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Determinants of Point-of-Sale System Adoption: A Survey among Small Retailers in The Netherlands

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ABSTRACT

Several threats affect the survival of small, independent retail companies. Adoption and use of Point-of-Sale (POS) systems may offer important benefits to counter these threats. POS systems are not widely used by these retailers, however. This research investigates the determinants of the adoption of POS systems using a conceptual model based on existing adoption theories. Based on this, a survey has been held among 37 Dutch small, independent retailers, to answer the question what the most important determinants for POS system adoption are. This study furthers theory on IT adoption, specifically for small organisations. The practical relevance is that its findings may help in improving POS system adoption.

Keywords

Point-of-sale system, POS, information technology, adoption, innovation, retail, SME, The Netherlands.

INTRODUCTION

The Dutch retail sector consists for 94% of small retail organisations (≤ 10 employees), altogether employing around 250,000 persons. The retail sector is noticeably present in the trade-driven Dutch economy and acts as an intermediary between industry and consumer. The sector is an important and relevant subject of study from an economical, social and cultural perspective.

In this paper we focus on in-store retailing. The environment of this type of retail trade is under pressure. Several interacting threats, like globalisation, demanding consumers, increasing administrative burden and an economic recession force the retailers into action. Information and communication technology (ICT) is a double-edged sword in this context (cf. Turban, King, Viehland and Lee, 2004). On the one hand, it can be a threat to smaller retailers for its disintermediation effects and competition through e-tailing (cf. Chircu and Kauffman, 1999), and by its supply chain management effectuation of the larger (franchise) organisations (cf. David, 2008). On the other hand, ICT likewise provides opportunities to smaller retailers, like opening up new sales channels, reducing administrative tasks and/or enabling strategic management of their enterprise (Turban et al., 2004).

A specific type of retail ICT that can be employed to achieve effective store management is a 'Point-of-Sale' (POS) system. POS systems are defined in many different ways. On Wikipedia, a retail POS system is defined as "a computer, monitor, cash drawer, receipt printer, customer display and a barcode scanner". Webopedia.com defines a POS system as "the capturing of data and customer payment information at a physical location when goods or services are bought and sold". YourDictionary.com defines it as: "A comprehensive computerized checkout system that includes a bar-code scanner, receipt printer, cash drawer, credit and debit card scanner, monitor, and inventory management software. A point-of-sale system tracks sales and identifies inventory levels in real time". There are many different types and brands of POS systems available. eBay.com and BuyerZone.com provide a web-based 'Point of Sale System Buying Guide', containing over 4,000 different POS equipments for retailers, and 91 different types of POS software. The POS system market in The Netherlands contains no less than 150 vendors, each offering their own 'unique' software package.

POS systems enable retailers to consult more detailed management information compared to traditional cash registers and Electronic Cash Registers (ECRs). As this management information is based on sales figures, retailers can improve their

business by maintaining a better product strategy and pursuing a more efficient replenishment process matching customer demand, alleviating what is often referred to as the 'bullwhip effect' (Lee, Padmanabhan and Whang, 1997). This enables inventory optimisation, minimising storage space and 'sold-out' situations. Moreover, cash slips can be stored electronically and the results can be brought up in the POS system immediately, both reducing time spent on administrative tasks. This is specifically relevant for The Netherlands, where the administrative burden for SMEs has increased through regulations concerning article pricing, tax regulations for transactions storing and ingredients tracing for food products. It can therefore be expected that POS systems lead to higher performance and support the development of small retailers (cf. Parkan, 2003). Professionalising through ICT may particularly help the small, independent retailers to improve their competitive position against larger retailers and internet based vendors.

Despite their potential benefits and their wide availability on the Dutch market, POS systems are not (yet) widely used by smaller retail organisations. Statistics from the Dutch central industry board for retail trades (HBD, 2009) show that in 2008, 30% of retail organisations actually used a POS system. This adoption level differs per branch, ranging from 57% for supermarkets to 10% for shops for household products. The most recent Sectoral e-Business Watch (European Commission, 2008) confirms that smaller retail companies tend to be less automated than larger ones.

