

The decision to innovate: Antecedents of opportunity exploitation in high tech small firms

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The decision to innovate:
Antecedents of opportunity exploitation in high tech small firms

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Abstract

The current paper explores the antecedents of small business owners' decision to exploit identified opportunities for innovation. Drawing on social psychology, entrepreneurship and organizational behavior literature three potential antecedents are proposed: attitude towards the opportunity, subjective norms of close ties, and perceived behavioral control. It is hypothesized that each of these constructs correlates with the decision to innovate. Drawing on multiple-source survey data of 160 high tech small business owners in the Netherlands, it is found that subjective norms and perceived behavioral control are positively related to the decision to innovate. Moreover, a three-way interaction is estimated and confirmed, suggesting that when all antecedents are simultaneously present, opportunity exploitation is significantly more likely. Implications for practice and future research are discussed.

Keywords

Decision-making, opportunity exploitation, attitude, subjective norm, perceived behavioral control, high tech small firms.

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1. Introduction

The successful business of the future is believed to be one that continuously innovates. Accordingly, the past twenty years have witnessed increased attention for the innovative efforts of entrepreneurs. A substantial part of the field of entrepreneurship research centers around the individual that discovers opportunities, decides to exploit them, and implements them through a process of resource acquisition and organization (Shane, 2003). In small firms, innovation primarily depends on the behavior of the business owner to pro-actively identify and act upon opportunities. Drucker (1985) was among the first to propose that innovation is at the very heart of entrepreneurship, as he claimed that 'the very foundation of entrepreneurship - as a practice and as a discipline - is the practice of systematic innovation' (p. 72). Entrepreneurship theory nowadays agrees that the entrepreneurial process requires some form of innovation - not just in the case of giant Schumpeterian opportunities, but also in situations of the relatively modest, Kirznerian types of opportunity (Shane, 2003).

Entrepreneurship is generally thought of as a multistage process which has been defined as 'an activity that involves the discovery, evaluation and exploitation of opportunities to introduce new goods and services, ways of organizing markets, processes, and raw materials through organizing efforts that previously had not existed' (Venkataraman, 1997, in: Shane, 2003: p. 7). Following this definition, entrepreneurship requires the existence of opportunities which are discovered by individuals. Another condition is that it 'requires a decision by a person to act upon an opportunity because opportunities themselves lack agency' (Shane, 2003: p. 7). Opportunities are usually exploited only when human beings decide to act.

This study focuses explicitly on small business owners' decision to innovate, i.e. to exploit identified opportunities for innovation. One drawback in previous work is that the stage in the entrepreneurial process at which individuals decide to engage in exploitation has been overlooked. Shane (2003) for example, in his broad review of the entrepreneurship literature, concludes that:

'...we could use more research that examines the actual decision to exploit opportunities rather than the static state of being an entrepreneur. (...) Research on the actual decision to exploit opportunities among people at risk of such exploitation would overcome many of the limitations inherent in much of our existing research on this topic, as well as provide more precise explanations for how individual differences influence the entrepreneurial process' (p. 264).

This paper contributes to the literature by its direct focus on the decision to exploit, where most previous studies use indirect proxies new firm formation and self employment (Shane, 2003: p. 5). We propose that opportunity exploitation correlates with individuals' attitude and perceived subjective norms towards the opportunity, and perceived behavioral control to successfully implement the opportunity. In doing so we test some

well-known social psychological constructs which, as far as we can overlook, have not seen application in the context of entrepreneurship research. The paper is organized as follows. Section 2 identifies our proposed antecedent variables and develops hypotheses. Section 3 elaborates on our samples, data collection procedures, measures and variables. Section 4 develops binary logistic regression models to test our hypotheses. Section 5 discusses our findings and elaborates on the implications for practice and future research.

2. Theory and hypotheses

Our starting point to identify potential antecedents of the decision to exploit is a well-known social psychological theory of individual behavior, i.e. the theory of planned behavior (Ajzen, 1991). This theory was designed to predict and explain human behavior in specific contexts, and more specifically, to explore the influence of individuals' attitudes on the behavior in question. The theory proposes that to predict whether a person will engage in specific behavior, we need to know whether the person is in favor of doing it (attitude), how much the person feels social pressure to do it (subjective norms) and whether the person feels in control of the behavior in question (perceived behavioral control). These antecedents increase the chance that the person will intend to act, and accordingly increase the chance of doing it.

Ajzen's theory has been applied in a plethora of contexts to connect people's attitudes and decisions to engage in specific types of behavior. Most examples relate to consumer behaviors, including leisure activities (Ajzen and Driver, 1992), health care (Albarracin et al., 2001) and purchasing decisions (Notani, 1997; East, 1993). In the context of business however, application of the theory is relatively scarce. Studies mainly focus on employees' decision to adopt new technologies (e.g., Morris et al., 2005; Harrison et al., 1997).

When applied to small business owners' decision to innovate, planned behavior theory thus offers three potential antecedents: attitude (whether someone likes the opportunity), subjective norms (whether someone experiences pressure or support from close social ties) and perceived behavioral control (whether someone is confident to acquire the resources needed for exploitation and the effectively combine these in order to realize the innovation). A central element in the theory of planned behavior is the individual's intention to perform a given behavior, but in this paper we are not interested in these intentions. Rather, we focus directly on individuals' actual decisions.

In the remainder of this section we elaborate on the planned behavior constructs and develop hypotheses. In addition to the entrepreneurship literature, we will also draw on organizational behavior studies. This literature includes employee-level innovation with studies on creativity (e.g., Zhou and Shalley, 2003), pro-activeness (e.g., Parker et al., 2006) and innovative work behavior (e.g., Scott and Bruce, 1994). As such behaviors overlap at least partly with entrepreneurial behavior, and also because organizational behavior studies focus on individuals, does not explicitly model the decision to innovate, and apply similar psychological antecedents, we use it to further develop and support our presuppositions discussed hereafter.

