

# The Drivers of Entrepreneurial Intentions - An Empirical Study among Information Systems and Computer Science Students

*Completed Research Paper*

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## ABSTRACT

The last decade has seen an enormous increase in research on entrepreneurship education. However, there is so far only little research on entrepreneurship education in the field of information technology. To address this research gap, we conducted an empirical study based on an extended model of the Theory of Planned Behavior among Information Systems and Computer Science students. We found Attitude being the main driver for Information Systems students, and having discovered a Business Idea being the most influential factor for Computer Science students. In a more detailed analysis, the perception that being an entrepreneur does not come with a high risk to fail, the opportunity for self-fulfillment, and the chance of a high monetary reward could be identified as the crucial drivers regarding Information Systems students. Based on our findings, we discuss the implications for developing more entrepreneurially-oriented courses tailored to both groups of students.

## Keywords

Computer Science, Information Systems, Curriculum, Entrepreneurship, Software industry.

## INTRODUCTION

The last decade has seen a considerable increase in the number of articles published on entrepreneurship education (Kozlinska, 2011), which is “the process of providing individuals with the ability to recognize commercial opportunities and the insight, self-esteem, knowledge and skills to act on them” (Jones and English, 2004, p. 416). Although information technology (IT) has played a major role in more recent entrepreneurial activity (Foster and Lin, 2003), there is surprisingly little research on entrepreneurship education in this field. Existing research in this context mostly focuses on the need for more practically-oriented courses of teaching entrepreneurship (Abrahams and Singh, 2010; Foster and Lin, 2003; Kor and Abrahams, 2007; Schilling and Klamma, 2010), which resonates with the shift from passive and formal modes of transferring knowledge to a more “learning by doing” approach (Kozlinska, 2011).

One important aspect that could guide the development of such entrepreneurship courses for IT students has received no explicit attention. It has been acknowledged that differences in prior knowledge can impact the learning of entrepreneurial content (Foster and Lin, 2003). However, there is a lack of research that analyzes the differences how entrepreneurial intentions are formed in two groups that are highly relevant regarding their intention to establish a company: More business-oriented Information Systems (IS) students and more technically-oriented Computer Science (CS) students. Because of their different educational backgrounds, these two groups of students might possibly be driven by different factors to engage in entrepreneurial activities. With this empirical study, we address this research gap and thus hopefully contribute to a data-driven curriculum design in entrepreneurial IT education.

The remainder of this study is structured as follows: First, we will present the theoretical background and related work, from which we identify the research gap that our study aspires to close. We will then provide details on the Theory of Planned Behavior (TPB) from which we derive our hypotheses and formulate our exploratory research question. After providing details on the scale development and the item refinement process, we will present the results of the descriptive analysis as well as of the analysis of the measurement model and the path model. In addition, we will present the results of the

comparison between the groups of CS and IS students. We conclude our study with a summary of the results and by pointing out potential limitations.

## BACKGROUND

### Definitions

We draw on the definition by Jones and English (2004), who define entrepreneurship education as “the process of providing individuals with the ability to recognise commercial opportunities and the insight, self-esteem, knowledge and skills to act on them. It includes instruction in opportunity recognition, commercialising a concept, marshalling resources in the face of risk, and initiating a business venture” (p. 416). Given the abundance of different fields of entrepreneurship research, it is difficult to derive an all-embracing definition of the term “entrepreneurship”. In our study, entrepreneurship refers to the creation of a new enterprise in the software industry and not a spin-off from or consolidation of already existing companies (Tegtmeier, 2008).

Furthermore, our study focuses on “opportunity entrepreneurship” (Stephan, 2008, p. 11), which suggests that individuals engage in entrepreneurial activity to take advantage of an opportunity and to achieve their personal goals. In the literature, this motivation to establish a company is often termed “pull” motivation (Stephan, 2008). In contrast to “push” motivation, in which entrepreneurship occurs due to misfortune or imminent unemployment, “pull” motivation is growth-oriented, as entrepreneurs are not “forced” but strive to establish a company based on their own accord (Llisterri, Kantis, Angelelli and Tejerina, 2006). From this point of view, our concept of an entrepreneur is based on a behavior-oriented definition, which states that “entrepreneurship is concerned with the discovery and exploitation of profitable opportunities” (Stephan, 2008, p. 10).

