Gaming to gain insight in pork farmers' innovation behaviour

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INTRODUCTION

Economic pressure and societal criticism are the two main developments that drive innovation behaviour in the pork sector. Added-value markets have been proposed as a promising way forward to tackle sustainability issues in the pork sector (e.g.. animal welfare, public health, landscape quality, and environment) while at the same time considering economic viability of farms (Greef & Casabianca 2009). Added-value markets differ in their ideology and their focus on sustainability indicators. Pork farmer strategic decision-making and their reaction to changes in their environment, e.g. whether to change markets, increase farm size, or do nothing, is influenced by several factors, which can be dynamic and time-dependent. Farmers are influenced by for example, the behaviour of other farmers, and previous investment decisions, and personality (Ambrosius et al. 2015, forthcoming). How these factors differ among farmers and influence farmer strategic decision-making and consequently influence pork sector performance on sustainability indicators is less clear.

A way to study behavioural responses of farmers on changes in the external environment, given farmers are heterogeneous and influence each other, is Agent-Based Modelling (ABM). ABMs can mimic real-world interrelationships and can investigate how the behaviour of individual agents, e.g. pork farmers, affect system behaviour and vice versa, through interaction, adaption to external changes and feedback mechanisms (Gilbert & Troitzsch 2005; Squazzoni et al. 2013). ABMs provide an experimental setting in which the effect of e.g. economic pressure or behaviour of other farmers, are simulated and affect system behaviour within an artificial environment (Squazzoni et al. 2013). To gain insight in real world systems through ABM, robust modelling assumptions on behavioural rules of agents are required (Smajgl & Barreteau 2014).

Role-Playing Games (RPG) are one of the methods to gain data on behavioural responses of participants to particular scenarios (Smajgl & Barreteau 2014; Bousquet et al. 1999), and can be used for the parameterisation of behavioural traits of human agents in an ABM by testing underlying assumptions of an ABM within an RPG (Smajgl & Barreteau 2014), and/or translating behavioural responses into modelling assumptions (Bousquet et al. 1999). The assumption behind the use of RPGs for data, is that participants in games base their behaviour on real-life decisions (Guyot & Honiden 2006; Washington-Ottombre et al. 2010). Several studies have confirmed this (Meadows 2001; Speelman et al. 2014). RPG sessions end with a debriefing session in which knowledge that is acquired about behavioural patterns can be consolidated, and when inserted in an ABM, simulation results can be discussed (Smajgl & Barreteau 2014; Bousquet et al. 1999).

The design of RPGs comes with several challenges. First, the RPG should be able to trigger imagination and exploration of the participants (Meadows 2001; Barreteau et al. 2007), in order to relate participants' decision-making in the game to decisions in possible real-world scenarios. Second, because the setting is a game, it should be playable and understandable so as to prevent boredom, and therefore simplified in such a way that it can be easily communicated and understood (Barreteau et al. 2001).

This research

In this research we present the first step of a Role-Playing Game (RPG) design that is meant to test the relevance of an existing framework of pork farmer strategic decision-making. First, the framework will be shortly discussed, and then the design decisions will be presented. We conclude by reflecting on the challenges of game design and the choices made, and discuss the future work that needs to be done.

FRAMEWORK

The framework distinguishes three factors that influence decision-making: attitude, social influence and perceived behavioural control. Attitude is determined by a personality characteristic innovativeness and the expected economic profitability of an innovation. Innovativeness refers to the degree to which an individual makes original decisions independent of other factors. The expected economic profitability is defined by the expected financial gains or losses of an innovation given the current economic situation of the farmer. Social influence is determined by the influence of important others, which include membership in social groups determined by the farmers' salient identity. The last construct, perceived behavioural control, is determined by the farmers' current resources, influenced by farmers' previous decisions, and the external environment defined by policy, society and markets (Ambrosius et al., 2015, forthcoming) (see figure 1).

