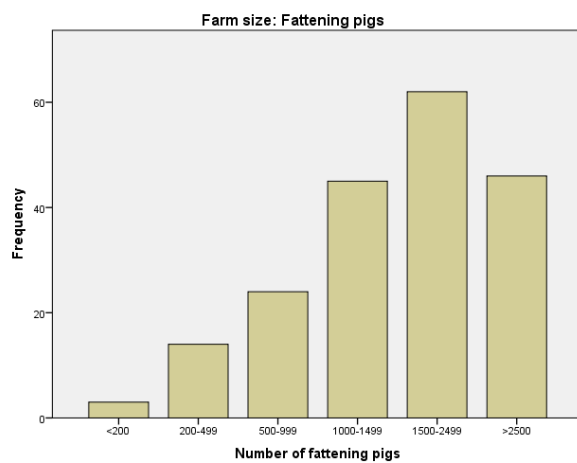


Figure 14 Number of fattening pigs

Appendix II: Social interdependence scales

The original Social interdependence scales and the adapted questions for pig farmers.

Original Social interdependence scales Source: (David W Johnson & Norem-Hebeisen, 1979)

Social Interdependence Scales

a. Cooperative Interdependence.

(1). Liking to cooperate.

I like to help other students learn.

I like to share my ideas and materials with other students.

I like to cooperate with other students.

(2). Valuing cooperative learning.

I can learn important things from other students.

I try to share my ideas and materials with other students when I think it will help them.

Students learn lots of important things from each other.

It is a good idea for students to help each other learn.

b. Competitive Interdependence.

(1). Liking to compete.

I like to do better work than other students.

I work to get better grades than other students do.

I like to be the best student in the class.

I don't like to be second.

(2). Valuing competitive learning.

I like to compete with other students to see who can do the best work.

I am happiest when I am competing with other students.

I like the challenge of seeing who is best.

Competing with other students is a good way to work.

c. Individualistic Independence.

(1). Liking to study alone.

I don't like working with other students in school.

I like to work with other students. (reverse)

It bothers me when I have to work with other students.

(2). Valuing individualistic learning.

I do better work when I work alone.

I like work better when I do it all myself.

I would rather work on school work alone than with other students.

Working in small groups is better than working alone. (reverse)

The social interdependence scales for pig farmers (T Lans et al., 2017). The numbers behind every question of the first table have been added to show how the questions were mixed in the survey.

a. Cooperative interdependence

(1) Liking to cooperate

1. I try to share my ideas and equipment with other pig farmers when I think it will help them. (34.2)
2. I like to work with other pig farmers. (34.11)
3. I like to help other pig farmers to improve. (34.16)

(2) Valuing cooperative learning

1. It is a good idea for pig farmers to help each other improve. (34.9)
2. Pig farmers learn lots of things from each other. (34.10)
3. I can learn important things from other pig farmers. (34.14)
4. I like to share my ideas and equipment with other pig farmers. (34.18)

b. Competitive interdependence

(1) Liking to compete

1. I don't like to be second (34.7)
2. I work to get better business results than other pig farmers (34.17)
3. I like to perform better than other pig farmers (34.19)
4. Competing with other pig farmers is a good way to work. (34.20)

(2) Valuing competitive learning

1. I like to compete with other pig farmers to see who can perform the best (34.3)
2. I like to be the best performing pig farmer of my region (34.6)
3. I like the challenge of seeing who is best (34.12)
4. I am the happiest when I am competing with other pig farmers (34.13)

c. Individualistic interdependence

(1) Liking to work alone

1. It bothers me when I have to work with other pig farmers. (34.1)
2. I don't like working with other pig farmers. (34.5)

(2) Valuing learning alone

1. I like my work better when I do it all myself. (34.4)
2. Working in small groups is better than working alone. (34.8)
3. I would rather work on my pig farm alone than with staff or other pig farmers. (34.15)
4. I do better work when I work alone. (34.21)

Appendix III: SIS before rejection of variables

Table 36 Summary of factor analysis results for Social interdependence scales (N=193)