Attitude

Attitude toward a behavior is 'the degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior in question' (Ajzen, 1991: p. 188). It is the general feeling for or against the action based on its expected outcomes. Ajzen (1991) discusses that they are actually two kinds of attitudes, i.e. evaluative and affective ones. Evaluative judgments relate to the perceived costs and benefits of a given behavior, indicating to the decision-maker if there is some kind of pay-off. Affective judgments are beliefs about positive or negative feelings derived from the behavior by itself. In earlier work, attitudes towards behaviors have been demonstrated to contain both evaluative and affective judgments (Ajzen, 1991).

Entrepreneurship literature regards business owners' attitudes an important determinant of the decision to innovate. Shane (2003) for example discusses that positive evaluative judgments are important because the exploitation of opportunities is uncertain. The information necessary to determine whether an effort to exploit an opportunity will pay off cannot be known with certainty at the time it is identified, simply because that information does not come into existence until the entrepreneur pursues the opportunity. For this very reason, the entrepreneurial process is always associated with the bearing of risk (p. 7). Likewise, Venkataraman (1997) discusses that to pursue uncertain opportunities, entrepreneurs must believe that they will gain more than they are giving up. When people make a decision to exploit an innovative opportunity, they do so because they believe that the expected value of exploitation (both monetary and psychic) exceeds the opportunity cost for alternative use of their time plus the premiums that they would like for bearing uncertainty.

Entrepreneurship studies also suggest that affective attitudes are important. It has been demonstrated that people with a greater desire for independence are more likely to start a business. Vesalainen and Pihkala (1999) surveyed Swedish citizens to find that a desire for independence increased the likelihood of new firm formation. Reynolds and White (1997) compared individuals in the process of starting a business to a control group of individuals who were not starting a business, and found that those in the process of starting up received higher scores on scales of autonomy and independence. Thus, individuals can be triggered by the very act of opportunity exploitation, and not necessarily by its outcomes.

Organizational behavior studies offer similar evaluation- and affection-based concepts to explain why individuals engage in innovation. Farr and Ford (1990) proposed that the likelihood of employees being innovative depends on the perceived pay-off achieved through innovation. Even if a person senses a need to innovate and has generated an idea to solve this need, implementation is unlikely to occur if it is felt that the pay-off from such behavior is low. Farr and Ford (1990) argue that individuals must see a reasonable set of positive outcomes before they will attempt to carry it out. As for affective judgments, a counterpart is seen in Amabile's (1996) argument of intrinsic motivation. She defined intrinsic motivation as 'any motivation that arises from the individual's positive reaction to a task itself; this reaction can be experienced as interest, involvement, curiosity, satisfaction, or positive challenge' (p. 115), and found that it influences creative performance. However, it has also been shown that intrinsically motivated persons are more likely to engage in specific behaviors, including donations of blood for medical applications, or picking up children from kindergartens in time (Frey and Jegen, 2001). In the context of opportunity exploitation, the more individuals find its

related tasks to be intrinsically motivating, the more likely they are to decide to do it. If one truly enjoys working on the implementation of opportunities, a positive decision becomes more likely. In all, we hypothesize

H1: Positive attitudes towards identified opportunities for innovation are positively related to small business owners' decision to exploit.

Subjective norm

Subjective norm is defined as 'the perceived social pressure to perform or not to perform the behavior' (Ajzen, 1991: p. 188). Such norms are concerned with the likelihood that important referents approve or disapprove of performing a given behavior. Subjective norms represent the internalized influences of close ties, i.e. persons and groups that the entrepreneur has close, frequent and intimate contacts, including friends, family, and close business contacts.

In the entrepreneurship literature, the role of ties in decision-making has been studied mainly for family members. It has been argued that the children of entrepreneurs should be more likely to exploit opportunities than other people (Shane, 2003). Observation of their parents' behavior provides the necessary inspiration and better motivation to engage in similar activities. This presupposition has been empirically supported many times, for example by De Wit and Van Winden (1989) in a study of Dutch males and their fathers, and by Dunn and Holtz-Eakin (1996) for people whose parents were self employed and when controlling for the wealth of parents. There is also occasional evidence for the influence of other close ties. Honig and Davidsson (2000) made a comparison between two groups of Swedish citizens, one of them being involved in the process of starting a business, while the others were not. The group engaged in opportunity exploitation was more likely to have close friends and neighbors who were self employed. Similarly, Caputo and Dolinsky (1998) studied a sample of over women from a national longitudinal survey of labor market experience. The result was that respondents were more likely to be self employed if their spouses were self employed.

Another reason why small business owners can be anticipated to account for the responses of their social ties, and especially the strong ones, is that they usually need their ties to provide the resources and information to facilitate the exploitation process. Bruderl and Preisendorfer (1998) for example showed that those ventures that receive more support from strong ties had better survival rates.

The organizational behavior literature also discusses the role of subjective norms. In this literature it is not friends and family that matter, but rather the influence of peers in work groups. Work groups have been shown to exert powerful pressures on individuals to adjust their behavior. Thus, if the norms in a work group prescribe that opportunity exploitation is desired, its members will be triggered to innovate. One relevant study in this context was conducted by Axtell and colleagues (2000). Drawing on a survey among the employees of a manufacturing plant, they concluded that climate for innovation is important to realize innovative outcomes. It made a difference if employees found their colleagues to be supportive as soon as identified ideas for innovations had to be implemented. In the divergent, initial phase of the innovation process, such a climate for innovation made no difference. Likewise, in a recent study of Korean workers Choi (2007) found a positive correlation between innovation climate and employees' change-

oriented behaviors, a construct that basically reflects employee behaviors to identify and act upon opportunities beyond their formal work roles. Thus

H2: Positive subjective norms of close ties towards identified opportunities for innovation are positively related to small business owners' decision to exploit.

