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by

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The Role of Current Customers for Radical Product Innovation in Small-Firms

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The market orientation of small-firms is questioned as a driver of radical product innovation. This study proposes a model to test whether radical product innovation in small-firms is truly market-oriented or customer-led.

Keywords: customers, market orientation, radical product innovation, small-firms.

The Role of Current Customers for Radical Product Innovation in Small-Firms

Market orientation is widely accepted as a leading business philosophy. It contributes to firm performance (Narver and Slater; Jaworski and Kohli) and product innovation success (Slater and Narver 1994; Gatignon and Xuereb; Li and Calantone). Christensen and Bower point out that firms that focus exclusively on the expressed needs of current customers may ignore innovations that turn out to be crucial for a firm's future prosperity. Slater and Narver (1998) highlight that truly market oriented firms listen to the expressed needs of current customers but will also identify potential customers in emerging market segments and current customers' latent needs. They call the exclusive focus on expressed needs of current customers customer-led.

It is not clear whether small-firms (SFs) are either truly market oriented or customer-led only particularly with respect to radical product innovation. On the one hand Narver and Slater found no evidence that SFs are less market-oriented than large firms. On the other hand specific SF characteristics might influence product innovation, in particular radical product innovation in a specific way as compared to large firms. Among others, SFs lack the financial means for doing their own independent *market intelligence* and consequently rely on general information available from customers and media, such as papers, radio and TV. Also SF's *responsiveness* to market information is constrained by limited financial and technical resources, which in particular may be a constraint when market information calls for radical product innovation. As a result, even if SFs are market oriented, their innovative behavior may differ from big companies. In fact, innovation, also radical innovation, by a SF is often an adoption process of a concept

developed by customers or third parties. Also, since SFs have limited financial means at their disposal, their response to market developments is limited, in case of radical product innovation. Empirical research has shown that SFs can introduce radical product innovations but that their innovative Behaviour is different from large firms because their resources are different (e.g. Galende and de la Fuente). Also it appears that SFs compensate for their limited resources by developing networks (Carson, McGowan and Hill; Bessant). Especially relationships with customers are important in this respect because customers are a valuable source for new product ideas (von Hippel) and because customers provide the necessary resources (Cooper and Schendel; Pfeffer and Salancik; Foster). However, in the case of radical innovation SFs may collect more market information than from current customers only, e.g. also from potential customers. In fact, it seems that the role of customers and potential customers in radical product innovation by SFs is not well understood yet. In this context general characteristics of SF managers may play a role too. Therefore a model will be proposed and tested, which hypothesizes that expressed needs and latent needs of current customers and the expressed needs of potential customers drive radical product innovation. Since customers by definition do not express latent needs, latent needs are pursued by SFs with foresight about customer needs.

This study is structured as follows. First, radical product innovation in general and radical product innovation in SFs are discussed. Second the research model for this study and the hypotheses about the relationships in it are presented. Third, the methodology to test the hypotheses is explained. Fourth, the results are presented and finally the conclusions are drawn and discussed.

Radical product innovation

What is a radical product innovation? Chandy and Tellis (1998) conclude after a review of the literature that two dimensions underlie most definitions: technology and markets. The technology dimension refers to the extent to which the technology involved in a new product is different from prior technologies. The market dimension refers to the extent to which a new product fulfils key customer needs better than existing products (on a per dollar basis) or even creates new needs. The term radical in the phrase “radical product innovation” refers to a high degree of product newness but the degree of newness that distinguishes radical product innovations from other innovations is not specified in most definitions. Furthermore, since newness is a relative concept the basis for comparison needs to be specified. In order to classify the degree of product newness, and for that matter radical new as against really new and incremental new, Garcia and Calantone have modeled product newness as a second order factor model. Three elements or bases for comparison are specified, newness to the customer, newness to the industry and newness to the firm. They elaborate on the latter two:

- Newness to the industry refers to an evaluation of newness relative to factors outside the firm and includes market newness and technology newness. Market newness means that the new product fulfils a demand previously unrecognized by the industry. This new demand requires new market know-how about new distribution channels, partners and competitors in order to take advantage of the product innovation. Technology newness means that the product innovation is based on new technical know-how for an industry.

- Similarly, newness to the firm includes newness of market know-how and of technological know-how but is evaluated relative to the situation of the firm. New market know-how refers to serving new customers, in ways unfamiliar to the firm and/ or with technologies unfamiliar to the firm's current customers. Technological know-how means that the product innovation is based on new technological know-how for the firm.