### Related Work and Research Gap

In entrepreneurship research, two influential streams can be distinguished: Person-centric and intention-based models. In the first stream, research’s main interest lies in the entrepreneur as a person and his/her motivation to create an own company. This perspective has been dominated by the trait approach, which focuses on an entrepreneur’s character traits (Wanberg and Banas, 2000). Nevertheless, no character traits that lead to the foundation of a business could be clearly identified. In summary, behavioral scientists could not prove definitive correlations between personality traits and specific entrepreneurial behavior (Wanberg and Banas, 2000). Consequently, the trait approach has been criticized frequently.

The second stream, intention-based models, has evolved to be the most widely-used type of models to explain entrepreneurial behavior. In this type of models, the intention moderates the influence of specific factors on actual behavior. One of these intention-based models is Ajzen’s (Ajzen, 1991) TPB. Despite other alternative intention-based models in the field of entrepreneurship research, such as the “Shapero-Krueger Model of Entrepreneurial Intent” (Krueger, 2009), Ajzen’s TPB (Ajzen, 1991) has become widely accepted in entrepreneurship research.

However, the TPB has not been applied to study the intention to become entrepreneurs among IT students in general and the difference between CS and IS students in particular. Our study therefore serves to close this research gap.

## RESEARCH MODEL AND HYPOTHESES

Ajzen’s Theory of Planned Behavior (Ajzen, 1991) is widely accepted in entrepreneurship research as a way of understanding the intention to found a company (Stephan, 2008). Intention is seen as a direct determinant of human behavior. The Theory of Planned Behavior postulates three conceptually independent determinants of intention: Subjective Norm, Attitude, and Perceived Behavioral Control. The first predictor, Subjective Norm, relates to whether the people persons in an individual’s social environment deem the respective behavior desirable. The second predictor, Attitude, relates to whether a person evaluates the behavior under consideration favorably or unfavorably. The third antecedent of Intention is the degree of Perceived Behavioral Control, which refers to the perceived ease or difficulty of conducting behavior and is assumed to reflect past experience, as well as the anticipated impediments and obstacles. TPB predicts that the more favorable the Attitude, the stronger the Subjective Norm and the greater the Perceived Behavioral Control, the higher will an individual’s intention to conduct the behavior under consideration be (Ajzen, 1991).

Based on TPB’s general propositions, we derive the following hypotheses:

*H<sub>1</sub>: Subjective Norm has a positive impact on students’ Intention to start a new business.*

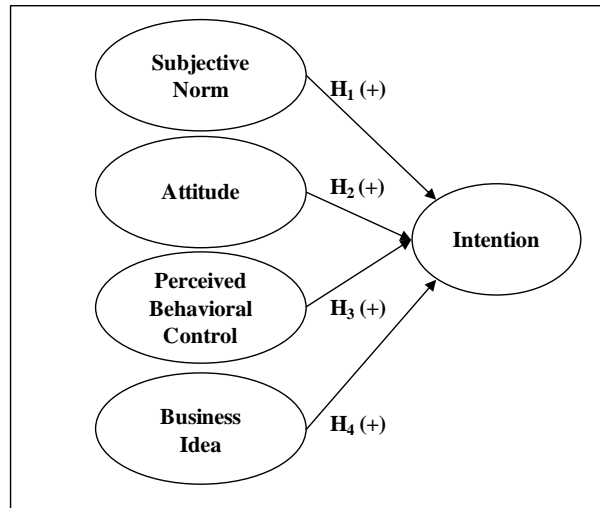
*H<sub>2</sub>: Attitude has a positive impact on students’ Intention to start a new business.*

*H<sub>3</sub>: Perceived Behavioral Control has a positive impact on students' Intention to start a new business.*

In addition to the three predictors that we derived from the TPB, we propose that an additional factor has a positive impact on students' Intention. Shane and Venkataraman (2000) emphasize the role of the "entrepreneurial opportunity" in starting a new company. While the discovery of an entrepreneurial opportunity is a subjectively controlled process, the opportunity itself is an objective phenomenon which existence is however not known to everybody. Based on these considerations, one can assume that students who were able to identify a specific business idea are more likely to start a company. We therefore propose:

*H<sub>4</sub>: Possessing a Business Idea has a positive impact on students' Intention to start a new business.*

Figure 1 summarizes the four hypotheses in a path diagram based on the TPB's base model extended by the construct Business Idea.