Perceived behavioral control

Perceived behavioral control is the 'perceived ease or difficulty of performing the behavior of interest' (Ajzen, 1991: p. 188). This concern is based on the presence of requisite resources and abilities. The more resources and abilities individuals believe they possess, and the fewer obstacles or impediments they anticipate, the greater should be their perceived control over the behavior. Perceived control was added to the theory of planned behavior specifically to explain the decision to engage in behaviors which are beyond individuals' volitional control (Ajzen, 1991: p. 184).

In the context of this paper, it makes sense to propose that perceived behavioral control is related to the decision to innovate. Ajzen (1991) himself stressed that perceived behavioral control is most compatible with Bandura's (1982) concept of perceived self-efficacy which 'is concerned with judgments of how well one can execute courses of action required to deal with prospective situations' (p. 122). In the entrepreneurship literature, it is well established that people with higher self-efficacy are more likely to exploit opportunities. Shane (2003) for example interprets self-efficacy as the belief in one's own ability to perform a given task (p. 111). He then refers to Casson (1995) to argue that entrepreneurs make judgmental decisions about resources that usually put their assessments at odds with those of other people. Consequently, they must have confidence in their own judgment and not be uncomfortable at the prospect of being wrong or at odds with a disbelieving majority. Empirical evidence for a positive relationship between self-efficacy and opportunity exploitation has been given by Baron and Markman (1999) and Vesalainen and Pihkala (1999), to mention only a few.

Entrepreneurship literature offers another argument in favor of perceived control, namely the extent to which people perceive to be able to finance innovations, or alternatively, to acquire capital from external sources. Authors like Aldrich (1999) argued that new businesses with abundant capital are more likely to succeed because it provides a buffer to overcome initial inferior performance or to bypass temporary liquidity constraints. Given such findings, entrepreneurs' perceived ability to find the resources needed for innovation is an obvious determinant of their decision to exploit opportunities.

In the organizational behavior literature, a counterpart of perceived behavioral control is found in Gebert's (1987) situation control theory. This theory draws on Lazarus's (1966) cognitive stress-coping theory to explore the psychological mechanisms underlying employees' decision to innovate. Situation control theory first assumes that a performance gap must be perceived before individuals even start thinking about innovation. Next, the individual engages in an appraisal of situation control. This appraisal focuses on the analysis of coping strategies, that is, the individual's ability to deal with the situation. Two considerations are essential here (Gebert, 1987: p. 944). First, individuals may judge that they personally possess the resources needed for exploitation (e.g. autonomy, time, budget, staff, knowledge) to cope with the situation. If insufficient control is perceived, the individual assesses the likelihood of reducing the discrepancy between the desired and actual state by procuring resources elsewhere, such

as from a superior, colleague or supplier. Whenever sufficient control is perceived, opportunity exploitation is more likely. Empirical support for these arguments has been found by Gebert et al. (2003) and Krause (2004) in studies of German managers. Given these considerations, we hypothesize

H3: Perceived control to exploit identified opportunities for innovation is positively related to small business owners' decision to exploit.

Interaction

So far we have argued that each of the planned behavior constructs may autonomously influence the decision to innovate. We here also propose that the constructs interact, i.e. that opportunity exploitation is more likely if all three antecedent variables are simultaneously present. Of the few who attempted an integrative approach, an early qualitative study by Mintzberg and colleagues (1976) combined various arguments to explain how innovative decisions are made. According to Mintzberg et al. (1976) the 'moment of action' is determined by an amplitude of stimuli, including the interest of the decision maker and the perceived payoff, the influence of the idea source and 'significant others', and the associated uncertainty and perceived probability of successful termination of the decision (p. 253). Our proposed antecedents of attitude, subjective norms and perceived control are easily recognized here.

In planned behavior studies, the assumption that individuals' motivation and ability interact in their effect on behavioral achievement has been tested many times - with miscellaneous results (Ajzen, 1991). In the context of entrepreneurial decision-making however, we argue that it makes sense to also explore interaction effects between attitude, subjective norm and perceived behavioral control interact in their influence on the decision to innovate. Consider the situation in which business owners have identified an opportunity, and that they like it and accordingly have a favorable attitude towards it. Since exploitation requires resource acquisition and combination, and usually a substantial individual effort while the outcomes are uncertain (Shane, 2003), the connection between attitude and the decision to innovate may be stronger if the other 'conditions' are met, i.e. if business owners perceive strong social support of their close ties, and feel that they are capable to successfully implement the opportunity. We remind that the exploitation of innovative opportunities is a clear example of behavior which is beyond the individual's volitional control - the very reason that Ajzen (1991) included perceived behavioral control in this theory. A positive attitude by itself may not be enough. Since innovation implementation is a significant and influential event in the lives of most business owners and their close ties, all antecedents can be thought of as necessary conditions which should be simultaneously present, and if one fails, exploitation may in general become less likely. We propose that

H4: The connection between the entrepreneur's attitude toward an identified opportunity and the decision to exploit is stronger, the more he/she perceives both positive subjective norms of close ties and being in control to exploit.

3. Data

We already mentioned that previous work on opportunity exploitation did not explicitly measure the decision to exploit, but rather relied on indicators like being self-employed (Shane, 2003). This is probably also because the required sampling and procedures are expensive and time-consuming. Finding entrepreneurs who are considering identified opportunities and monitoring their decisions requires multiple data collection efforts, and is relatively expensive because initial respondents may fail to respond to follow-up surveys.

Sampling and procedures

In this research we tested our hypotheses on data collected from high-tech small business owners in the Netherlands. The Dutch research organization EIM Business and Policy Research conducts an annual survey among a panel of owner/managers of high tech small firms. This panel defines high-tech small firms as those having no more than 250 employees, that are actively engaged in R&D, and that developed new technology-based products in the past three years. In terms of revenues and size, high-tech small firms are slightly bigger than regular small firms in the Netherlands (EIM, 2006). They usually operate in manufacturing and knowledge intensive services industries, for example manufacturers of chemicals, rubbers and plastics, machinery and equipment, technical wholesale traders, IT and software developers, engineers and commercial R&D services firms. The panel is financed by the Dutch Ministry of Economic Affairs to study the behavior and performance of high tech small firms. Although such firms are the primary target of most innovation and entrepreneurship policy instruments, their actual features are poorly documented in standard Dutch statistics. The first wave of the panel was conducted at the end of 2005 by means of telephone and internet surveys. For our current research we were allowed to add questions to the second and third waves in the fall of 2006 and 2007, respectively.