Item	Pattern matrix		
Cooperative attitude	Individualistic	Competitive	Cooperative
1. I try to share my ideas and equipment with other pig farmers when I think it will help them.	0.626	0.237	0.127
2. It is a good idea for pig farmers to help each other improve.	0.027	-0.01	0.672
3. Pig farmers learn lots of things from each other.	0.25	-0.065	0.598
4. I like to work with other pig farmers.	0.551	0.152	0.291
5. I can learn important things from other pig farmers.	0.194	-0.046	0.557
6. I like to help other pig farmers to improve.	-0.152	0.037	0.698
7. I like to share my ideas and equipment with other pig farmers.	-0.099	0.201	0.539
Competitive attitude			
1. I like to compete with other pig farmers to see who can perform the best	0.099	0.514	0.247
2. I like to be the best performing pig farmer of my region	-0.004	0.725	0.049
3. I don't like to be second	-0.052	0.726	-0.108
4. I like the challenge of seeing who is best	0.107	0.755	-0.157
5. I am the happiest when I am competing with other pig farmers	0.163	0.796	-0.131
6. I work to get better business results than other pig farmers	-0.05	0.471	0.319
7. I like to perform better than other pig farmers	-0.351	0.478	0.334
8. Competing with other pig farmers is a good way to work.	0.169	0.67	0.063
Individualistic attitude			
1. It bothers me when I have to work with other pig farmers.	-0.52	0.052	-0.212
2. I like my work better when I do it all myself.	-0.79	-0.172	0.136
3. I don't like working with other pig farmers.	-0.561	-0.031	0.042
4. Working in small groups is better than working alone.	-0.314	0.121	-0.395
5. I would rather work on my pig farm alone than with staff or other pig farmers.	-0.807	-0.068	0.105
6. I do better work when I work alone.	-0.75	0.092	-0.091
Eigenvalue	5.33	2.85	1.89
% of variance	25.37%	13.59%	9.02%
Cronbach's Alpha	0.71	0.82	0.75

Note: Factor loadings over .40 appear in bold

Appendix IV: Social competences before rejection of variables

Table 37 Summary of factor analysis results for Social competences (N=193)

Item	Components		
	1	2	3
Social perception (Robert A. Baron & Markman, 2003; Lans et al., 2016)			
1. I am a good judge of other people*	0.702	-0.260	0.095
2. I know where to find relevant information	0.259	-0.180	0.721
3. I can usually recognize others' traits accurately by observing their behaviour*	0.763	-0.228	0.307
4. I can easily assess the wishes of others in my audience	0.769	-0.141	0.310
5. I have a clear idea about how my enterprise performs in relation to other enterprises in the sector	0.199	-0.473	0.529
6. I can tell why people have acted the way they have in most situations*	0.523	-0.287	0.522
7. I generally know when it is the right time to ask someone for a favour*	0.225	-0.591	0.308
Self-promotion (Robert A. Baron & Tang, 2009)			
1. I make people aware of my accomplishments*	0.423	-0.694	0.077
2. I let others know that I have a reputation for being competent in a particular area*	0.485	-0.443	0.399
3. I make other people aware of my talents or qualifications*	0.334	-0.738	0.106
4. I talk proudly about my experience or education*	0.071	-0.781	0.158
Social learning orientation (Lans et al., 2016)			
1. I am very aware of my own strong and weak points	0.302	-0.218	0.424
2. I am open to criticism from others (colleagues, employees, etc.)	0.332	-0.053	0.462
3. I am open to suggestions of others	0.047	-0.226	0.750