To be able to further stimulate the uptake of POS systems, it is important to understand how retailers value POS systems and which determinants play a role in the decision to adopt such a system. Until now, only limited knowledge on these matters is available. In this paper, we therefore investigate how existing theories can be applied to understand the POS adoption by small retailers. We will do this by answering the following research questions:

- From literature study, what are the main determinants of POS system adoption for small, independent retailers?
- From a survey among Dutch small, independent retailers, which determinants of POS system adoption can be found in practice?

The results of this study are of scientific and practical relevance. Although the field of ICT adoption research is abundant, a preliminary literature study revealed that limited research has been conducted on ICT adoption in the retail sector, especially concerning POS systems. The practical value of this work lies in the input the results may give to policy makers on possibilities to improve POS system adoption among small (Dutch) retailers.

The objective of this research is to identify the key determinants of POS system adoption by small, independent businesses. As much research on IT adoption has been conducted in fields closely related to the adoption of POS systems, the next section provides an overview of these studies. Based on these models, we derive our conceptual model and corresponding hypotheses, which we test through a survey. The final section contains main conclusions and ideas for future work.

LITERATURE REVIEW: ADOPTION MODELS

In this section we review eight different studies on the adoption of information systems, which were found through (meta) literature study. The meta literature search focused on theories and models concerning IS/IT adoption, more specifically of small businesses, retail and/or POS systems. Below, as a result, we first describe two generic adoption models with regard to IS/IT adoption. Next, we discuss six models that address adoption within the retail or small business domain.

Generic models

The first generic adoption model we refer to here is that of Rogers (2003). His Diffusion of Innovations (DOI) theory describes the adoption of innovations over time. He ascribes the dynamics of adoption behaviour in terms of different groups of people, like innovators and laggards. His theory also indicates how an individual or organisation (i.e. any decision-making unit) decides to adopt (or not) an innovation. This adoption process consists of five different stages: knowledge acquisition, persuasion, adoption, implementation and confirmation. Rogers specifies three groups of determinants that influence this process: characteristics of the decision-making unit, characteristics of the innovation and information channels. Based on DOI theory, factors concerning the decision-making unit that positively influence adoption are e.g. high social status, low age and financial flexibility. According to DOI, important characteristics of an innovation include: relative advantage, compatibility, complexity, trialability (the degree to which it can be experimented with), and observability (the visibility of its results). Information channels (personal and mass communication channels) are required to spread knowledge of an innovation.

The second generic adoption model is based on Venkatesh, Morris, Davis and Davis (2003), who reviewed technology acceptance models, among which the Technology Acceptance Model (Davis, 1986) and the Theory of Planned Behaviour (Ajzen, 1985). They used elements of each model for a new unified model, called the Unified Theory of Acceptance and Use

of Technology (UTAUT) model. Contrary to Rogers' model, UTAUT concentrates on the adoption behaviour of individuals. In this model, four constructs are defined as determinants of a user's acceptance and behaviour. Performance expectancy relates to the degree to which the technology is expected to improve job performance. Effort expectancy concerns the ease of use associated with the technology. Social influence is defined as "[t]he degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh et al., 2003). Finally, the construct facilitating conditions deals with the degree to which a support infrastructure for the technology is believed to exist. In addition, these four constructs are modelled to be influenced by four so-called moderators, i.e. gender, age, experience and voluntariness.

Retail and SME-specific models

We will discuss six main studies and their adoption models below.

First, the study by Julien and Raymond (1994) can be mentioned. Their technology adoption model for the retail sector proposes eight organisational aspects as determinants of technology adoption: centralisation, complexity, size, status (i.e. independent/affiliated), sector, and assertiveness, rationality, and interaction of the organisational strategy.