We collected data by means of three distinct surveys. Firstly, in the fall of 2006 a telephone survey was done with the full panel of 779 members. We added screening questions to identify those that had identified and were still considering opportunities for innovation at the time. More specifically, innovation was introduced as any purposeful renewal aimed to produce some kind of benefit, and based on an identified opportunity (cf. King and Anderson, 2002: p. 2-3). It was mentioned that innovation is not limited to new products, but may also relate to processes including methods of marketing or organization. We then asked if respondents had identified any opportunities for innovation and if these included examples that they were still considering. If these criteria were satisfied respondents were asked to describe the opportunity (open-ended question)ⁱ. In all, 532 panel members responded to the survey, a response rate of 68.3%. Within this group, 332 panel members actually passed the screening (42.6%). In comparison with the full panel, both response distributions were not selective. Drawing on χ^2 - and t-tests we found that respondents were not different from non-respondents in terms of industry types, size classes, education level and age. We found that p-values of significance of difference tests were above the 5% level no matter what distribution and variable was tested.

Secondly, we organized a pen-and-paper survey that was sent out to those respondents that had passed the screening. In the introduction letter we indicated that we

ⁱ In case respondents had identified multiple opportunities we asked to describe their most recent one.

were interested in the specific opportunity that respondents had described on the phone. Their full description was printed on top of the questionnaire. The survey then offered multiple-item scales to measure the planned behavior constructs (details discussed hereafter). Moreover, the survey checked and documented relevant background variables including industry types, firm size, education and career experience, and asked respondents to classify the type of opportunity, i.e. if they primarily regarded it as a product or process innovation. This survey was sent out in January 2007 with a stamped envelope for easy return, and an introductory letter which included our names in case of any questions. After three weeks, a reminder letter was sent to all non-respondents to increase the response rates. Eventually, we received the questionnaires of 185 persons, a response rate of 55.7%. Again, responses were representative in terms of industry types, size classes, education level and age.

Thirdly, we added questions to the third wave of the high tech panel which was conducted in the fall of 2007, again by telephone interviewing. Now our focus was only on the 185 panel members that had responded to the pen-and-paper survey. The interviewers first reminded the respondent of their opportunity by reading out loud its description. Then they asked what the respondent had decided; to exploit the opportunity or not ('did you decide to implement this opportunity, i.e. have you implemented it or are you currently implementing it?'). We obtained responses of 160 panel members. Again, these responses were representative for those that had qualified for our research. Drawing on χ^2 - and t-tests no significant differences were found between the distributions of respondents and non-respondents on the variables: industry type ($p=0.71$), size class ($p=0.73$), education level ($p=0.08$) and age of the respondent in years ($p=0.50$).

Variables and descriptive statistics

By means of unique identification numbers data from all three sources were merged in a single dataset of 160 respondents. Table 1 describes the variables that we used to test our hypotheses, and presents descriptive statistics. Our dependent variable was dichotomous, indicating if high tech entrepreneurs had decided to exploit the opportunity one year after they first described it to us. In 44% of the cases, this appeared to be true.

Table 1. Variables and descriptive statistics (n = 160)

<i>Variable</i>	<i>Description</i>	<i>Statistics^a</i>
decision	decision to innovate, i.e. after one year the opportunity has been (or is currently being) implemented	yes (44%); no (56%)
attitude	mean score of five items ^b ($\alpha = 0.84$, mean $r = 0.51$, $IRC \geq 0.54$): I find this opportunity... A1. ...bad - good A2. ...boring - exciting A3. ...not rewarding - rewarding A4. ...common - very special A5. ...not attractive - very attractive	M = 5.84, SD = 0.97
subjective norm	mean score of four items ^c ($\alpha = 0.90$, mean $r = 0.69$, $IRC \geq 0.69$): SN1. People who are important to me like this opportunity SN2. My relatives and friends support this opportunity SN3. People who are important to me pressure me to exploit this opportunity SN4. My close ties expect me to go ahead with this opportunity	M = 3.75, SD = 0.71
perceived	mean score of four items ^c ($\alpha = 0.82$, mean $r = 0.53$, $IRC \geq 0.56$):	M = 3.40, SD = 0.69

behavioral control	PBC1. I am confident that I can implement this opportunity PBC2. I am capable to obtain the resources for this opportunity PBC3. For me exploiting this opportunity is an easy job PBC4. I anticipate few problems if I would proceed with this opportunity	
type of opportunity	opportunity relates to a product innovation (versus process innovation)	yes (73%); no (27%)
firm size	number of employees in full-time equivalents	M = 24.2, SD = 43.7
type of industry	firm operates in a services industry (versus manufacturing)	yes (54%); no (46%)
education level	respondent has a bachelor degree (at university or advanced professional education level)	yes (89%); no (11%)
experience	career experience of the respondent in years	M = 17.6, SD = 10.1

^a M = mean, SD = standard deviation

^b rated on 7-point semantic differential scales, coded 1 (bad, etc) to 7 (good, etc)

^c rated on 5-point scales (fully disagree/disagree/neither agree nor disagree/agree/fully agree), coded 1 to 5

To measure our focal independent variables of attitude, subjective norm and perceived behavioral control, we followed the guidelines for planned behavior studies as described by Ajzen (1991) and Francis et al. (2004). We designed our measures in such a way that they were compatible with the behavior that was to be predicted, i.e. exploiting the opportunity that respondents had identified and described to us. The full description was therefore printed on top of the pen-and-paper questionnaire, and items made explicit reference to the identified opportunity.