Appendix V: Correlations table

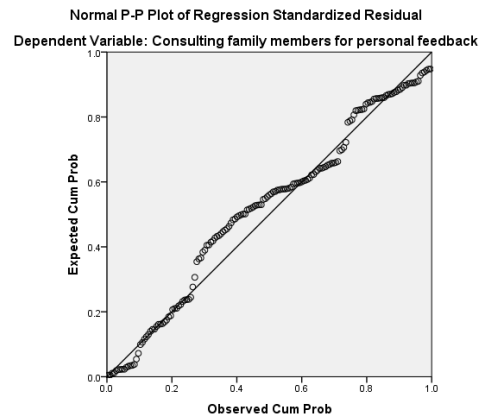
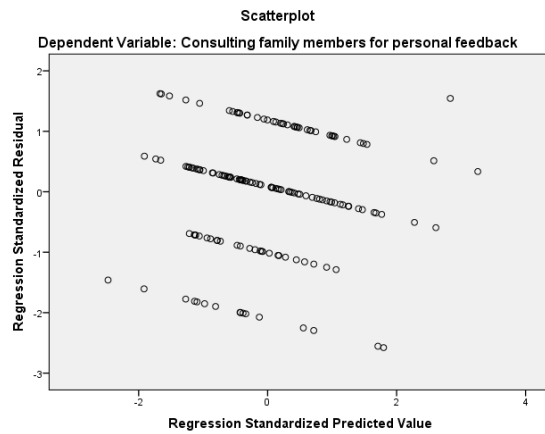
Correlations	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Age	4.86	1.06																			
2. Education level	3.54	1.01	-.59**																		
3. Number of sows	4.1	1.31	-.15*	.16*																	
4. Number of fattening pigs	4.48	1.26	-.15*	.16*	.65**																
5. Competitive	.00	1.00	.01	-0.1	.22**	.03															
6. Individualistic	.00	1.00	.11	-.17*	-.20**	-.11	-.07														
7. Cooperative	.00	1.00	-.05	.14	.21**	.10	.24**	-.15*													
8. Mean social competences	.00	1.60	.05	.01	-.06	-.07	.19*	-.03	.27**												
9. Comparing my practices with other pig farmers in my region	2.90	1.20	.01	.05	.06	.00	.27**	-.19*	.31**	.05											
10. Consulting other pig farmers for personal feedback	3.09	1.13	.03	.081	.15*	.12	.25**	-.24**	.49**	.01	.59**										
11. Consulting family members for personal feedback	2.54	1.33	.13	-.14*	.00	-.11	.19*	-.02	.15	.02	.26**	.17*									
12. Consulting an expert to identify new opportunities	3.46	1.08	-.08	.17*	.29**	.20**	.20**	-.17*	.42**	.11	.32**	.39**	.20**								
13. Experimenting by doing things differently	1.53	1.60	-.28**	.32**	.29**	.08	.27**	-.11	.26**	.13	.24**	.17*	.18**	.27**							
14. Attending a course/training	3.15	1.17	-.06	.06	.19**	.08	.33**	-.07	.21**	.14	.39**	.39**	.19**	.28**	.27**						
15. Looking for information in agricultural magazines, in books, or on the internet	3.20	1.02	-.12	.27**	.23**	.12	.25**	-.07	.32**	.18*	.29**	.23**	0.11	.46**	.36**	.42**					
16. Exchanging information with pig farmers during informal meetings	2.81	1.23	-.04	.07	.02	-.02	.35**	-.17*	.37**	.04	.45**	.43**	0.11	.28**	.10	.35**	.25**				
17. Joining a pig farmer cooperation	3.70	1.44	.21**	.00	-.03	.12	-.01	-.03	.18*	.07	.19**	.31**	.05	.27**	-.16*	.19**	.13	.29**			
18. PSY	4.11	1.25	-.03	.15*	.24**	.38**	.06	-.04	.14	.05	.09	.18*	.07	.28**	-.14	.07	.13	.05	.11		
19. MSY	2.98	1.13	.00	.08	.23**	.30**	.09	.06	.10	-.04	.16	.14	.07	.28**	-.00	.10	.21**	.06	.04	.72**	
20. Score Disease And Treatment	18.21	2.01	-.03	-.03	-.04	.15*	-.04	.08	.09	-.01	-.09	.00	-.02	.14	-.26**	-.15	-.03	.10	.20**	.19*	.22**