These determinants were identified in earlier research on technology adoption in small organisations. Technology adoption in this case concerned the use of hardware (business computing, POS systems and telecomputing) and software. In the study 79 firms in food, hardware and clothing were assessed through questionnaires and semi-structured interviews. Clothing firms and large firms were less apt to use POS systems, while firms that had a longer organisational planning horizon used POS systems more often.

Secondly, Chau (1995) researched which factors are important for small businesses in software selection of software. His research focused on packaged software, as small organisations usually do not buy custom developed software, due to their limited resources. Chau argues that owners/managers of small organisations are less focused on budgeting techniques like 'net present value' or 'internal rate of return' to make decisions on software investments. Instead, they focus more on criteria aimed at the functionalities and popularity of the software. Also, opinions of vendors, employees, consultants or acquaintances are believed to influence decision making. Based on empirical research among 122 small businesses, he found that the importance of selection criteria varied between owners and managers. In general, owners seem to focus more on technical aspects, while managers focus more on non-technical aspects.

Third, Thong and Yap (1995) developed a model based on the notion that the adoption process of small businesses differs from that of large firms. One of their main assumptions is that characteristics of the CEO are critical for IT adoption decisions. CEOs play a major role in small firms as they are the primary decisions makers. In their research, the authors developed a causal model, which assumes that the following factors are positively correlated with the likeliness of IT adoption for small firms: business size, competitiveness of the business environment, information intensity, innovativeness, and attitude towards adoption of IT and IT knowledge.

A survey among 166 Singaporean small organisations in the manufacturing, commerce and service industry was used to validate these assumptions. Results showed that firm size, the CEO's innovativeness, attitude towards IT adoption and IT knowledge were indeed positively correlated with IT adoption. Although competitiveness and information intensity were both not correlated with IT adoption, they were positively correlated with the CEO's attitude towards IT adoption.

Fourth, Iacovou, Benbasat and Dexter (1995) studied the adoption and impact of Electronic Data Interchange (EDI) in small organisations. Their research was driven by the fact that small organisations are often related to value chains that use EDI and so their potential resistance to adopt EDI could hinder the overall adoption of the technology. Three major factors were identified with regard to EDI adoption: perceived benefits, organisational readiness, and external pressure.

Using data from 7 small organisations, these three determinants were measured through multiple variables. The factor perceived benefits is measured as direct and indirect benefits, organisational readiness through financial and technological resources, and external pressure by the competitive pressure and imposition by trading partners. The analysis showed that the strongest determinant of EDI adoption was the imposition by (large) trading partners. In addition, it was found that sales volume also determined EDI adoption. Another finding was that perceived benefits were congruent with the adoption decision. Non-EDI adopters primarily focused on direct benefits, while EDI adopters mainly focused on the indirect and strategic benefits, like improving interorganisational communication and entry on new and remote markets. Barriers to adoption were costs and lack of technical knowledge within the organisation, and technical and financial assistance by the government.

The fifth study is by Van Akkeren and Cavaye (1999), who reviewed various IT diffusion and adoption models applicable to SMEs. They found that some had overlapping factors, but most models either focused on organisational or individual

adoption. Van Akkeren and Cavaye proposed a new model, capturing and summarising all factors identified in the literature as ‘the’ IT adoption factors for SMEs. The factors identified were divided in three categories:

- owner-manager characteristics: perceived benefits, computer literacy, assertiveness (also identified in earlier discussed models), perceived control and their subjective norm,
- firm characteristics: organisational readiness, external pressure to adopt, structural sophistication of the firm, sector, status (also identified in earlier discussed models), and customer/supplier dependency,
- return on investment.

Finally, the more recent economic/financial oriented study by Ekanem (2005) can be mentioned. He identified the phases and influential factors during investment decisions for durable products (like machinery) in small firms. Ekanem argues that in small organisations the owner-manager has a more dominant role in the decision-making process compared to large firms. The results are based on a longitudinal study among 8 small manufacturing companies, and their non-routine investments in e.g. new computerised printing machines. Based on the case studies, Ekanem developed a model consisting of five steps: identifying need, collecting information, evaluating alternatives, choosing alternatives and financing. Furthermore, there are key players whose information or opinions play a significant role in some phases. Ekanem acknowledges the influence of the external environment in which the organisation operates. Examples of this are the demand of customers or the presence of specific equipment that may influence the outcome of the phases.