Attitude was measured by means of a semantic differential scale which involved the use of five bipolar adjectives. Some of the items were evaluative (e.g., not rewarding-rewarding) and others affective (e.g., boring-exciting). The good-bad scale was also included to capture overall evaluation (Francis et al., 2004). We remark that, although both evaluative and affective judgments are relevant aspects of attitude, the construct itself is one-dimensional as it should be (Ajzen, 1991). As for subjective norm, we used a four-item measure to rate the extent to which close ties approve or disapprove opportunity exploitation. For perceived behavioral control, four items recorded the extent in which respondents perceived themselves capable of exploiting the opportunity by obtaining and combining the necessary resources. Following Francis et al. (2004) the items reflected either confidence or perceived ability.

Various reliability statistics were calculated to assess internal consistency. We computed Cronbach's α , mean correlations between the items (mean r) and all item-rest correlations (IRCs). The last two criteria were adopted because α tends to vary with the number of items in a scale (Cortina, 1993). Recommended critical values are 0.70 for α , 0.40 for mean r , and 0.30 for any item-rest correlation (Cortina, 1993; Hair et al., 1998). Table 1 reveals that all measures satisfy these criteria.

We also found that the planned behavior measures were distinct and reflected truly different constructs. We applied exploratory factor analysis with oblique rotation to explore the dimensionality of the items (cf. Hair et al., 1998). Pre-analysis tests for the suitability of data for factor analysis were computed. The Kaiser-Meyer-Olkin (KMO) measure for sampling adequacy was 0.74 and the Bartlett test of sphericity was significant at $p < 0.001$, indicating the data were suitable for factor analytic procedures. The analysis suggested three dimensions with eigenvalues > 1 , explaining 68% of the variance. After oblique rotation the anticipated patterns of factor loadings were clearly

found. All items loaded > 0.50 on their anticipated dimension, while cross-loadings did not exceed 0.15.

Table 1 also lists five variables that we used as control variables in the analysis presented hereafter: opportunity type, firm size, industry type, education level and experience. We included a dummy indicating if respondents were considering a product innovation (versus process innovation). Process innovations may be more difficult to implement, as they tend to affect internal organization processes more substantially. As Kanter (1988) notified, the more ideas need to be 'sold' to others, the less likely they are to be implemented. Secondly, firm size was added because previous innovation studies show that larger organizations are materially advantaged but behaviorally constrained when compared to small firms (Rothwell, 1983). Firm size could well influence individuals' decision to exploit, for example because they find it more difficult to acquire resources, or perceive to be restricted by lack of organizational agility. Thirdly, a dummy for services industries was included (versus manufacturing). Innovation in services tends to be less constrained by capital requirements (Shostack, 1984) which may also have consequences for the decision to innovate. Finally, level of education and career experience were included because previous studies showed that individuals are more likely to exploit opportunities if they are better educated (Casson, 1995) or experienced in their domain (Romanelli and Schoonhoven, 2001).

Log transformation was applied to our measure of firm size because it appeared not to be normally distributed (absolute values of skewness and kurtosis > 2). After this transformation all variables satisfied the basic assumptions of the regression models presented hereafter. Correlations between the variables are shown in table 2.

Table 2. Correlation matrix (n = 160)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) decision to innovate								
(2) attitude	0.19*							
(3) subjective norm	0.19*	0.28**						
(4) perceived behavioral control	0.34**	0.10	0.12					
(5) product innovation	0.13	0.05	-0.05	0.01				
(6) log firm size	0.13	0.02	-0.12	-0.03	0.03			
(7) service industry	0.10	0.08	0.02	0.06	-0.07	-0.24**		
(8) education level	0.10	0.11	-0.11	-0.03	0.16*	0.07	0.01	
(9) experience	-0.02	0.04	-0.08	-0.06	-0.17*	-0.03	-0.05	-0.09

** p < 0.01; * p < 0.05; ^ p < 0.10

The largest single correlation is between the decision to innovate and perceived behavioral control. The reported correlations indicate no concerns for multicollinearity. As a rule-of-thumb, multicollinearity problems may be present if correlations exceed absolute values of 0.80 (Hair et al., 1998: p. 189).

4. Results

We conducted binary logistic regression analysis to test our hypotheses on the decision to innovate. Binary logistic regression is a form of regression which is used when the dependent is a dichotomy and the independents are of any type (Verbeek, 2004). Logistic

regression applies maximum likelihood estimation after transforming the dependent into a logit variable (i.e. the natural log of the odds of the decision to exploit). We thus estimated the relationship between planned behavior constructs and the odds that high tech small business owners decide to exploit. We first centered our measures around their mean scores and computed interaction terms by multiplying the mean centered values for the various two- and three-way combinations of attitude, subjective norm and perceived behavioral control (cf. Jaccard, 2001). Next, various specifications of the model were applied by entering the independent variables and interaction terms at successive steps.

Table 3 presents the results. The goodness-of-fit of logistic regression models is assessed by comparing the transformed loglikelihood value -2LL with the previous model. The difference between both values follows a χ^2 -distribution and may be tested accordingly (Verbeek, 2004). Other fit measures include the hit rate (representing the share of correctly classified cases) and Nagelkerke's R^2 (indicating the strength of association in the overall model).

