## CHAPTER 3 CONCEPTUAL FRAMEWORK

The conceptual framework for this research bases on the problem of information asymmetry in markets as first mentioned in the new institutional economic model. Several studies have identified information asymmetry as a severe issue in the agricultural sector. Market information asymmetry, in particular, has been the research topic of many studies in the field of information and communication technologies. Thereby the studies focused on the role of the farmer and the adverse consequences due to the lack of access to relevant on-time information and knowledge.

In a perfect market, following the neoclassical economic model, individuals make rational choices, maximise their utility, while firms maximise their profit and information is freely available to everyone. Although all of the assumptions of the neoclassical theory provide solutions and explanations to research questions and problems, the theory often misses analysing real world scenarios. As a result, researchers have focused on explaining real world observation. In the case of information asymmetry, the first significant contributions were made by Akerlof, Spence and Stiglitz who later received the Nobel Prize in Economics for their pioneer work.

George A. Akerlof was the first who addressed the concept of asymmetric information in his paper "The Market for Lemons", in which he explained the construct of information asymmetry using the automobile market in the United States of America (Auronen, 2003, p. 7). According to him, buyers of cars use some form of information to judge the value of automobiles, while the seller has accurate information about the product and therefore an advantage over the buyer. Akerlof argues that sellers will use this advantage to overprice cars with a lower quality resulting in an overall drop in quality and the disappearance of other sellers for high-quality products. As a solution, he sees market institutions controlling the market to some extent such as guarantees for cars (Akerlof, 1970).

Spence follows the idea of Akerlof by using the job market as an example developing the concept of signalling. Therefore he separates the market into two groups, a smaller group which can build a reputation as signallers and a larger group which changes frequently. The focus of his paper from 1973 lies thereby on the smaller group. He asks the question, how a company can overcome the uncertainties aligned with hiring employees. According to him, the company has difficulties to see the productive capabilities before and even shortly after hiring a new employee as it takes time to train him. Therefore he argues those decisions base on an information asymmetry where the hiring employer has certain disadvantages and has to make investment decisions under uncertainties. The solution to this problem Spence sees in a form of signalling the productive capacities to the employer before to overcome the information asymmetry. Thereby the job applicant provides certain signals, such as educational level, to the employer to improve his change of employment and a higher wage. Based on the signal, the employer will hire him and adjust the wage. According to Spence, this results over time in an information equilibrium. (Auronen, 2003, p. 10; Spence, 1981).

The last pioneer in the research of information asymmetry, Joseph Stiglitz, analysed the aspect of information asymmetry by developing the theory of screening. His argument bases on the assumption that products or individuals are significantly different regarding their qualities or characteristics. According to him, the identification of these features or qualities can be achieved by screening. Therefore he uses a simple example narrowing the individuals down to one characteristic which is directly related to the person's productivity. In a situation without screening everyone will get a wage correlated with the mean productivity. However, Stiglitz argues that individuals with a higher productivity have incentives to be identified to receive a wage above the average productivity. Only under screening, he states, individuals can be matched with suitable groups and jobs which would result in social returns. One of the screenings he proposes in his paper is based on the educational level. In general, the idea of signalling and screening are similar and complement each other (Auronen, 2003, pp. 13–14; Stiglitz, 1975).

In one line with the research on information asymmetry in markets the principalagent-problem, also called the theory of agency or agency dilemma, was developed. One of the most cited papers dealing with this problem was published by Jensen and Meckling (1976). In a broad context, the principal-agent-problem arises when one individual, group or company, the principal, hires or interacts with another one, the agent, without having the same level of information or the ability to observe the actions of the agent (Vestergaard, 2010). Agency theory thereby tries to solve two problems that can occur in this relationship. Both actors have conflicting desires or goals and it is hard or cost intensive for the principal to verify the actions of the agent or both parties have different attitudes toward risk resulting in contrasting actions (Eisenhardt, 1989, p. 58). This can result either in moral hazard or adverse selection.

Following Eisenhardt (1989) moral hazard refers to the poor effort from the agent. It implies that the agent does no act in the agreed effort and is shirking. As an example Eisenhardt refers to a research scientist in a firm that works on a personal project during work and the management cannot confirm what he is doing (Eisenhardt, 1989, p. 61). Adverse selection, on the other hand, refers to the inability of the principal to confirm or interpret certain statements of the agent, for example about his skills or abilities. Eisenhardt (1989) again uses a scientist to illustrate the idea of adverse selection. In this case, the scientist claims to have certain experiences or knowledge which the employer cannot verify (Eisenhardt, 1989, p. 61).