Green, Gavin and Aiman-Smith elaborate on the newness to the firm by arguing that radical innovation incorporates four dimensions: technological uncertainty, technical inexperience, high technology costs and business inexperience, where the former three focus on technological know-how and the latter one focuses on market know-how. However, while there is no full agreement about a formal definition of radical product innovation (McDermott and O'Connor) most researchers agree that a radical product innovation "contains a high degree of new knowledge and represents a clear departure from existing practices" (Dewar and Dutton).

In line with the studies reviewed I suggest that an operational definition of radical product innovation should include two perspectives: the customer's and the firm's perspective. I propose that from the customer's perspective the extent to which a new product fulfils customer needs better than existing products on a per dollar basis (i.e. the benefits) is the most important characteristic to determine the degree of newness. From the firm's perspective, two dimensions need to be evaluated, newness of market know-how and newness of technological know-how. I consider newness to the industry a matter of degree on market know-how and technological know-how because it affects technological uncertainty and technology costs. Technological uncertainty, technical

inexperience and high technology costs are considered to be drivers of technological newness. I suggest as an operational definition of radical product innovation a product innovation that meets the following characteristics:

- ❑ Requires the acquisition of new technological know-how by the firm, which is surrounded by technological uncertainty (i.e. about the performance of the new technology), and involves large investments relative to the firm's resources.
- ❑ Serves new customers or new customer needs and therefore requires the acquisition of new market know-how by the firm.

Small-firms and innovation

Since my analysis of the relationship between current customers and radical product innovation focuses on SFs a definition, at least an operational definition, of SF's seems appropriate. There is no widely accepted statistical demarcation of a SF. The number of employees might define a SF. In Europe the demarcation between small and medium sized firms ranges, across countries, between five and fifty employees (Nooteboom). The importance of SFs is illustrated by the fact that in the European Union about 34 percent of the workforce is working in firms with less than 10 employees (European Commission). I will refrain from the debate about the appropriate definition of a SF and lay down a definition, which focuses on the decision making process in a small firm: a SF is a firm which is run and controlled under the direct supervision of the owner-manager.

Differences exist in innovation Behavior between large and SFs (Galende and de la Fuente). In the context of industry wide innovation, it has been suggested that Small and Medium Enterprises (SMEs) and large-firms are complementary with respect to

innovation (Pavitt, Robson and Townsend; Rothwell 1978; Rothwell and Dodgson). One perspective on industry wide innovation is that the initial invention and innovative activities take place in large-firms while SFs play an important role in the diffusion of innovations because the disadvantages in product innovation for SFs outweigh the advantages (Kamien and Schwartz; Scherer; Cohen). The initial invention and innovative activities often require large investments in technological know-how and SFs lack the economies of scale and scope to make efficient use of an R&D staff. Furthermore the performance of new technology is uncertain. SFs can not bear the financial burden of technological failures. Also SFs have difficulties to appropriate the gains of new technologies. (Rothwell and Dodgson). Kamien and Schwartz conclude that beyond some magnitude size does not contribute to innovation anymore and that this magnitude varies across industries.

Still classical examples exist of radical product innovations that bring down dominating large firms and catapult SFs into leadership (Chandy and Tellis 2000). Whether these cases are the exception rather than the rule (Sorescu, Chandu and Prabhu) or whether the rule can not be generalized to all classes of goods (for example to services) is unknown. In spite of this large firms should be willing to cannibalize their existing products to avoid losing their leading positions (Christensen and Bower; Chandy and Tellis 1998).

To overcome their disadvantages in radical product innovation SFs mainly apply technology that is developed outside the SF. Therefore, a model about radical product innovation in SFs should incorporate explicitly or implicitly the adoption of new technologies that are required for radical product innovation.

The personality of a person is the unique psychological make-up, which consistently influences how he responds to his environment. Personality can be quantitatively measured with personal traits. SF-owner-managers have more room for expressing their personal traits in the firm's decision making process than managers of large firms (Nooteboom), which justifies the inclusion of personal traits in models about SF Behavior. Particularly innovativeness should be included because it is a personality trait that influences a person's adoption Behavior.

SFs have weak management skills in areas like strategic planning, marketing and finance (Bessant) because their size is too small to develop special skills in that field. In SFs strategic planning and implementation converge. This results in greater flexibility and informal controls, which are considered to be advantages of SFs with respect to innovation. Consequently, a model about radical product innovation in SFs should not focus on planning and procedures but on the mental processing of the owner-manager. The correct understanding of consumer needs is important for successful product innovation by both large and SFs (e.g. Myers and Marquis; Rothwell 1972; Cooper 1979; Montoya-Weiss and Calantone). However, SFs lack expertise to do market research. Furthermore, marketing efforts to convince potential customers seems crucial for successful radical product innovation (Di Benedetto) but SFs have little control over the elements of the marketing mix. Consequently, good relationships with customers are hypothesized to be important for successful radical product innovation in SFs.