Table 3. Binary logistic regression models of the decision to innovate (n = 160)

	Models				
	I	II	III	IV	V
<i>Effect parameters:</i>					
constant		-2.28**	-2.91**	-3.04**	-3.02**
product innovation		0.65	0.62	0.68	0.71
log firm size		0.55^	0.71*	0.74*	0.70^
service industry		0.62^	0.57	0.57	0.60
education level		0.51	0.84	0.85	0.88
experience		0.01	0.02	0.02	0.02
attitude (A)			0.18	0.26	0.26
subjective norm (SN)			0.62*	0.66*	0.80*
perceived behavioral control (PBC)			1.07**	1.02**	0.83**
A*SN				0.35	0.08
A*PBC				0.28	0.40
SN*PBC				0.05	0.00
A*SN*PBC					1.14*
<i>Model fit:</i>					
hit rate	56.3%	60.9%	69.5%	68.9%	70.9%
Nagelkerke R^2		0.075	0.262	0.283	0.318
-2LL	207.96	197.76	173.62	170.63	165.51
Δ -2LL		10.20	24.14	2.99	5.12
Δ df		5	3	3	1
significance		^	**		*

** p < 0.01; * p < 0.05; ^ p < 0.10.

The first model was an empty model (estimating only the intercept) to obtain baseline values for -2LL and the hit rate. It appeared that 56.3% of the sampled firms is classified correctly, reflecting the share of high tech entrepreneurs who did not implement their opportunity one year after they first reported it to us.

The second model added the control variables to the equation. This diminished the transformed log-likelihood value (Δ -2LL = 10.20) with marginal significance (p < 0.10). With the exception of experience, the effect parameters of all had their anticipated sign, but only log transformed firm size and the dummy for services industries were

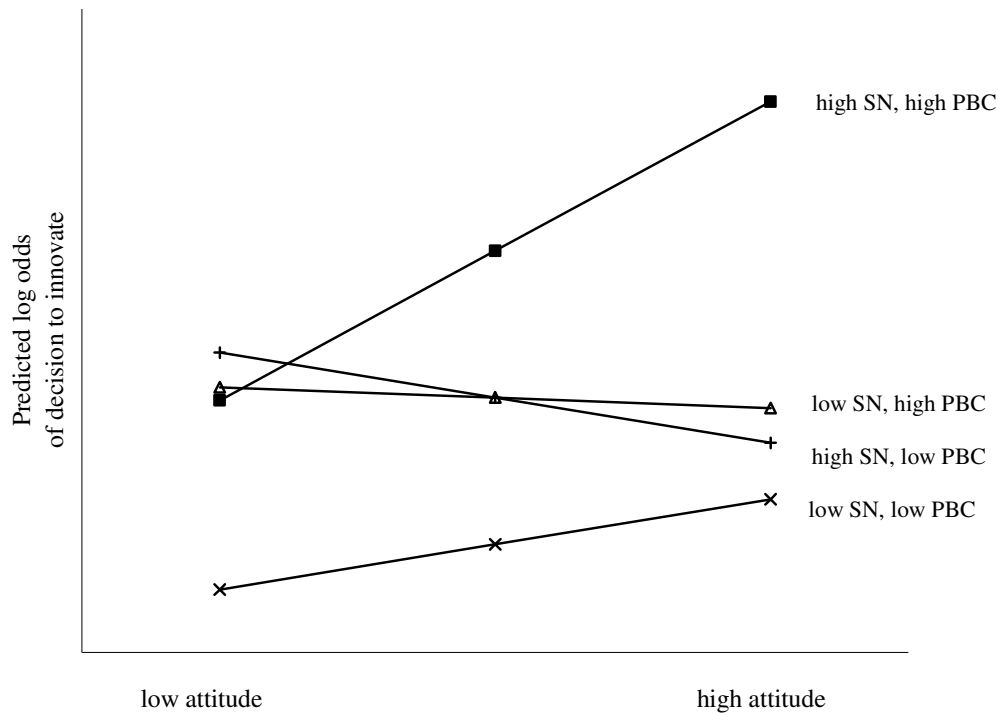
marginally significant. We remark that despite our substantial data collection effort the sample size is relatively small, which diminishes the power of our estimates.

In the third model we entered the planned behavior constructs to test hypotheses H1-H3. Goodness-of-fit improved significantly ($\Delta-2LL = 24.14$ with $\Delta df = 3$, $p < 0.01$). Besides, we found that the share of correctly classified cases (hit rate) and Nagelkerke's R^2 increased to 69.5% and 26.2%, respectively. From the Wald tests we conclude that after checking for the control variables and other planned behavior constructs, attitude toward the opportunity is not related to the decision to innovate. Its effect parameter was non-significant ($b = 0.18$, $p > 0.10$), and hypothesis H1 is not confirmed. In the discussion section we will elaborate on this result. As for subjective norms, we found that the effect parameter ($b = 0.62$) was significant at the 5% level. This implies that a one unit increase in perceived subjective norm increases the odds of opportunity exploitation by $\exp(0.62) = 1.86$. Hypothesis H2 is supported in our sample of high tech entrepreneurs. Finally, for perceived behavioral control, we found a strong and positive connection with the decision to exploit ($b = 1.07$, $p < 0.01$). This implies that favorable perceptions of one's ability to exploit are clearly correlated with the eventual decision - such perceptions increase the odds of exploitation by $\exp(1.07) = 2.92$. Hypothesis H3 is supported.

Following Jaccard's (2001) recommendation of hierarchically well-formulated models, the fourth model contained all two-way interactions between attitude, subjective norm and perceived behavioral control. This model only served as a baseline to test the proposed three-way interaction in the next step. One notable finding however was that none of the two-way interactions was significant.

The fifth model tests hypothesis H4 on the interaction between the three focal independent variables. We found that model fit improved significantly ($\Delta-2LL = 5.12$, $p < 0.05$). We also found that the hit rate and Nagelkerke's R^2 were better compared to model IV. To further analyze the significant effect parameter ($b = 1.14$, $p < 0.05$), we rearranged the regression equation in simple regressions of the decision to innovate, with the entrepreneur's attitude as the focal independent variable, and at conditional values of subjective norm and perceived behavioral control. Following Jaccard (2001), we evaluated these simple regressions at high scores (one standard deviation above the mean) and low scores (one standard deviation below the mean) for both moderator variables. Figure 1 shows the relationship between attitude and the predicated log odds of the decision to innovate at various combinations of subjective norm (SN) and perceived behavioral control (PBC).