** Correlation is significant at the 0.01 level (2-tailed).

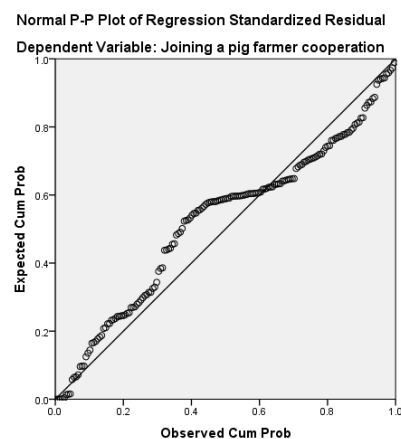
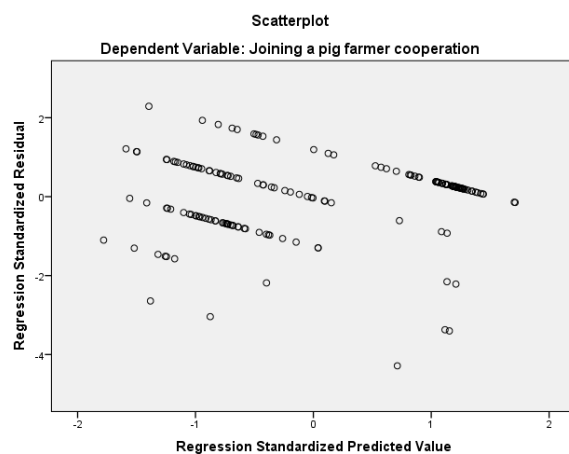
* Correlation is significant at the 0.05 level (2-tailed).

Appendix VI: Social interdependence attitudes on learning activities (4.2)

Model 3: Consulting family members for personal feedback⁵⁰



Model 9: Joining a pig farmer cooperation⁵¹

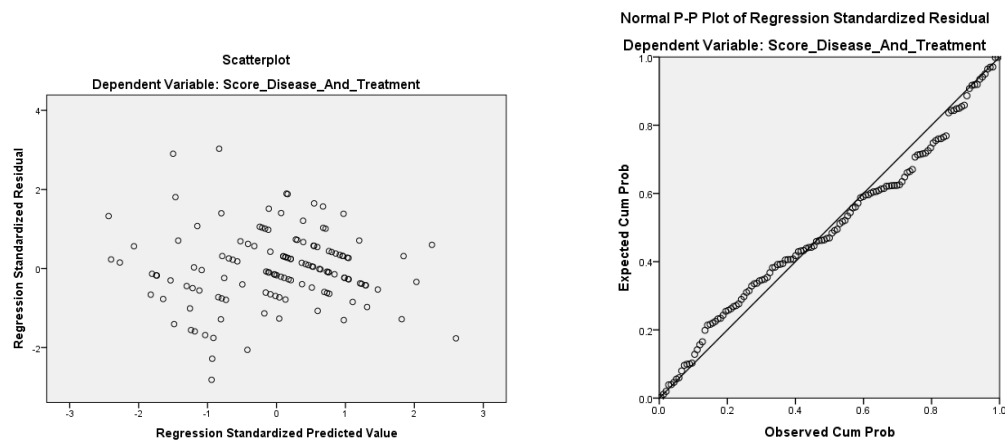


⁵⁰ $F=1.563$; $Sig=.150$; $df=7$; $N=160$; $r^2=.067$ r^2 change=.019 $DW=1.937$

⁵¹ $F=15.118$; $Sig=.000$; $df=7$; $N=172$; $r^2=.365$ r^2 change=.356 $DW=2.081$

Appendix VII: Relation learning activities and performance indicators (4.4)

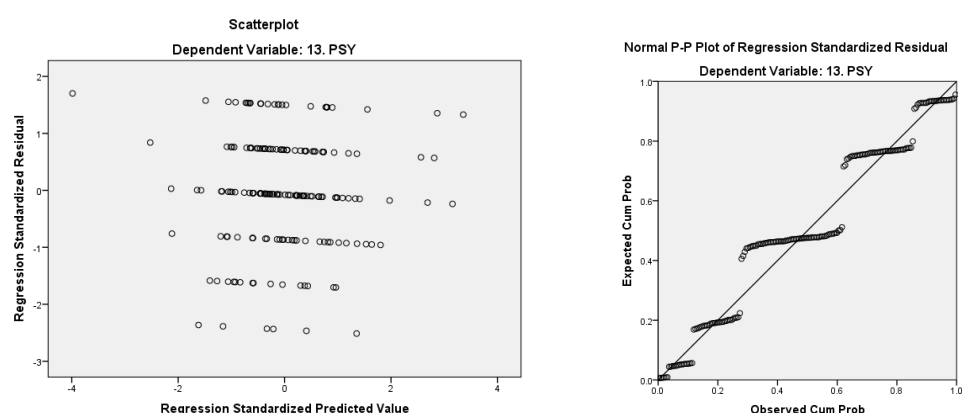
Animal disease and health knowledge score⁵²