**Figure 1. Research Model**

From an exploratory perspective, we want to compare the importance of the four factors (i.e. the respective path coefficients) between the groups of CS and IS students. Identifying inter-group differences can then subsequently guide decisions to effectively develop more entrepreneurially curricula based on the most influential factors. We therefore formulate the exploratory research question:

*Do CS and IS students differ regarding the relative impact that the four factors Subjective Norm, Attitude, Perceived Behavioral Control, and Business Idea have on their Intention to start a new business?*

## SCALE DEVELOPMENT AND ITEM REFINEMENT

### Conceptualization and Development of the Indicators

The constructs applied in the TPB are usually measured reflectively and have been used in previous research. We could therefore adapt items that had already been developed and validated before (cf. Venkatesh, Morris, Davis and Davis, 2003). We additionally measured the constructs Subjective Norm, Attitude and Perceived Behavioral Control formatively. With the help of this approach, we are not only able to draw a general conclusion (MacCallum and Brown, 1993) regarding whether a student believes that the social environment approves of the decision to start a new company (Subjective Norm), whether the student views being an entrepreneur as something positive (Attitude), or whether the student believes that he/she is capable of setting up a new company (Perceived Behavioral Control), but also from which specific influences these beliefs stems from.

In order to generate formative indicators, we first analyzed studies which had already developed a measurement instrument based on the Theory of Planned Behavior. The formative items from these studies were collected and, if necessary, complemented with information from qualitative interviews with several founders of software companies. Based on these steps, the formative indicators were chosen to measure Subjective Norm, Attitude, and Perceived Behavioral Control.

In contrast, the construct "Business Idea" had not been operationalized and validated yet. As we could not revert to an already verified construct in the literature, we created seven reflective items and tested their unidimensionality and reliability

with a pre-test (see next paragraph). Sample items are “I have discovered a market niche in the software industry.”, or “I have an idea for a software product or a software service.”.

### Refinement of the Indicators

A pre-test (N=21) was undertaken in December 2011 to test the developed questionnaire in preparation for the main survey and to ensure that all the items were understood as intended. The pre-test generated positive feedback concerning the length and comprehensibility of the questionnaire. With the exception of small adjustments (e.g. reducing the Likert scale from seven to five points), we maintained the basic structure of the survey. We found that multicollinearity was not an issue regarding the formative indicators, as the variance inflation factors were smaller than 10 and the condition indices smaller than 30 (Diamantopoulos and Winklhofer, 2001). Additionally, principal component analysis showed that all seven reflective items of the Business Idea load on one single factor.

## SURVEY RESULTS

In this section, we will first describe the survey setting. We will then provide the results of the descriptive analysis, the analysis of the measurement and path model, and the group comparison of CS and IS students. To account for measurement error, we employ structural equation modeling instead of multiple linear regression for data analysis (Chin, 1998). Since our study focuses on identifying key drivers of entrepreneurial intention, we employ partial least squares structural equation modeling (PLS-SEM), which also makes no distributional assumptions such as multivariate normality (Hair et al., 2011).

### Setting and Descriptive Results

We distributed the two-page questionnaire to students from three German public universities related to students’ intention to start a new company in the software industry. We focused on bachelor and master-level students, who participated in nine selected lectures during the winter term 2011/2012. The data was collected during January and February 2012. We decided in favor of a paper-based and not an online survey as we expected a higher response rate (Schnell, Hill and Esser, 2005). A total of 598 questionnaires were distributed and 402 completed responses were received, yielding a response rate of 67.22%. This rate reflects the respondents’ high interest in the research subject. The sample (N=402) consists of 295 (73.4%) male and 107 (26.6%) female students in IS (44.3%), CS (20.4%), and Media Informatics (27.9%). Furthermore, 7.4% of the respondents took CS as a minor. 24.4% of the respondents pursued a master’s and 75.6% a bachelor’s degree. In addition to the constructs specified above, the questionnaire included control variables for the students’ backgrounds and socio demographics (Schnell et al., 2005).

### Test of the Reflective Measurement Model

The reflective measurement model for the five constructs, which were measured on a 5-point Likert scale, was assessed in terms of composite reliability (CR) and average variance extracted (AVE). The results can be found in Table 1.