SYNTHESIS: CONCEPTUAL MODEL AND HYPOTHESES

In the previous section, a total of eight models for adoption have been discussed. Most models view the (retail) organisation and/or its owner as the decision-making unit. In small organisations, the owner-manager/CEO almost by definition determines IT investments and the IT strategy. Thong and Yap (1995), Ekanem (2005) and Chau (1995) all point out this phenomenon. Therefore, we consider personal variables of the owner (like age and gender) as key determinants of POS adoption by retailers. In addition, organisational characteristics (like size and competition) can be considered as additional, contextual determinants of the IT adoption decision. This idea is framed into a conceptual model for this study (Figure 1).

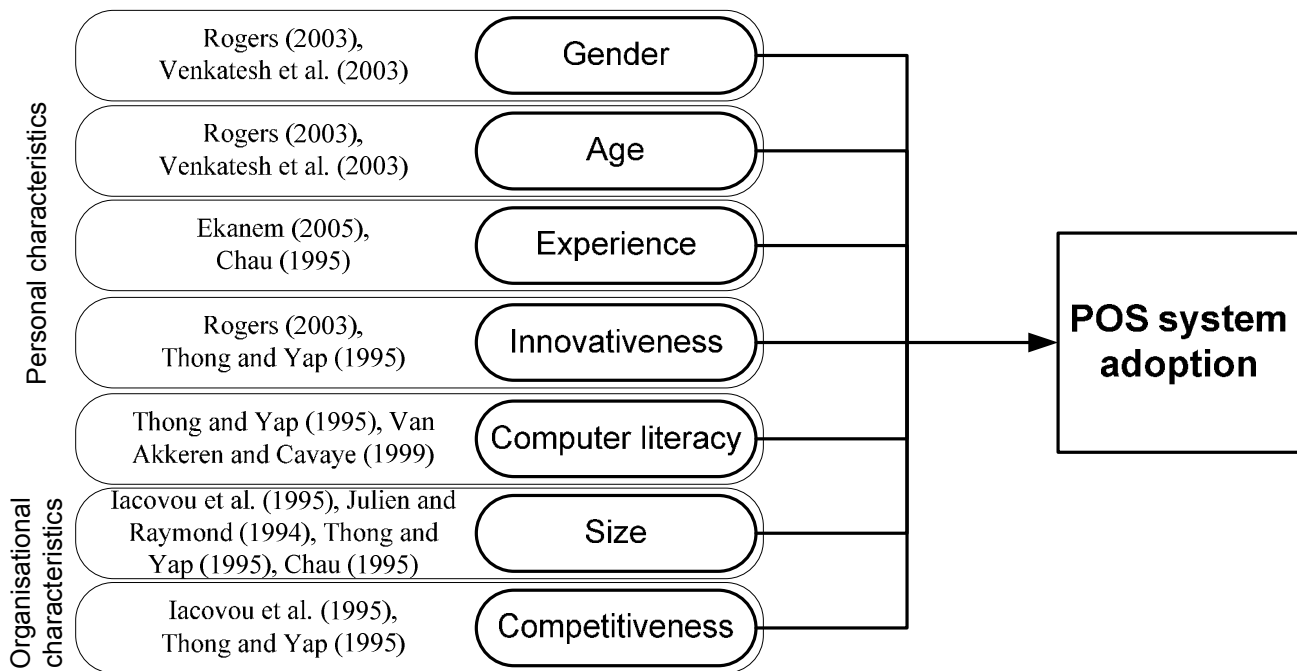


Figure 1. Conceptual model

From this conceptual model we derive the hypotheses on how the seven determinants potentially influence the probability that independent entrepreneurs of a small retail organisation adopt a POS system. Doing so, differences between adopters and non-adopters of POS systems can be found and validated. Through identifying these differences, stimulation of POS system adoption could possibly be concentrated on or tailored to specific groups.