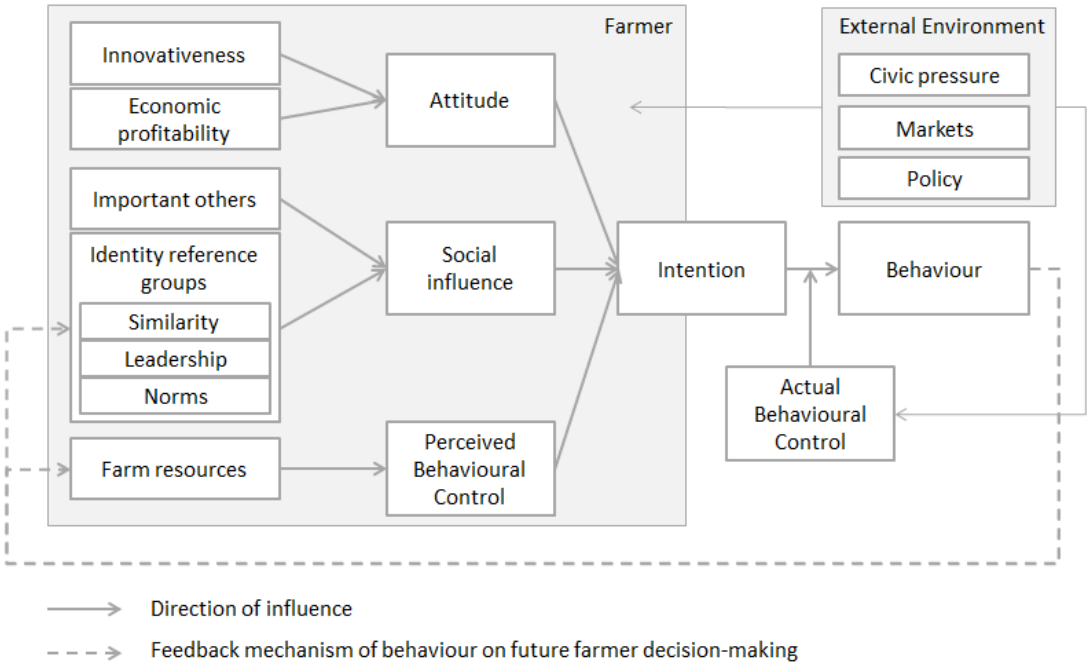

Figure 1: Framework of pork farmer decision-making (Ambrosius et al., 2015, forthcoming)

ROLE-PLAYING GAME DESIGN

To design the model of a Role-Playing Game with pork farmers we answered the following questions: 1) how can farm resources and the external environment, on which the participants base their decisions, be simplified and designed in such a way that participants have enough information to relate decision-making in the game to real life strategic decisions, and 2) how can the game be coupled to the underlying assumptions of the farmer decision-making framework so that they can be tested?

SYSTEM REPRESENTATION – LEVEL OF ABSTRACTION

The current farm resources influence the following two factors in the framework: 1) perceived behavioural control through the ability to innovate, and 2) expected economic profitability of the innovation, which is influenced by the farmers' current economic situation, which in turn is influenced by farm resources. Experts mentioned that the ability to innovate and invest in an added-value market depends on the lifetime of a housing system, current debt and capital, farm performance and entrepreneurial skills (personal conversation). Farm performance is, for now, not included in the design of the game, because the focus is on strategic decision-making and not on everyday management decisions to improve farm performance. Furthermore, entrepreneurial skills are farmers' own abilities, and are not operationalized as farm resources. For the game design, we therefore simplified farm resources into the following variables: debt, capital, and farm size. In the game, debt represents the lifetime of a housing system, if there is no more debt the farmer is able to invest in a complete new housing system (niche market), if a farmer invests in an intermediate market, he extends the lifetime of the housing system via a higher loan. The farm size determines the income farmers receive in every round.