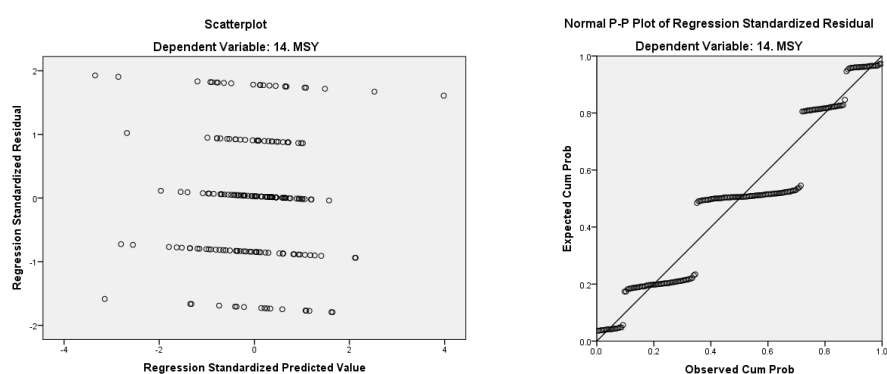
⁵² $F=2.268$; $Sig=.008$; $df=15$; $N=130$; $r^2=.228$ $r^2\text{change}=.158$ $DW=1.909$

Appendix VIII: Social competences and performance indicators (4.5)

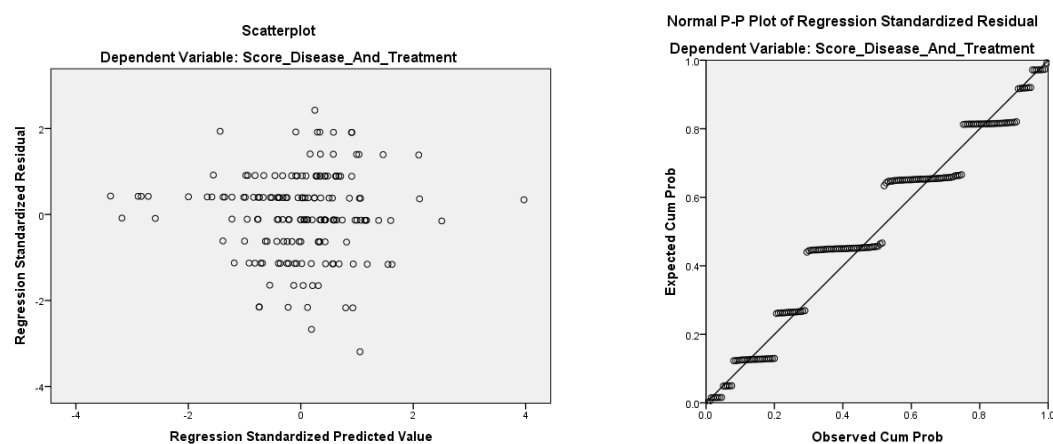
Regression analysis to test the combined social competences as predictor for Piglets per sow per year⁵³



Regression analysis to test the combined social competences as predictor for Marketed piglets per sow per year⁵⁴



Regression analysis to test the combined social competences as predictor for Score animal disease and health knowledge⁵⁵



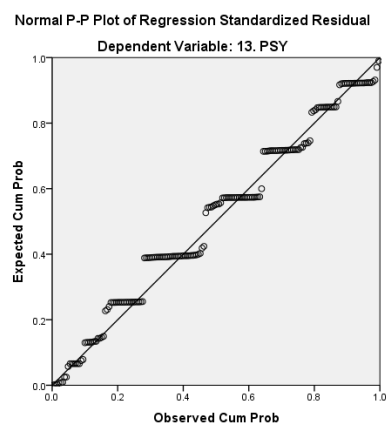
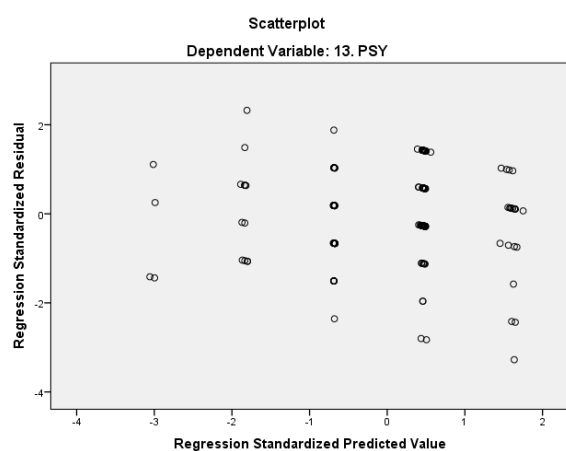
⁵³ $F=.462$; $Sig=.498$; $df=1$; $N=180$; $r^2=.003$ DW 2.032