In both of the cases, moral hazard or adverse selection, the principal has two options to solve the problem. Firstly he can try to overcome the issue of the unobservable by investing in information and thereby revealing the agent's intentions and actions. The second possibility is to establish a contract based on the outcomes of the agent's actions and behaviour (Eisenhardt, 1989, p. 61). The principal-agent-problem is in many ways similar to the theory of transaction costs, which is often used in the context of ICTs and agriculture. In the agency theory, information is treated as a commodity which is related to costs and can be purchased.

Transaction costs are a fundamental component of the new institutional economy and have been widely discussed in all sectors and under various circumstances. A comprehensive survey of the application of transaction cost theory in agriculture is provided by Cuevas (2014). In his paper, he cites Masten (2000) who stated that "agricultural transactions provide a rich area for application and refinement of transaction cost theory" (Cuevas, 2014, p. 27). Numerous studies have already highlighted that transaction costs can prevent farmers, particularly small-scale farmers, from entering markets and increase productivity and efficiency. Cuevas (2014) provides a good overview of the development of the transaction cost theory and its definition in the agricultural sector over time, referring, among others, to Eggertsson (1990) who sees the origin of transaction cost from four activities:

(1) searching for information about potential contracting parties and the price and quality of the resources in which they have property rights (includes personal time, travel expense, and communication costs)

(2) bargaining to find the actual position of contracting parties, especially when prices (including wages and interest rates) are not determined exogenously

(3) making contracts (formal or informal)—that is, defining the terms of the contract

(4) enforcing the contract and collection of damages when partners fail to observe their contractual obligations (Cuevas, 2014, p. 28)

Transaction costs can thereby originate at both sides of the farmer, the input side and the output side. They can significantly affect the market participation of farmers but also the use of inputs as well as the level of mechanisation (Cuevas, 2014, p. 33, 2014, p. 30)

In the context of agriculture, small-scale farmers are mostly seen as the most disadvantaged due to information asymmetry. Following the literature, due to the limited access to relevant and timely information, small-scale farmers have a weaker position in the value chain, less marketing possibilities or are exploited by other actors (Adegbidi, 2012; Baumüller, 2015; Okello et al., 2014; Patkar et al., 2012). Furthermore missing knowledge inhibits the adoption of more sustainable practices and can limit the productivity and efficiency of farmers (Ali & Kumar, 2011; Anoop et al., 2015; The World Bank Group, 2011). Overcoming the barriers is, therefore, a fundamental

contribution of information and communication technologies in agriculture (Aker, 2008, p. 1; Singh, 2006, p. 5; The World Bank Group, 2016b, pp. 9–10).

This conceptual framework (Figure 10) follows the idea of information asymmetry and the use of ICTs. It builds on the principal-agent-problem and the transaction cost theory, which are both dealing with information asymmetry but focusing on different aspects. The framework takes into account two sides a farmer has to face. On the one hand, farmers are provided with inputs from certain sources (Input Markets), and on the other side they have certain channels to sell and distribute their products to (Output Markets). Thereby they are always motivated by self-interest to improve their situation, same as the actors in the input as well as output markets. However, the information and knowledge of the farmer are often limited compared to the other stakeholders. Although, farmers in general are guided by self-interest there are certain barriers which prevent them from obtaining more or better knowledge and information. Either both are not available to them, or the acquisition involves costs they cannot bear. As a result, other actors, with more knowledge and information, are in a better situation compared to the farmer and can benefit from the situation following their self-interest. This situation can lead to moral hazard and adverse selection following the principle-agent-problem which the farmer cannot prevent due to high transaction costs.





Source: Own illustration

In this framework ICT based agricultural extension provides a solution to the problem of information asymmetry by improving farmer's position in the agricultural value chain. In more detail, the conceptual framework of this research focuses on the "Farmer Info" smartphone application and its impact on the farmer's level of information and knowledge. The framework thereby implies that ICT-based agricultural extension services will help to improve the farmer's access to knowledge and information by reducing or eliminating transaction costs aligned with the process. As a result, the farmer's bargaining and marketing power, as well as their agricultural sustainability, productivity and efficiency, will be improved. Consequently, the farmer's position in the value chain is strengthened, and they can achieve higher incomes as a result of higher selling prices and reduce the use of chemical inputs due to more sustainable and better inputs. In the end, this should lead to more efficient markets (Parker, Ramdas, & Savva, 2016, p. 1).



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