The Model

Based on the arguments in the previous section, radical product innovation behavior of SFs is specified as an adoption process. Three forces drive radical product innovation adoption in SFs:

- Current customers' expressed needs for radical product innovation, which reflects the limited autonomy of SFs to respond to the market with radical product innovation.
- Potential customers' expressed needs for radical product innovation, which indicates that SFs may be able to respond to emerging market segments.
- SF owner-manager's attitude towards radical product innovation, which indicates that SF owner-managers may autonomously respond to market developments with radical product innovation.

It is assumed that expressed customer needs for radical product innovations affect radical product innovation adoption in SFs directly and not via the SF owner-manager's "attitude towards the Behavior". The *resource dependence* view on innovative activity (Pfeffer and Salancik; Cooper and Schendel; Foster) holds that firms allocate resources to innovative programs that are required of the firm by customers who provide the resources that the firm needs to survive. The resource dependence view holds that a manager's freedom to choose is limited. The resource dependence view may be particularly relevant for radical product innovation in SFs because they have limited financial resources and therefore cannot adopt radical product innovations without the support of their current customers. In Ajzen's (1988) theory of planned Behavior it is argued that models, which predict Behavior should account for situations where subjects have limited freedom to choose. A direct influence of expressed customer needs on radical product innovation adoption is in line with that theory.

According to Slater and Narver (1998) market orientation is distinctive from customer-led by taking into account also latent, not expressed, needs. Therefore latent customer needs preferably should be introduced in the model as an explanatory variable of radical product innovation adoption by SFs. However, SFs will not have the financial means to execute the market research to probe such latent needs systematically. The owner-manager's industry foresight (Hamel and Prahalad), industry insight and customer insight (Slater and Narver 1999) is an important subset of the variables relevant for being market oriented. They might play a role with respect to SF owner-manager's knowledge of and his response to latent customer needs. Measurement of this subset of variables is difficult, but it is assumed that manager's attitude, as a proxy, is representing the impact of these variables on radical product innovation. Consequently, in the model the owner-manager's attitude towards a radical product innovation is included as a predictor of radical product innovation adoption by SFs, which is in line with the theory that attitude predicts Behavior (Ajzen and Fishbein).

The model also includes "dependence on current customers" as a moderator of the influence of current customers on radical product innovation adoption. This reflects the limitation of a SF to serve the market with radical product innovations if its current customers do not express a need for radical product innovation.

As discussed in the previous section, an important element in the model is that the SF owner's personal traits influence radical product innovation adoption in the firm. Innovativeness is considered as a higher order construct, determined by more fundamental personality variables, which influences all stages in the adoption process of new products (Mudd). Therefore, the innovativeness of the owner of a SF is an element

in the model. I hypothesize that innovativeness strengthens the influence of the SF owner-manager's attitude towards radical product innovation on the adoption of a radical product innovation. Figure 1 shows the model.

In addition to the variables in figure 1, three background variables were included, i.e. age of the owner-manager, the SF's specialization and social norm towards radical product innovation.

Hypotheses

A positive relationship between behavior and attitude towards that behavior is well established (e.g. Ajzen and Fishbein; Ajzen 1991). Moreover, most studies support the view that attitude causes behavior, rather than the other way around (East, p. 121).

Particularly for high involvement problems like decisions about radical product innovations a causal relation from attitude to behavior is most likely (Mowen, p. 234). A SF owner-manager first has to acquire information about the characteristics of a radical product innovation. Based upon this information the radical product innovation is evaluated and an attitude is formed. If this attitude is positive it will stimulate the adoption of the radical product innovation. Since in SFs the owner-manager is the key decision-maker, the following hypothesis is proposed.

H1: SF owner-manager's attitude towards radical product innovation positively influences radical product innovation adoption

Innovativeness is expected to influence all stages in the adoption process of new products (Mudd). Moreover, it better predicts adoption Behavior for radical product innovations than for incremental product innovations (Mudd). However, how innovativeness affects each stage in the adoption process is unclear. Midgley and Dowling describe the nature of innovativeness as it relates to the adoption of new products by consumers. Innovators are those who "decide to adopt an innovation independently of the decision of others" (Midgley and Dowling). In other words, the decision-maker's attitude towards the product innovation is decisive. In a SF context, these arguments support the following hypothesis.

H2: The influence of SF owner-manager's attitude towards radical product innovation on radical product innovation adoption will be larger the higher the owner-manager's innovativeness

It is widely accepted that new products that do not meet market needs lead to failure (See for an overview Cooper 1993). Therefore, firms allocate resources to product innovations for which they can identify a need. The *resource dependence* view on innovative activity (Pfeffer and Salancik; Cooper and Schendel; Foster) holds that firms allocate resources to innovative programs that are required of the firm by current customers who provide the resources that the firm needs to survive. This seems particularly relevant for SFs.