With regard to the personal characteristics and POS adoption, the following five hypotheses can be formulated:

H1: Male retailers are more likely to adopt a POS system than female retailers.

H2: The age of retailers is negatively related to their adoption of a POS system.

For these hypotheses, we follow Rogers (2003), who acknowledges the influence of gender and age on adoption of innovations. Venkatesh et al. (2003) found that men and younger people have a higher performance expectancy of IT systems than women or older people. This performance expectancy in turn positively influences the attitude towards adoption.

H3: The experience of retailers is negatively related to their adoption of a POS system.

This hypothesis is mainly based on Ekanem (2005), who underpins the importance of the owner-managers' ability to learn from their experience and decisions while managing their organisation. Hence, we expect that starting retailers will have a greater need for a POS system to support them in decision-making, while more experienced retailers (as well as managers of small businesses) are more likely to rely on their 'gut feeling'. Note that 'experience' here refers to the profession of being an owner of a retail store (cf. Chau, 1995).

H4: The innovativeness of retailers is positively related to their adoption of a POS system.

H5: The computer literacy of retailers is positively related to their adoption of a POS system.

These two hypotheses are derived from the study by Thong and Yap (1995), who found that CEOs of organisations that adopt IT are generally more innovative and more computer literate than CEOs of organisations that do not adopt IT. H4 is also supported by the theory of Rogers; H5 by the study of Van Akkeren and Cavaye (1999). The same relations are therefore expected to be found when it comes to POS system adoption by retailers.

Finally, addressing the organisational determinants of the conceptual model, two POS system adoption hypotheses are formulated:

H6: The size of retail organisations is positively related to their adoption of a POS system.

This hypothesis is based on Iacovou et al. (1995) and Thong and Yap (1995), who found that larger organisations (measured by respectively turnover and employees) are more likely to adopt IT. On the contrary, Julien and Raymond (1994) found that retail organisations with a POS system were generally smaller. Based on the positive relationship between organisational size and innovation (Damanpour, 1992) and the findings of both Iacovou et al. and Thong and Yap, we hypothesise that larger retail organisations are more likely to have a POS system than their smaller counterparts.

H7: The competitiveness of the environment of retail organisations is positively related to their adoption of a POS system.

It should be noted that the relation between competition and innovation is far from clear-cut (Carlin, Schaffer and Seabright, 2004). More competition likely leads to more innovation, but this relationship may be in the form of an inverted U-shape (Aghion, Bloom, Blundell, Griffith and Howitt, 2005). Thong and Yap (1995) however found that organisations in a more competitive environment have a more positive attitude towards adoption. Iacovou et al. (1995) also mention competitive pressure as an aspect that positively influences adoption. We therefore assume that retail organisations which experience more competition are more likely to have a POS system.

METHOD: A SURVEY AMONG RETAILERS

The data collected for this research are based on a written questionnaire among Dutch small, independent retailers. The survey has been discussed and adapted through multiple iterations, after which it was presented for expert review to a technology and innovation expert of the Dutch central industry board for retail trades (HBD). After evaluation of comments, one retailer was asked to fill out the questionnaire as a pilot and comment on it. Following some final adjustments based on this, the questionnaire was distributed.

The target population encloses retailers in all branches of the Dutch retail trade. To set out the survey in the most random and practical manner (i.e. through convenience – but controlled – random sampling, cf. Lunsford and Lunsford, 1995), retail

organisations in two Dutch municipalities (one large city and one large town) have been personally visited. Beforehand, it was not known if retailers used POS systems, electronic cash registers or no cash register at all. In all stores the owner was handed the questionnaire in person, to be picked up a week later. This meant that the survey could be introduced personally and that the retailer could indicate directly whether s/he would participate. Returning to retrieve the questionnaire furthermore serves as a reminder for those who did not complete the questionnaire yet. A practical disadvantage of this distribution method is that it is very time consuming, especially when multiple visits are required until a questionnaire is completed.