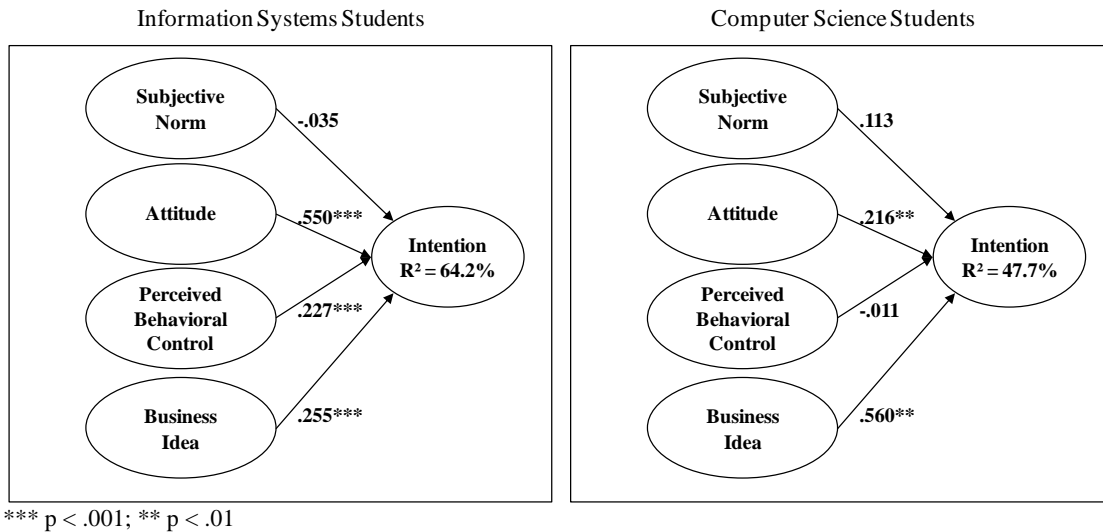
	CR		AVE	
	IS students	CS students	IS students	CS students
<b>Intention</b>	.97	.97	.92	.92
<b>Subjective Norm</b>	.94	.93	.84	.81
<b>Attitude</b>	.91	.86	.78	.68
<b>Perceived Behavioral Control</b>	.91	.89	.78	.73
<b>Business Idea</b>	.97	.97	.81	.82

**Table 1. CR and AVE per Construct and Group**

The analysis shows that CR scores range between .86 and .97, thus exceeding the recommended threshold of .7 (Fornell and Larcker, 1981). AVE values lie between .68 and .92. Factor loadings are all above .79 for both groups. As additionally the square root of all AVE values exceeds the respective inter-construct correlations, there is strong evidence of convergent and discriminant validity (Fornell and Larcker, 1981).

**Analysis of the Path Model**

We analyzed the path model for each of the two groups using the SmartPLS 2.0 (Ringle, Wende and Sinkovics, 2005) software. The values displayed in Figure 2 were obtained using case wise replacement, which resulted in samples of 175 IS students and 81 CS students. The significance levels were obtained through bootstrapping with 5,000 samples.



**Figure 2. Path Coefficient for IS and CS Students**

As can be seen, Attitude, Perceived Behavioral Control and Business Idea have a significant impact on IS students’ Intention. For CS students, Attitude and Business Idea have a significant impact. Although we therefore have to reject H<sub>1</sub>, we can accept H<sub>2</sub>, partially accept H<sub>3</sub> (as Perceived Behavioral Control only has an impact for IS students), and accept H<sub>4</sub>.

To answer the exploratory research question whether the factors’ impact on Intention differs between the two groups, we conducted a group comparison of the path coefficients based on Henseler and Fassott (2010) for the constructs Attitude, Perceived Behavioral Control, and Business Idea. The results of this analysis can be found in Table 2.

Paths	Path coefficients		p values for difference
	IS students	CS students	
Attitude → Intention	.550	.216	.000
Perceived Behavioral Intention → Intention	.227	-.011	.016
Business Idea → Intention	.255	.560	.001

**Table 2. Group Comparison of Path Coefficients**

The analysis shows that Attitude and Perceived Behavior Control have a stronger impact on Intention for IS students than for CS students, whereas Business Idea has a stronger impact for CS students.

Attitude turned out to have the strongest impact on IS students. As we additionally measured the construct with formative indicators, we could identify the strongest drivers for Attitude through a redundancy analysis (Cenfetelli and Bassellier, 2009) by analyzing the impact of the formatively measured construct on the reflectively measured construct. T-values for the formative items were generated using the SmartPLS bootstrapping procedure with 5,000 samples. The results are displayed in Table 3.