In SFs the resources to generate market information and hence to identify market needs are limited (Smeltzer, Fann and Nikolaisen; Carson, McGowan and Hill), which

makes it even harder for SFs than for large firms to identify market needs other than expressed needs of current customers. In SFs, personal contacts with customers are recognized as an important source of market information (Smeltzer, Fann and Nikolaisen; Carson, McGowan and Hill; Hartman, Tower and Sebor). Furthermore, SFs usually can not completely finance radical product innovations themselves. The required consent of financial institutions to radical product innovation adoption by a SF amplifies the importance of risk reduction that expressed needs of current customers can offer. Consequently, product innovations that match current customers' expressed needs are adopted at the expense of new product ideas that match other needs (e.g. emerging markets and latent needs). Furthermore, because SF's have limited power vis a vis customers I hypothesize that expressed needs of current customers explains radical product innovation adoption rather than the other way around. These arguments lead to the following hypothesis.

H3: Expressed needs by current customers for radical product innovation positively influence radical product innovation adoption by small-firms

Small firms depend on their customers to acquire the resources for radical product innovation. However, this dependence may vary across firms. This suggests that dependence on customers would stimulate radical product innovation in a SF if customers have a need for radical product innovation but decrease radical product innovation if customers do not have a need for radical product innovation. The following hypothesis is proposed

H4: The influence of expressed needs of current customers for radical product innovation on radical product innovation adoption will be larger the higher the dependence on current customers

Slater and Narver (1998, 1999) argue that market oriented firms also respond to the needs of potential customers. Furthermore, Slater and Narver (1999) argue that SFs are also market oriented and therefore respond to the needs of potential customers. It is hypothesized that this response also includes the potential customer's need for radical product innovation. More formally:

H5: Expressed needs by potential customers for radical product innovation positively influence radical product innovation adoption by small-firms

Methodology

Sample

The proposed model will be tested for firms in the Dutch laying hen industry. So, our testing refers to real decision-makers in a real decision-making context as opposed to testing by respondents in an experimental laboratory setting, which seems important to understand the market Behavior of SFs (e.g. Smith). Firms in the Dutch laying hen industry suit my purpose since they are SFs and have to respond currently to customer needs, which require radical changes in production methods. Most SFs in this industry sell to only one customer/ wholesaler for a relatively long period of time, which makes it

easier to isolate the influence of customers. Specifically, 90.5% of the respondents in my sample sell over 90% of their produce to their most important customer and only 4.5% switched to another main customer in the year prior to the computer guided interviews. Therefore, the influence of an occasional second customer is neglected.

The market for eggs was during the time of the data collection (2000) in a state of flux. Customer needs and preferences with respect to eggs had been highly predictable for most of the 20th century, i.e. clean, undamaged and fresh eggs. During the 1990's, more and more consumers, retailers and wholesalers preferred eggs that were also produced more animal friendly. This trend has led to radical product innovations, such as birdcage stable (In Dutch: volière) with or without chicken run, free range stable (In Dutch: scharrelstal), with or without chicken run and biological production of eggs, which require high investments in production methods. In 1999 this radical product innovation had gained a market share of 45% in the Dutch market for fresh consumed eggs.

A random sample of 220 poultry farmers was drawn from a list including all firms with more than 1000 laying hens. The respondents were first contacted by phone to ask for their participation. Over 90% of the respondents agreed to participate. Face to face interviews were conducted, using a computer-guided questionnaire. Exactly 200 interviews were completed.

Scale development

All items of the measurement scales are shown in the appendix (in Dutch). All scores on the multi item scales were divided by the number of items used to make the estimated coefficients more comparable.

Three group discussions were conducted to obtain a list of all innovations that were under consideration by owners of SFs in this industry or had been under consideration in the past 5 years. Five innovations from this list were considered to be radical product innovations in line with our conceptual definition of radical product innovation. The participants in the group discussions formulated these radical product innovations as production technologies, i.e. birdcage stable (In Dutch: volière) with or without chicken run, free range stable (In Dutch: scharrelstal), with or without chicken run and biological production of eggs. These production technologies require the acquisition of new technological know-how by the SF. Furthermore it is not clear how these production technologies will perform and the investments involved are very large for SFs. Furthermore, these production technologies all add “animal friendly” as a radically new product attribute for eggs. A product attribute, for which some consumers are willing to pay. Therefore, the adoption of these production technologies is used as an indicator for radical product innovation.