In order to avoid complicated routing, two versions of the same questionnaire have been used. Some questions' phrasing or relevance depended on whether the respondent has a POS system or not. Both questionnaires consisted of three sets of questions, related to:

- the organisational characteristics of the retail organisation,
- the usage of the cash register/POS system,
- the personal characteristics of the respondent.

In total 61 retailers have been approached to participate in the research. Finally 37 questionnaires were completed which entails a response rate of 61%. We explored whether the sample of 37 respondents mirrors the population of small Dutch retailers, by comparing it with a study that was conducted by the Dutch central industry board for retail trades (HBD, 2009) among 2,500 small (1-10 employees) retailers in 2008. With regard to POS system adoption, our sample holds 41% adopters, whereas the HBD sample holds 30%. Concerning branch diversity, the distribution within our sample is approximately equal to that of the HBD study. Furthermore, our sample contains somewhat more males (68%) than the retailers that participated in the HBD survey (58%), while the age distribution of our sample is slightly younger on average: 43 versus 45 years in the HBD sample. All in all, we conclude that our sample of 37 responding retailers is relatively small, but holds a good variety of relevant background characteristics. This is important, as our aim is to test our conceptual model and the relationship between a number of variables that are addressed by our hypotheses. Therefore, the 'full' representation of the sample is of less importance, compared to the suitability of the sample to allow (deductive) hypothesis testing and analysis.

RESULTS

A basic result is that 41% of our response group used a POS system. Through the questionnaire, we also informed about the year that they adopted their POS system. We classified this into three categories, following Rogers, as: innovators (i.e. the frontrunners that adopted their POS system 4 or more years ago), early adopters (adopted 2-3 years ago) and late adopters (adopted less than 2 years ago). The remainder of our sample (59%), which does not own a POS system (yet), is labelled laggards. Figure 2 shows the composition of the sample by these classes.

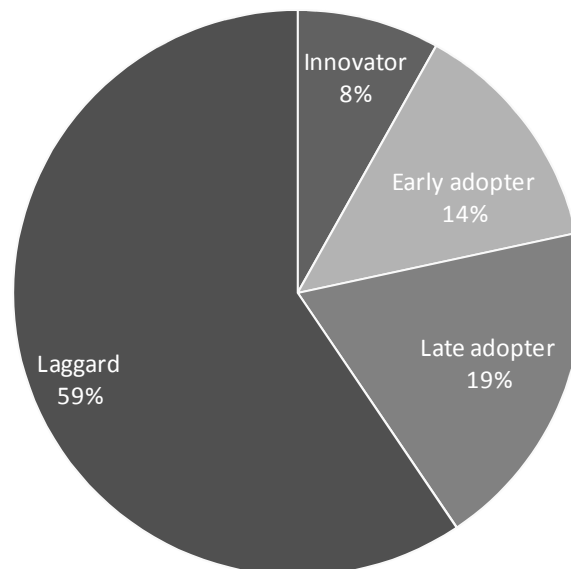


Figure 2. Classification of POS adopters in our sample

Turning to our conceptual model, we tested the hypotheses on the potential determinants of POS adoption, through bivariate analysis of the data. Table 1 gives an overview of the independent samples *t*-test results. Some variables may require additional explanation on how they were measured. For the concepts of age and of experience, retailers were asked how many years of experience they have as entrepreneur in the retail trade. Innovativeness was measured through a Likert-scale question asking whether the respondent generally is one of the first in his/her social environment to adopt new technologies. The measurement of computer literacy is based on a set of questions on the (perceived) interest in IT-related developments. The size of the organisations was measured in number of employees. Finally, perceived competition was measured as the degree to which internal rivalry among small, independent retail stores is experienced by the respondents. The Likert-scale answer options were: no, little, moderate, high, or very high competition.