Drivers of Attitude	t-values
Self-fulfillment	4.103***
High risk to fail (negatively coded)	2.469*
High monetary reward	2.459*
Working Independently	1.217 <sup>n.s.</sup>
High social status	0.413 <sup>n.s.</sup>
High work load (negatively coded)	0.327 <sup>n.s.</sup>

\*\*\* p < .001; \*\* p < .01; \* p < .05; n.s.: not significant

**Table 3. Drivers of Attitude**

Only the perception of a high risk to fail, an opportunity for self-fulfillment, and the chance of a high monetary reward turned out to be significant drivers of Attitude. Working independently, achieving a high social status and the expectation of a high work load were found not to have a significant impact. Analysis of variance inflation factors, which were all below 1.4, indicated no issues of multicollinearity that might have possibly confounded our analysis.

As we integrated Business Idea as a fourth construct into TPB, we analyzed the magnitude of this construct's impact on Intention by calculating effect sizes for both groups of students. Business Idea had a small to medium effect of .13 for IS students and a large effect of .52 for CS students (Chin, 1998; Cohen, 1988). We therefore conclude that integrating Business Idea can considerably increase TPB's explanatory power regarding students' behavioral intention.

### CONCLUSION, DISCUSSION AND LIMITATIONS

The results of our study show that IS and CS students are driven by different factors regarding their intention to start a company in the software industry. Attitude emerged as the most influential factor for IS students, whereas having discovered a Business Idea turned out as the most important aspect for CS students.

The results could have consequences for the development of entrepreneurship curricula for IT students. Above all, IS and CS students are driven by different factors regarding their entrepreneurial intentions. Therefore, designing effective curricula for both groups need to take these differences into considerations. Entrepreneurship courses for IS students should focus on fostering a positive Attitude towards founding an own company. In general, this may include presenting entrepreneurship as an attractive career choice for students after graduation. More specifically, recommendations based on the three formative drivers that turned out to shape students' Attitude could show the most promise. First, courses should emphasize that being an entrepreneur is not necessarily a high-risk endeavor when certain steps are followed, such as creating a detailed business plan, conducting a thorough market and competitor analysis, and choosing co-founders that complement one's own strengths and competences. Second, entrepreneurship should be clearly depicted as a great route to fulfill one's own dream. Entrepreneurship provides the unique opportunity to build a company that delivers products or services that a founder can be proud of. Third, our analysis shows that it is not only intrinsic factors that motive potential founders. The expectation for a high extrinsic monetary reward turned out to be a driving factor. Therefore, courses could improve students' Attitude by giving examples of founders who sold their company successfully. However, even the drivers that did not turn out to be significant can guide future entrepreneurial curricula. For example, courses do not need to downplay the high work load of being an entrepreneur as it has no negative impact on students' Attitude.

In contrast, having a Business Idea emerged as the strongest predictor for CS students. As having a Business Idea combines technological knowledge with the knowledge how to exploit it commercially, courses for CS students should not restrict themselves to only teaching the latest technologies. Rather, courses should present these technologies in a business-relevant way which clearly shows how these technologies affect the operations of current business or how these technologies have the potential to disrupt whole industries. We are explicitly not demanding that CS courses should be less technical. Instead, we recommend embedding the technical content in a way that fosters seeing technology as a means and not as an end. This could possibly involve a stronger focus on the teaching of business models (Osterwalder, Pigneur and Tucci, 2005) and how new technologies might have an impact on these. Moreover, courses in creative thinking could help CS students to connect different areas of their expertise and combine them to create innovative entrepreneurial ideas.

From a theoretical point of view, our study also indicates that studies that analyze entrepreneurship can benefit from including the construct Business Idea into TPB's base model. As Business Idea turned out to be a significant predictor for

both groups of students (with an effect size of .13 for IS and .52 for CS students), incorporating this construct can increase the predictive power of models based on the TPB.

There are some potential limitations to our study. First, we confined our study to students of three German public universities. Further research with a more representative sample could reveal whether this might have biased the results. Second, a replication of our study in different countries could show if our results are culturally influenced and whether IS and CS students in other countries are driven by different factors. Third, as our study is cross-sectional, only a longitudinal study could show whether students' intentions to become entrepreneurs actually translates into starting a new company. Fourth, although IS and CS students are an important source of entrepreneurial activity in the software industry, we did not include students from other fields, such as business, economics, or mathematics in our study. Further research should examine whether these groups of students are motivated by other factors than IS and CS students.

In summary, we hope that our study can provide valuable input for more data-driven curriculum development efforts. Our study can assist in tailoring entrepreneurship curricula to the specific needs of different groups of IT students, which in the long run can positively influence a nation's entrepreneurial activity.

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