“Radical product innovation adoption” was measured by asking respondents whether they had already adopted one of the radical product innovations. Note that this is a dichotomous variable, with 0 if the answer is no, i.e. the SF only produces eggs in a traditional system and 1 if the answer is yes, i.e. the SF has adopted one of the animal friendly production systems.

“SF owner-manager’s attitude towards adopting radical product innovation” refers to the degree to which the owner-manager has a favorable or unfavorable evaluation or appraisal of the radical product innovation (This is in line with Ajzen’s (1991) definition of attitude). SF owner-manager’s attitude towards adopting the radical product innovation was measured using three items. Respondents indicated their attitude towards “producing free-range eggs” using a seven point semantic differential scale. The three semantic differential scales were anchored by “a bad idea versus a good idea”, “not wise versus wise” and “not attractive versus attractive”. In a principal component analysis all items loaded higher than 0.8 on the first component, before rotation. The reliability of the measure, using alpha scores, was 0.89. The average score of the items was used as measure for “SF owner-manager’s attitude towards adopting radical product innovation”. This attitude measure mentions one specific production technology, which is typical for adding the “animal friendly” product attribute (In Dutch: scharrelsysteem met vrije uitloop) but it is slightly different from my adoption measure, which includes all production technologies that add the “animal friendly” product attribute. This specific production technology was selected to measure an owner-manager’s attitude towards radical product innovation because it is well known by all owner-managers and most owner-managers have evaluated its merits at some point in time. The other production systems basically build on this system but the specifics may not be known to all of the respondents.

“Owner-manager's innovativeness” was measured with five items taken from Pallister and Foxall. With the items, the respondent indicates whether he considers himself as creative and inventive and whether he is willing to try innovations before other

people do. Only one (negatively formulated) item loaded slightly below 0.6 on the first component, before rotation. The reason for this is probably that some respondents became confused by the question wording change from item to item. It was decided to maintain this item in the measure because reversed items are not supposed to reduce the reliability (Churchill and Peter). The reliability of the measure, using alpha scores, was 0.71.

“Dependence on the current customers” is defined, as the firm’s need to maintain a relationship with its current customers to achieve its goals (Kumar, Scheer and Steenkamp). Replaceability of the current customers is used to measure the SF’s dependence on the current customers (Heide and John, Kumar, Scheer and Steenkamp). Three items were taken from Kumar, Scheer and Steenkamp and adapted for use in this study, based on discussions with potential respondents. All items loaded higher than 0.68 on the first component, before rotation. The reliability of the measure, using alpha scores, was 0.64.

Expressed needs of current customers. Our respondents provided the name and address of their main customer at that time, which allowed an assessment of the effect of specific customers on radical product innovation in the SF. In total 54 different customers were identified. The customer's turnover in radically new products was used as an approximation for “expressed needs of current customers”. The customer's turnover in radically new products was estimated based on the percentage of eggs that had the “animal friendly” product attribute in the customer’s assortment. For each customer I calculated how many eggs were sold to this customer by the respondents in my computer-guided interviews and how many of these eggs had the “animal friendly” product

attribute. Then the percentage of eggs with the “animal friendly” product attribute was used as a proxy for the expressed needs of current customers.

Expressed needs of potential customers. In the Netherlands, most SFs with laying hens sell their eggs to assembler packing plants, which are trading companies that assemble eggs from SFs with laying hens, pack for consumers and distribute to retail outlets. All assembler packing plants except the SF’s current customers were assumed to be potential customers for SFs with laying hens. To measure the “expressed needs of potential customers”, respondents rated the following statement on a seven point semantic differential scale anchored by very unlikely and very likely: “Assembler packing plants think I should produce free-range eggs”. This measurement is suggested by East (p. 141) to measure referent beliefs in the theory of planned behavior.

Social norm was operationalized with one single item as suggested by East (p.143). Respondents rated the following statement on a seven point semantic differential scale anchored by very unlikely and very likely: “Most people who are important to me think I should produce Free-range eggs”. As previously discussed for a “SF owner-manager’s attitude towards adopting radical product innovation” my measure for social norm also mentions one specific system, which is typical for adding the “animal friendly” product attribute.

Age was measured by subtracting the respondent’s year of birth from the year 2000 (year of the computer-guided interviews).

Specialization was operationalized with three items, where respondents indicated what part of their firm constituted the production of eggs in terms of turnover, labor

demand and income. All items loaded higher than 0.95 on the first component, before rotation. The reliability of the measure, using alpha scores, was 0.95.