Figure 1. Simple binary logistic regression models of the decision to innovate (n=160)



We found that at high scores of subjective norm and perceived behavioral control, the relationship between attitude and the odds of opportunity exploitation was positive and significant. The simple regression equation was estimated as $D(ecision) = 1.16 * A(ttitude) - 1.88$, with a significant effect parameter at $p < 0.05$. For all other regressions in figure 1 the estimated effect parameters were not significantⁱⁱ. This result suggests that attitude and the decision to innovate are connected only if entrepreneurs perceive their close ties to be supportive and to be in control when exploiting the opportunity. Hypothesis H4 is supported.

We also conducted the simple regression analyses from the perspectives of subjective norm and perceived behavioral control. For subjective norm, we found that the connection with the decision to innovate was stronger at simultaneous high levels of attitude and perceived control. For perceived control, a similar result was obtained - the correlation with the decision to innovate was stronger when respondents perceived favorable attitudes and subjective norms. To further illustrate the relationships we computed the descriptive statistics that can be found in the annex to this paper. The annex gives the share of respondents which decided to implement their identified opportunity at various combinations of the antecedent variables. When high tech small business owners scored above the mean on all three constructs, 79% indicated to exploit the opportunity. When respondents scored below the mean on all constructs, only 17% did.

Finally, we conducted a sensitivity analysis to check if our findings were not a result of overfitting the data with too many independent variables. For each independent variable one popularly needs ten outcomes in the sample (Peduzzi et al., 1996), a rule of thumb that is violated here. This may cause large estimated coefficients and/or estimated

ⁱⁱ For high SN and low PBC the equation was estimated as $D = -0.51 * A - 3.02$ with $p > 0.10$.
 For low SN and high PBC the estimate was $D = -0.08 * A - 3.02$ with $p > 0.10$.
 For low SN and low PBC the estimate was $D = 0.48 * A - 4.16$ with $p > 0.10$.

standard errors. Although it has recently been argued that the rule of ten events per independent variable is probably too conservative (Vittinghof and McCulloch, 2007), we did investigate if we would find similar results with more parsimonious models. Since our control variables of product innovation, education and experience were not significant, we ran a range of models in which these variables were omitted. Results were identical, i.e. significant effect parameters for subjective norm, perceived control and the three-way interaction term, while the other parameters were insignificant.

5. Discussion

Although the literature recognizes decision-making as an essential part of the entrepreneurial process, previous work has measured and modeled the decision to innovate only indirectly. We felt challenged by Shane's (2003) recommendation to examine the actual decision to exploit opportunities rather than the static state of being (or becoming) an entrepreneur. Thus, in this paper, we focused on high tech small business owners to explore the antecedents of their decision to innovate, i.e. to exploit identified opportunities for innovation that they had already identified. In doing so, we hoped to contribute to the literature by giving more precise explanations for individual differences in opportunity exploitation.

Drawing on social psychology (the theory of planned behavior), entrepreneurship and organizational behavior literature, we hypothesized that the decision to innovate is preceded by favorable attitudes toward identified opportunities, favorable subjective norms of close ties, and perceived control to actually exploit the opportunities. Our approach was multidisciplinary - we also included organizational behavior literature to develop our hypotheses because of its clear parallels with the entrepreneurship literature. Our overall conclusion is that the planned behavior constructs are well applicable and help to explain the decision to innovate. In terms of model strength, our findings are in line with earlier work, i.e. meta-analytic evidence found the share of explained variance in planned behavior studies to be in the 28-34% range (Albarracín et al., 2001; Godin and Kok, 1996). In our logistic regression models, Nagelkerke's pseudo- R^2 was not far from this range.

Surprisingly, we found no evidence for our hypothesis that a positive attitude toward an identified opportunity is related to the decision to exploit. In previous work with planned behavior constructs, attitude is usually a very strong and significant predictor of behavior, but here we found no significant relationship. This may be caused by the type of decision that is under investigation. Conditions for innovation are possibly more severe compared to other decisions that have been studied with the theory of planned behavior. Compared to technology adoption, health issues and choice of leisure activities, innovation is heavily characterized by uncertainty - especially in small firms. A positive attitude may simply not be enough for business owners to engage in opportunity exploitation.

Alternative reasons why correlations between planned behavior constructs and outcomes fail to be significant were offered by Ajzen (1991). Prediction is often limited by the fact that attitudes - but also perceived subjective norms and behavioral control - may change. As we documented the decision to innovate after one year we cannot

exclude that this explanation has influenced our findings. Another reason may be that our screening of respondents resulted in selection bias. We noticed that the mean scores on our attitude measure were relative high - 5.84 on a scale coded 1 to 7 (see table 1). This suggests that respondents mainly reported opportunities that they found attractive. If respondents are unable to identify opportunities that they do not like - e.g., unattractive opportunities disappear from their radar immediately - this would imply that our data suffered from reduced variance on this construct. Future research on this issue is certainly called for (see hereafter).

The hypothesis that subjective norms are positively related with opportunity exploitation was supported. We found that favorable subjective norms increased the odds of exploitation by 1.86, implying that close ties are indeed influential. Given this result, we note that there have been relatively few studies on the role of close ties in entrepreneurial decision-making so far. As discussed in the theory section, entrepreneurship studies have mainly demonstrated that individuals are more likely to start a business when their parents, friends or spouses are self employed. In the case of existing business owners however, the subject of how close ties influence the decision to innovate is relatively uncharted. Social networks are mainly studied numerous times a source of resources and legitimacy in the phase of exploitation (e.g., Bruderl and Preisendorfer, 1998; Elfring and Hulsink, 2003), but not as an antecedent of decision-making.

As for the third proposed antecedent, our finding was that perceived behavioral control is strongly associated with the decision to innovate - the more high tech small business owners perceive to be able to effectively implement the opportunity, the more likely they are to proceed with it (the odds of exploitation increasing by 2.92). This finding is well in line with what previous work in both the entrepreneurship and organizational behavior literatures suggests.