⁵⁴ $F=.339$; $Sig=.561$; $df=1$; $N=180$; $r^2=.002$ DW 2.186

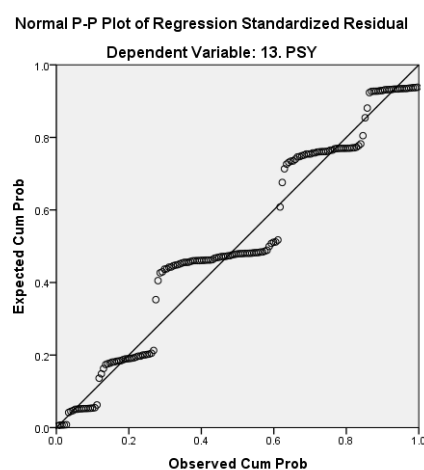
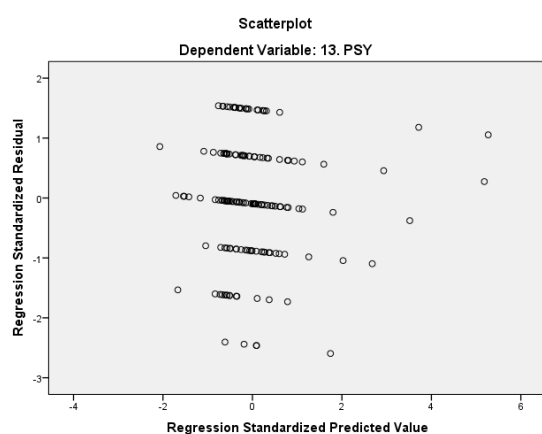
⁵⁵ $F=.023$; $Sig=.879$; $df=1$; $N=167$; $r^2=.000$ DW 1.979

Appendix IX: Social competence as a moderator for learning activity (4.6)

Regression analysis to test moderator for Consulting an expert to identify new opportunities⁵⁶



Regression analysis to test moderator for Exchanging information with pig farmers during informal meetings⁵⁷

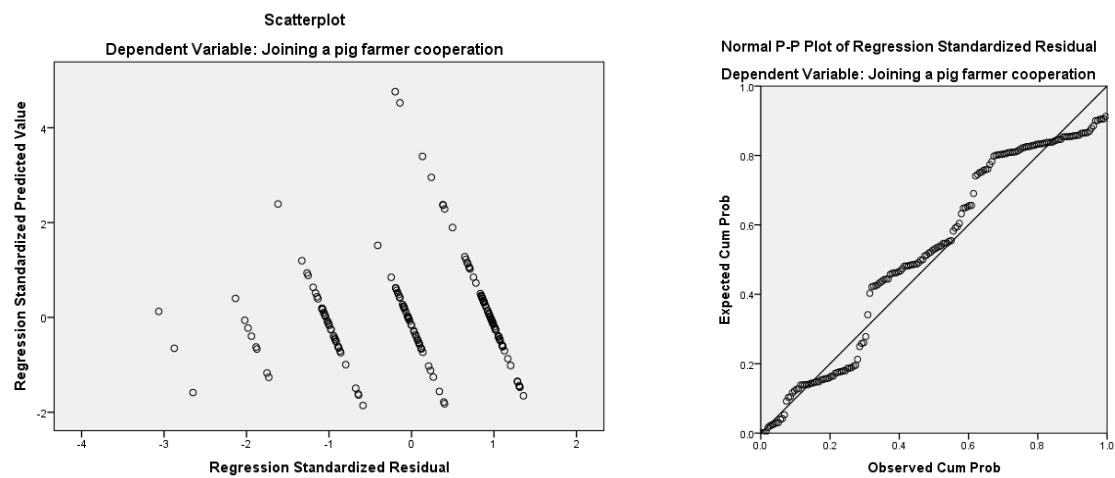


⁵⁶ $F=9.183$; $Sig=.000$; $df=3$; $N=175$; $r^2=.123$ $r^2\text{change}=.000$ $DW=2.103$