Hypotheses testing

Binary logistic regression with radical product innovation adoption as the dependent variable was used to test the hypotheses. The logistic regression model takes the following functional form:

$$(1) \quad \ln \left[\frac{p}{1-p} \right] = \beta_0 + \beta_1 X_1 + \dots + \beta_k X_k$$

where p corresponds with the probability of radical product innovation adoption.

Results

Table 1 shows the results of the binary logistic regression where “SF owner-manager’s attitude towards adopting radical product innovation”, “Owner-manager’s innovativeness”, “Expressed needs of potential customers”, “Expressed needs of current customers” and “Dependence on the current customers” explain “Radical Product Innovation Adoption”.

The predictive validity of the model is good (see table 2). Out of 200 respondents, 156 (78%) are correctly classified by the model, 113 are classified as non-adopters and 43 as adopters where the observed classification is 125 and 75 respectively. The proportion of correctly classified respondents significantly exceeds the proportion of choices correctly classified by chance (The test statistic for Huberty’s test = 7.0 ($p < 0.001$)) (Sharma). The proportion of correctly classified respondents also significantly exceeds the proportion of choices correctly classified by a naïve model where all

respondents are classified as non-adopters (The test statistic for Huberty's test = 4.5 ($p < 0.001$)).

Hypothesis 3 is supported by the findings in table 1 because "expressed needs of current customers for radical product innovations" has a positive influence on "radical product innovation adoption" ($b=7.3, p < 0.001$). This finding acknowledges the relevance of the research dependence view for radical product innovation in SFs (Pfeffer and Salancik; Cooper and Schendel; Foster).

Some marginal support is found for Hypothesis 2 with the significant coefficient for the interaction term between "Owner-manager's innovativeness" and "SF owner-manager's attitude towards adopting radical product innovation" ($b=0.13, p=0.097$) in row three of table 1.

To analyze the nature of this interaction the sample is split in three groups of equal size with low, medium and high scores on "Owner-manager's innovativeness" and the binary logistic regression is repeated per group, excluding the interaction term between innovativeness and attitude. The results of these analyses are shown in table 3. "SF owner-manager's attitude towards adopting radical product innovation" is – 0.21 ($p=0.29$) when "Owner-manager's innovativeness" is low, 0.05 ($p=0.88$) when "Owner-manager's innovativeness" is medium and 0.38 ($p=0.081$) when "Owner-manager's innovativeness" is high.

Some partial support is found for Hypothesis 1 with the findings in table 3 because "SF owner-manager's attitude towards adopting radical product innovation" has a positive influence on "radical product innovation adoption" if "Owner-manager's innovativeness" is high ($b=0.38, p=0.081$). This support is surprisingly weak, which

underlines that attitude predicts human Behavior only in specific contexts (Ajzen and Fishbein). Apparently, attitude is a poor predictor of Behavior in the context of radical product innovation in SFs.

Hypothesis 4 is not confirmed. The coefficient for the interaction term between “Dependence on current customers” and “expressed needs of current customers for radical product innovations” ($b=-0.83$, $p=0.08$) in row six of table 1 is significant but negative.

Further analyses of the nature of this interaction presented in table 4 shows that this is opposite to hypothesis 4. The sample is split in three groups with low, medium and high scores for “Dependence on the current customers” and the binary logistic regression is repeated per group but excluding the interaction term between dependence and current customers’ needs. These analyses showed that the coefficient for “expressed needs of current customers for radical product innovations” is 9.04 ($p=0.001$) when “Dependence on current customers” is low, 6.17 ($p=0.04$) when “Dependence on current customers” is medium and 2.9 ($p=0.009$) when “Dependence on current customers” is high.

Dependence on current customers limits the positive influence of expressed needs of current customers for radical product innovations on radical product innovation adoption by SFs. This is opposite to hypothesis 4. SFs that are highly dependent on their current customers are less likely to serve them with radical product innovations. Our explanation is that dependence on the customer increases the risk of asset specificity of investments in case of radical new production systems. As a results farmers are less inclined to respond positively to the customer’s needs for radical product innovation if dependence on that customer is high.

Hypothesis 5 is not confirmed because the coefficient for “Expressed needs of potential customers” ($b=0.11$, $p=0.32$) in row 8 of table 1 is not significant. In Slater and Narver’s (1998) terminology this suggests that overall SFs in this sample are not truly market oriented with respect to radical product innovation. Surprisingly, the analyses in table 3 show that “Expressed needs of potential customers” has a positive influence when “Owner-manager's innovativeness” is high ($b=0.39$, $p=0.08$).

The three additional explanatory variables that were included, “Social Norm” ($b=0.13$, $p=0.11$), Age ($b=-0.01$, $p=0.78$) and specialization ($b=-0.01$, $p=0.88$) did not have a significant influence on “radical product innovation adoption”.