The results support two hypotheses related to personal characteristics: H4 and H5. This implies that retailers who have adopted a POS system are innovative and computer literate. The *p*-values smaller than .05 indicate that the differences found are 'significant', i.e. fall within confidence 5/95%-intervals. The other personal determinants (gender, age and entrepreneurial experience) are not related to the likeliness of POS system adoption, neither are the determinants on the organisational level (size and competition), based on the *t*-test results (*p*-values are above .05). Still, we need to take into account that we apply *t*-tests on a relatively small sample.

H	Determinant	POS adopters (mean; n=15)	Non-adopters (mean; n=22)	Difference	t-value	p-value (1- sided testing)
Personal						
1	Gender (proportion male retailers)	0.53	0.77	-0.24	-1.48	0.08
2	Age (years)	42.50	43.52	-1.02	-0.34	0.37
3	Entrepreneurial experience (years)	10.98	15.75	-4.76	-1.26	0.11
4	Innovativeness (Likert-scale: 1-5)	2.93	2.24	0.70	1.81	0.04*
5	Computer literacy: interest in IT (Likert-scale: 1-5)	3.60	2.67	0.93	2.37	0.01*
Organisational						
6	Size (number of employees)	4.85	3.73	1.12	0.77	0.22
7	Competition: internal rivalry among small retailers (Likert-scale: 1-5)	2.33	2.05	0.29	1.07	0.15

Table 1. T-test results on the influence of individual/organisational characteristics on POS system adoption (*=significant at the 0.05 level)

CONCLUSION & DISCUSSION

In this study we examined a specific adoption problem, namely that of Point-of-Sale (POS) systems in small retail firms. This is interesting from a scientific perspective, because to the best of our knowledge, this has not been done previously and thus provides an extension of the theory on adoption of innovations. However, it is also of practical value. The retail industry, and especially the small retailer, is currently suffering from various interacting threats, for which POS systems could possibly be an antidote.

Based on literature study of existing models and theories, we formulated a conceptual model and seven corresponding hypotheses. We tested these hypotheses in the Dutch retail sector, specifically targeting small, independent retailers. A questionnaire was used to survey 37 respondents from diverse store types, both with and without a POS system.

In our model we distinguish several personal and organisational determinants related to the decision-making unit (i.e. the retailer). Of these, only the retailer's innovativeness and computer literacy proved to be significantly related to POS adoption.

Gender, age, entrepreneurial experience, organisational size and the competitiveness of the environment were not found to differ between adopters and non-adopters. With these results, our theoretical model seems only partly accurate in practice.

In terms of policy for POS system stimulation, computer literacy seems to have a positive effect, so it may prove worthwhile to try and interest people in general for the benefits of IT.

An obvious limitation of our research is that the model is applied to only one sector (although with many different branches), one country, and only a limited number of cases. It would still be interesting to see if the same results would be found for other countries, other sectors, and other technologies. Different technology is almost a necessity when one starts looking at other sectors, because POS systems seem to be retail specific software. Obviously, it would also be valuable to test the hypotheses on a larger sample as well, to see if the results are representative for the Dutch retail sector as a whole. In addition, it would be useful to conduct case study research to explore the concept of our model in more depth. This may help in formulating policies to stimulate POS system uptake.

Future studies could take into account the specificity of POS systems: benefits may very well be contingent on the specific situation of the retailer. In supply chain simulations for instance the benefits of sharing POS information were found to be dependent on the nature of the demand pattern (Steckel, Gupta and Banerji, 2004). This implies that POS systems are possibly more beneficial for one retail branch than for the other. This would explain the current differences in POS system uptake between different branches. Future research could also focus on the role of software suppliers in the adoption process. What different software packages do they offer? I.e., is there really something to choose between, or are all systems similar? Finally, if we view a POS system as the starting point of retailers' automation, it would be of interest to study their further digitisation, e.g. by looking at the information systems and their interconnections with other parties in the value chain.

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