⁵⁷ $F=.356$; $Sig=.785$; $df=3$; $N=165$; $r^2=.007$ $r^2\text{change}=.002$ $DW=1.878$

Appendix X: Social competence as a moderator for Social interdependence attitude (4.7)

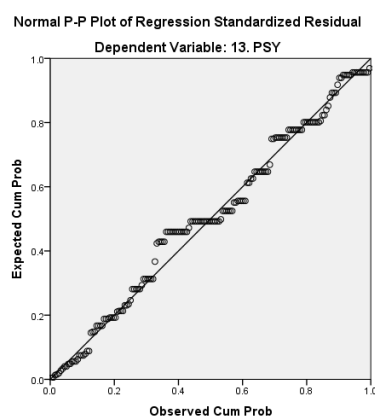
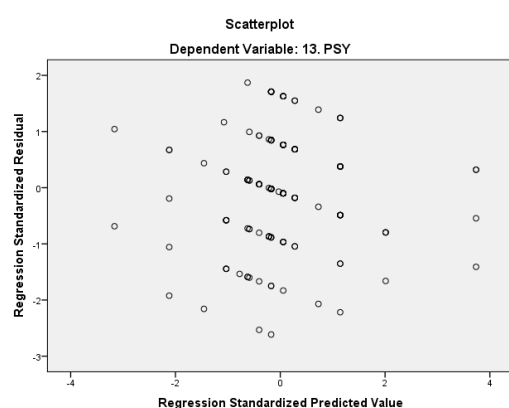
Regression analysis to test moderator for Joining a pig farmer cooperation⁵⁸



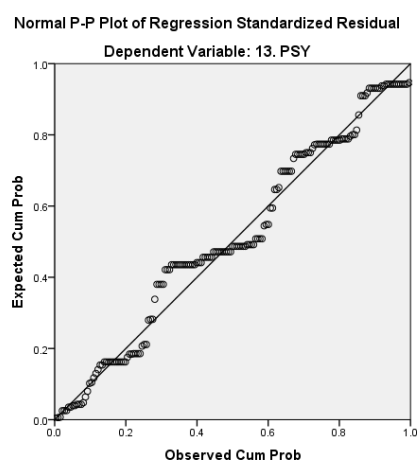
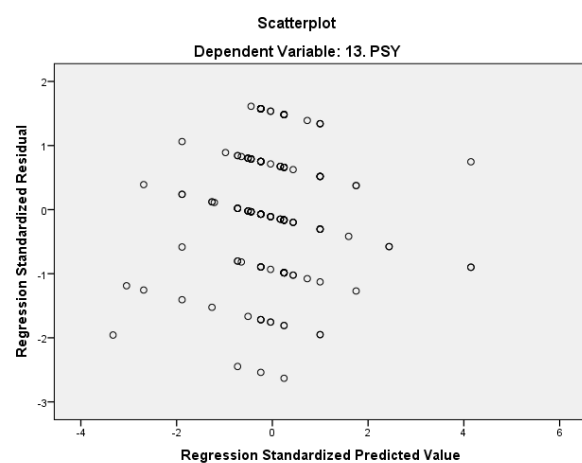
⁵⁸ $F=1.419$; $Sig=.201$; $df=7$; $N=169$; $r^2=.058$ $R^2Change=.030$ $DW=2.071$

Appendix XI: Trust and learning activities on performance (4.8)

Regression analysis to test moderator for comparing practices with other pig farmers in my region⁵⁹



Regression analysis to test moderator for Exchange information with pig farmers during informal meetings⁶⁰



⁵⁹ $F=7.119$; $Sig=.000$; $df=3$; $N=169$; $r^2=.114$ $r^2\text{change}=.036$ $DW=1.861$

⁶⁰ $F=1.994$; $Sig=.117$; $df=3$; $N=168$; $r^2=.035$ $r^2\text{change}=.024$ $DW=1.819$