Conclusions and discussion

This study proposes a model to test whether radical product innovation in SFs is driven by the SF owner-managers attitude towards adopting radical product innovation, which serves as a proxy for latent needs, expressed needs of current customer, or expressed needs of potential customers. In Slater and Narver’s (1998) terminology the model tests whether radical product innovation in SFs is driven by a true market orientation or customer-led only.

The results show that radical product innovation in most SF’s of the sample is customer-led because radical product innovation is driven by the expressed needs of current customers and not by expressed needs of potential customers or the SF owner-managers attitude towards adopting radical product innovation. However following Slater and Narver (1999) this does not mean that a true market orientation is only feasible for large firms. The results also indicate that radical product innovation in SFs with highly

innovative owner-managers is predicted by expressed needs of potential customers and the owner-manager's attitude towards radical product innovation. Consequently, radical product innovation in SFs with highly innovative owner managers may be driven by a true market orientation. The latter elaborates on Verhees and Meulenbergh who find that SF owner-manager's innovativeness is related positively to customer market intelligence.

It has been argued that customer-led firms may ignore decisive innovations (Christensen and Bower; Slater and Narver 1998; 1999). On the one hand, my results indicate that SFs with less innovative owner-managers may ignore radical product innovations because they are customer-led only with respect to radical product innovation. On the other hand, my results indicate that highly innovative owner-managers of SFs may be fully market-oriented with respect to radical product innovation and acknowledge the need for radical product innovations that may be decisive. There is no indication that in this respect the situation in SF is different from the situation in large firms and medium sized firms.

Furthermore, my results show that in SFs the influence of a customer's expressed needs on the adoption of radical product innovation is reduced by the SF's dependence on that customer. Further research should explore whether asset specificity plays a role.

Further research should explore whether these finding can be generalized to other, less radical product innovations and to other industries.

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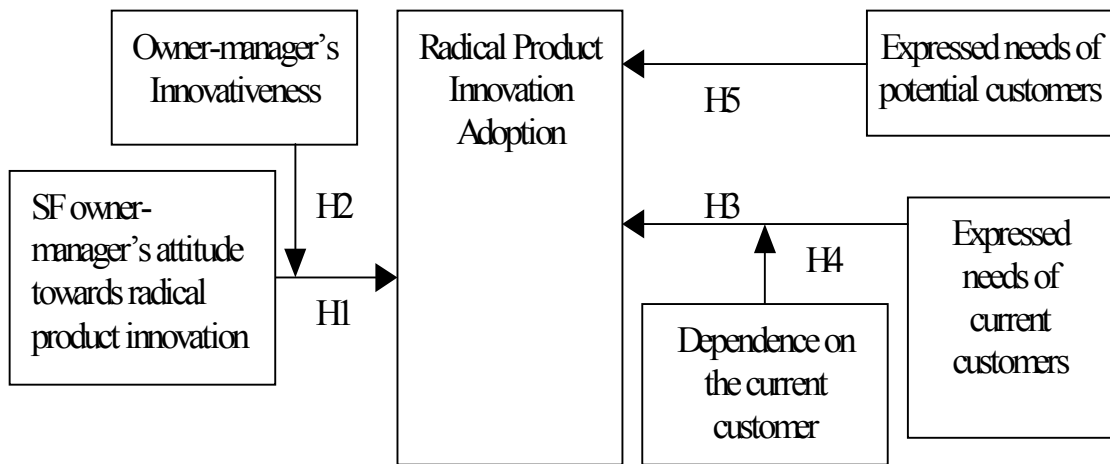


Figure 1. Radical product innovation adoption in small-firms

Table 1. Results of Binary Logistic Regression of “Radical Product Innovation Adoption” on a Number of Explanatory Variables

	Radical Product Innovation Adoption
“SF owner-manager’s attitude towards adopting radical product innovation” (H1)	-0.45
“Owner-manager's innovativeness” x “SF owner-manager’s attitude towards adopting radical product innovation” (H2)	0.13*
“Owner-manager's innovativeness”	-0.50
“Expressed needs of current customers” (H3)	7.3***
“Expressed needs of current customers” x “Dependence on the current customers” (H4)	-0.83*
“Dependence on the current customers”	0.01
“Expressed needs of potential customers”	0.11
“Social Norm”	0.13
Age	-0.01
Specialization	-0.01
N	200
Correctly predicted	156 (78%)
Nagelkerke R ²	0.42

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2. Classification Table for the Logistic Regression in Table 1

		Predicted radical product innovation	
		No	Yes
Observed radical product innovation	No	113	12
	Yes	32	43