Finally, in our exploration of interaction effects we found strong empirical support for a three-way interaction implying that all proposed antecedents need to be present simultaneously for opportunity exploitation to be much more likely. We found that attitude is significantly related with opportunity exploitation only under conditions of both favorable subjective norms and perceived behavioral control. Likewise, the influence of subjective norms and perceived behavioral control was stronger when respondents simultaneously reported high scores on the other two constructs. This suggests that in addition to their additive effects, there is a multiplicative influence of the planned behavior constructs.

Implications

To anyone with a professional interest in innovation by small business owners, and high tech ones in particular, our findings confirm that the decision to exploit is not just a matter of either 'like' or 'ability'. Close ties appear to be influential as well, are more importantly, exploitation is much more likely when all three antecedents are present. This evident proposition is relevant not for just small business owners, but also for a broad range of professionals who normally contribute to innovation in small firms and make money from that - consultants, suppliers, accountants and engineers for example. Our findings also have implications for policy makers interested in stimulating opportunity exploitation in small firms. Entrepreneurship and innovation are nowadays among the

main pillars of economic policies in basically all developed countries. To mention only one example, the European Commission (2008a) recently launched a Small Business Act with the following motivation:

'dynamic entrepreneurs are particularly well placed to reap opportunities from globalization and from the acceleration of technological change. Our capacity to build on the growth and innovation potential of small and medium-sized enterprises will therefore be decisive for the future prosperity of the European Union. (...) Now it is time once and for all to cement the needs of SMEs in the forefront of the EU's policy and to translate the vision of the EU Heads of State and Government into reality' (p. 2).

Ever since the EU's Lisbon conference in 2000, national governments within the European Union have embraced the idea of stimulating innovation in business. Accordingly, individuals who decide to proceed with opportunities for innovation are very much needed. Given our findings, we notice that most of today's policy interventions aim to relieve hampering factors like access to finance and knowledge, by providing subsidies and fiscal incentives, or by stimulating public-private partnerships (European Commission, 2008b). Implicitly, policy makers intervene mostly on perceived behavioral control issues to stimulate innovation in small firms. Our results suggest that this approach has limitations, and that the attitudes of small business owners, as well as perceived social pressure from their close ties, are influential too. Current policies however tend to completely ignore these other antecedents. A serious reflection on what policy interventions are suitable to improve the attitudes of business owners and social subjective norms towards innovation behavior can eventually help to design better policy measures.

Limitations and suggestions

The research had some limitations that need to be addressed in future research. As discussed above, our findings call for future work to explore the impact of individuals' attitudes towards identified opportunities in more detail. It is recommended to organize future data collection efforts in such a way that small business owners will also report opportunities that they find less attractive. Such an effort would enable a better assessment of the impact of attitudes on decision-making. Likewise, our finding that subjective norms are significant suggests that more work is needed on how close ties are influential in the decision to exploit, rather than in the phase of resource acquisition. Moreover, it is a challenge to reproduce our findings with larger samples. Despite our significant efforts to collect data, the sample size was relatively limited ($n = 160$). As a consequence our significance tests had limited power, implying that some significant relationships may have been overlooked.

Another recommendation is to develop similar studies in other contexts. Due to our focus on high tech small business owners, our findings cannot necessarily be generalized to the broad business population. Remind that our sample contained only small business owners representing R&D performing firms, with recent technology-based product developments, and operating in manufacturing and knowledge intensive services industries. Such respondents are by definition used to engage in innovation behavior. In a way this was convenient because we could anticipate that many high tech entrepreneurs

would pass the screening. Thus, one should anticipate that in broader samples, business owners who are considering opportunities for innovation may be harder to find.

Future applications of planned behavior constructs may also be conducted in the context of individuals within organizations, i.e. in organizational behavior studies to explore employees' decision to innovate. In the current paper we focused on business owners, but we did include organizational behavior studies to justify our hypotheses. Given its parallels with the entrepreneurship literature, it may be presupposed that similar antecedents and interactions can be found in samples of employees. There may of course be differences as well - for example within organizations the influence of subjective norms may be more substantial.

Another challenge relates to the measurement of the decision to exploit. Remind that our dependent variable was dichotomous, indicating if high tech entrepreneurs had decided to exploit the opportunity one year after they first described it to us. In reality however, the decision to exploit is more subtle. Previous work suggests that decisions to innovate are not taken at a single, discretionary point in time. Rather, after an initial positive decision, individuals usually collect additional information and can possibly decide whether to terminate or go ahead (e.g., Gibcus and Van Hoesel, 2008; Mintzberg et al., 1976). In future work, we recommend a more subtle question with multiple answer categories to enable a distinction between opportunities which are exploited, still under consideration, or discarded. Such data should preferably be collected on subsequent points in time to enable more sophisticated models of the decision to innovate, and also allow the researcher to explore if and how attitude, subjective norms and perceived control change over time.

A disclaimer to our work presented here is that planned behavior constructs obviously represent only a fraction of the possible antecedents of opportunity exploitation. Extensive reviews of alternative antecedents can be found in Shane (2003) and not discussed here. Nevertheless, our findings suggest that the constructs of a well-known social psychological model can be applied to explore when small business owners are likely to engage in innovation. Our findings also suggest a relatively new direction for future entrepreneurship research by focusing directly on actual decisions made by individuals. Such an approach holds a potential for enhancing our understanding of opportunity exploitation in business.

Annex

The following table presents the share of high tech small business owners which decided to implement the identified opportunity at various combinations of the proposed antecedent variables.

number of respondents	attitude	subjective norm	perceived behavioral control	decision to innovate
18	-	-	-	17%
12	+	-	-	17%
17	-	+	-	41%
15	-	-	+	40%
25	+	+	-	36%
13	+	-	+	38%

26	-	+	+	42%
34	+	+	+	79%

+: score is above the average, -: score is below the average.

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