The external environment is represented by three categories of markets: conventional, niche and intermediate markets. Markets in the pork sector differ in ideology, management style that influence market price (free versus semi-controlled), investment costs (changing from conventional to the added-value market), and information on demand and market share (Greef et al. 2008). Markets in the game are given the following characteristics: ideology, investment costs, cost price per pig, market price fluctuations, and information on demand and market share. Market characteristics influences the following factors in the framework: 1) similarity in the social influence construct, through similarity between the farmer and the ideology of the market, 2) perceived behavioural control, via the investment costs of the market given the farmer's farm resources, 3) perceived behavioural control via market demand, and 4) economic profitability in the attitude construct, via market prices. A market's ideology reflects sustainability indicators of the pork sector, i.e. animal welfare, environment, and public health, and relate to one of the farmer identities. The conventional market is governed by minimal law requirements, while added-value markets go beyond on one or more of the sustainability indicators (Greef & Casabianca 2009). Investment costs reflect the investments that need to be made for each of the strategies. When a participant goes from conventional to an added-value market, niche markets require much larger investments than intermediate markets. Market price fluctuations reflect the management style of a market: if semi-controlled the prices fluctuate less than when it concern a free-market. Information on demand, or absence of information increases uncertainty, and market share reflects the possibility for scale enlargement once producing for the market.

ARRANGEMENT OF THE GAME

One round in the game represents one year. Each round the participants go through two steps: 1) first, participants choose their strategy, and 2) second their income is calculated given the market price of the market they produce for, and an update is given on the sustainability indicators of the pork sector, following the strategies farmers have chosen.

The behavioural options of participants are closed. Participants can choose between the following strategies: 1) scale enlargement within their current market, 2) market change, and 3) do nothing. If participants want to choose another strategy, i.e. more off-farm income or quit farming, this can be proposed during the game, and discussed in the debriefing session of the game, but for now, these decisions are not included, because the focus is on added-value market adoption.

Uncertainty in the game is given by 1) demand per market, which influences the market price and consequently farm income, and 2) the possibility of extra government requirements in the conventional market and extra sustainability requirements in the added-value markets. Extra requirements result in higher cost-price and can therefore be a threat to the long-term viability of the farm. Market prices can compensate for this, but this depends on market management and demand.

MEASUREMENT OF BEHAVIOUR

To measure the influence of different factors regarding the framework of pork farmer decision-making participants are asked to fill in a questionnaire from which we derive their farmer identity and they are asked to judge other participants on their innovativeness. The game will, therefore, be played with farmers who already know each other. The following underlying assumptions of the framework and model will be explored: current economic situation given by the farm resources, and social influence (similarity). Initialisation of resources and markets is equal for all players: conventional market, debt, farm size, and capital. Participants, therefore experience the same external changes given similar resources on which they base their strategy. They start with enough resources to invest in added-value markets or scale enlargement.

In the debriefing session the similarity and discrepancies between system representation in the game and the real world are discussed, to validate the factors that influence farmer decision-making. Furthermore, knowledge acquired about behavioural patterns during the game is consolidated. Discussions will focus on heterogeneity and similarity of behavioural patterns between participants. This knowledge will eventually be used to calibrate the model and determine the weights per factor, and simulation results will be discussed (Smajgl & Barreteau 2014; Bousquet et al. 1999).

CONCLUDING REMARKS AND FUTURE WORK

Role-Playing Games are a promising tool to gain information and data on behavioural strategies of participants given different scenarios (Meadows 2001; Speelman et al. 2014; Becu et al. 2003). The challenges of game design (i.e. system representation to trigger imagination and playability) and the choice for game elements depend on the purpose of the game. In this research we try to gain information on factors driving added-value market adoption and gain insight in behavioural responses of participants during game sessions. The level of abstraction, i.e. leaving out farm performance indicators and strategies to increase farm performance, is following the logic of the game's purpose. The choice for a storyboard opens up the possibility for interaction between players and social influence, while the choice for participants and the roles are chosen based on the idea of gaining more information on real-world behaviour.

The game is currently under development, and system representation will first be discussed with experts and pork farmers before playing the game. If the system represented by the game is related to the real-world system according to experts and pork farmers, the game will first be tested with students and finally played with pork farmers. More reflection can be given on game design challenges, following the interaction with experts and farmers. The behavioural responses of participants and information gathered during the role-playing game will be used to calibrate an agent-based model, and simulation results will be discussed with the stakeholders.

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