Table 3. Results of 3 Binary Logistic Regressions of “Radical Product Innovation Adoption” on a Number of Explanatory Variables. The Sample is Split Into Respondents that Score Low, Medium and High on “Owner-Manager's Innovativeness”

Dependent variable:	Radical Product Innovation Adoption		
	“Owner-manager's innovativeness”:		
	Low	Medium	High
“SF owner-manager’s attitude towards adopting radical product innovation”	-0.21	0.05	0.38*
“Owner-manager's innovativeness”	0.44	3.3**	0.37
“Expressed needs of current customers”	6.73*	24.65**	3.38
“Expressed needs of current customers” x “Dependence on the current customers”	-0.45	5.69**	1.21
“Dependence on the current customers”	-0.25	1.37*	-0.12
“Expressed needs of potential customers”	-0.02	-0.07	0.39*
“Social Norm”	0.29	0.48	-0.23
Age	-0.03	0.04	-0.01
Specialization	-0.18	0.18	-0.01
N	67	62	71
Correctly predicted	49(73.1%)	48(77.4%)	60(84.5%)
Nagelkerke R ²	0.39	0.61	0.57

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4. Results of 3 binary logistic regressions of “Radical Product Innovation Adoption” on a number of explanatory variables. The sample is split into respondents that score low, medium and high on “dependence on the current customers”

Dependent variable:	Radical Product Innovation Adoption		
	Dependence on the current customer:		
	Low	Medium	High
“SF owner-manager’s attitude towards adopting radical product innovation”	-0.92	1.09	-0.14
“Owner-manager's innovativeness” x “SF owner-manager’s attitude towards adopting radical product innovation”	0.22	-0.06	0.03
“Owner-manager's innovativeness”	-1.08*	0.77	0.01
“Expressed needs of current customers”	9.04**	6.17**	2.89***
“Dependence on the current customers”	1.00	0.63	-0.16
“Expressed needs of potential customers”	0.07	0.24	0.18
“Social Norm”	0.27	-0.22	0.16
Age	-0.03	-0.08	0.00
Specialization	-0.11	0.21	0.03
N	81	52	67
Correctly predicted	65(80.2%)	45(86.5%)	49(73.1%)
Nagelkerke R ²	0.57	0.57	0.32

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix

SF owner-manager's attitude towards radical product innovation

Keeping chickens in a free-range stable with a chicken run is:

(Ik vind het houden van kippen in scharrelsystemen met vrije uitloop)

1. A bad idea - A good idea (Een slecht idee - Een goed idee)
2. Unwise - Wise (Onverstandig - Verstandig)
3. Not attractive - Attractive (Onaantrekkelijk - Aantrekkelijk)

Owner's Innovativeness

1. I am reluctant about introducing new ways of doing things until I see them working
for other poultry firms

(Ik ben terughoudend met het doorvoeren van nieuwe werkwijzen totdat ik zie dat het
goed werkt op andere pluimveebedrijven)
2. I must see other people using something new before I will consider it

(Ik moet eerst zien dat andere mensen iets nieuws gebruiken voordat ik het zelf
overweeg)
3. I often find myself skeptical of new ideas

(Ik merk dat ik vaak sceptisch sta tegenover nieuwe ideeën)
4. I consider myself to be creative and original in my thinking and behavior

(Ik zie mijzelf als creatief en origineel in denken en doen)
5. I am an inventive kind of person

(Ik ben een inventief persoon)

Dependence on the current customer

1. There are other customers than my major buyer to whom I could sell my eggs
(Er zijn andere klanten dan mijn belangrijkste afnemer aan wie ik mijn eieren kan leveren)
2. It is costly for me to switch to another buyer
(Het is voor mij kostbaar om om te schakelen naar een andere afnemer)
3. It would be difficult for me to replace my most important buyer without losing some income
(Het zou voor mij moeilijk zijn om mijn belangrijkste afnemer te vervangen zonder dat mijn inkomen daardoor onder druk komt te staan)

Expressed needs of potential customers

1. Wholesalers think I should switch to a free-range stable with chicken run
(De eierhandel denkt dat ik over zou moeten schakelen op een scharreelsysteem met vrije uitloop)

Social Norm towards radical product innovation

1. Most people who are important to me think I should produce eggs in a free-range stable with chicken run
(De meeste mensen die belangrijk voor mij zijn denken dat ik kippen moet houden in scharreelsystemen met vrije uitloop)

Specialization

Which part of your firm consists of laying hens in terms of (in a normal year):

Welk deel van Uw bedrijf bestaat uit legpluimveehouderij (in een normaal jaar)

- | | |
|-----------------------|--------------------|
| 1. Turnover | In omzet |
| 2. Labor requirements | In arbeidsbehoefte |
| 3. Income | In inkomen |