THE EFFECT OF SOFTWARE DEVELOPERS' CAPABILITIES ON ENTREPRENEURIAL INTENTION IN ICT INDUSTRIES

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ABSTRACT

This study investigates the effect of software developers' capabilities on entrepreneurial intentions in the Information Technology (IT) and software industries. Five independent factors-technical skills, industry knowledge, creativity, cooperation and communication and benchmarking-were adopted for this study. Two factors of entrepreneurial self-efficacy and entrepreneurial motivation were selected as mediating factors in the relationship between independent factors and entrepreneurial intentions in the IT and software industries. Data were collected from entrepreneurs and employees working in these industries in northern Vietnam and statistically analysed using structural equation modelling. The analysis showed that software developers' capabilities significantly affected entrepreneurial intentions via two mediating factors.

Keywords: Software Developers' Capabilities, Entrepreneurial Intention, Industry Knowledge, Technical Skills, Creativity, Cooperation and Communication, Benchmarking, Entrepreneurial Motivation, Entrepreneurial Self-Efficacy.

INTRODUCTION

Entrepreneurship is a process by which individuals pursue opportunities to run their own business or to develop creative ideas inside the organisation where they work. It plays a vital role in new business creation, expansion of existing business and social and economic development. Entrepreneurship is very important, but identifying a goal and opportunities must be done first. The current point in time is a golden one to establish business opportunities in the Information Technology (IT) industry, given that our lives are becoming increasingly reliant on computer software. Furthermore, researchers and businessmen regard IT as a competitive tool in a business environment. There are many aspects of the IT industry that warrant study. However, focusing research on the human aspect, especially on developers, will be highly beneficial. There is an ever-increasing demand for software developers. In some parts of the world, the number of software developer vacancies is expected to rise by up to 30% by the year 2020. Software developers in the IT industry are responsible for designing the computer programmes and operating systems that we use in everyday life. From word processors to games and websites, software developers are the people who design these systems so that we can use them easily and efficiently. A software developer in the early stages of his career will be focussed on the design, maintenance and implementation of technology. As their careers develop, developers will move away from many of the day-to-day aspects towards project management and strategic roles as employees of the company. Software developers will then support the company when integrating

software into a business. After that, they will provide ongoing management support and recommend system updates. Information technology is a core ingredient of nearly every part of our everyday life. Many previous studies have described the entrepreneurial intention factors and processes that drive entrepreneurship to understand the role of IT in business more fully. More attention is being paid to the notion of IT capabilities in the business setting. These include a developer's capabilities, entrepreneurial capability and administrative capability. However, few studies have investigated how software employees, especially software developers, can become entrepreneurs in their own businesses. Hitherto, research concerning software developers has considered a vast number of factors that affect project outcomes, ranging from processes and tools to programming languages and requirement elicitation. They have rarely considered one of the most fundamental components of a software developer, i.e., what makes a software developer great? This basic question is at the foundation of nearly every part of our world's rapidly growing software ecosystem: employers want to hire and retain great developers, universities want to train great developers and young developers want to become great entrepreneurs. And yet our understanding of what characteristics define a software developer's expertise in this regard still lacks specificity, breadth and rigour. We are seeking answers to these questions; more specifically, we aim to identify the relationship between a software developer's capabilities and entrepreneurial intention in the Information and Communication Technology (ICT) industry. This paper is aimed at bringing essential knowledge to researchers and practitioners in the IT field. Moreover, the results of this study will enable businessmen and developers to envision the path to success more clearly. The experiment was undertaken in Vietnam, a country with a developing economy and a potential location for IT companies. This study will identify new opportunities for people who desire to be involved in both IT and entrepreneurship.

BACKGROUND

Literature Review

Software developer's capabilities

The relevance of the concept of capability is attested to by its adoption in various fields. Individual capability has been found to be the most significant determinant of performance among software developers (Brooks, 1987). Previous studies identified programming capabilities and human capabilities, such as the "*ability to work with others*". Bock-Google's vice president of people operations-indicated that a software developer's ability to learn on the job was critical, and also claimed that human judgment, inspiration, motivation and creativity were more important than technical knowledge. Similarly, McConnell (2004) argued that effective developers, in addition to technical skills, had various personality traits such as being humble about their creativity and communication capability. Lee and Han studied skill requirements for entry-level programmers/analysts. They found that application development, software, social, and business skills were highly valued and recommended that knowledge of technological trends, knowledge of business functions and general problem solving skills be included in future Information Systems/Information Technology (IS/IT) programs. Lethbridge (2000) found that a decreased level of importance is being placed on mathematics and basic science and new areas of emphasis, such as web-related skills are emerging. Fang et al. (2005) found that personal/interpersonal skills such as creativity were more important than core IT skills and organisational knowledge. Conversely, Abraham (2006) found that technical skills were the most

desired in new hires. They also reported that these technical skills were more likely to be outsourced and that the skills associated with the "*business content*" found in IS curricula were more likely be retained in the IT major. Kim (2006) found that soft skills such as management, communication, and cooperation should be given more emphasis in IS/IT curricula.

Entrepreneurial intention (EI)

The entrepreneurial intention of an individual is defined as the alleged desire to start a business or to form a new organisation in the future (Gartner, 1988). Entrepreneurial intention is also defined as the commitment to performing behaviour that is necessary to physically start a business venture (Krueger et al., 2000). Entrepreneurial intentions are assumed to predict an individual's choice to found his or her own firm (Ajzen, 1991). Meanwhile, Krueger and Carsrud (1993) defined the term employment status choice as "*the individual decision to enter an occupation as a waged/salaried individual or as a self-employed one."* In other words, it is the motivation for an individual to become self-employed in contrast to organisational employment. Intentions are assumed to capture the motivational factors that influence a behaviour; they are indications of how hard people are willing to try and how much of an effort they are planning to exert to perform the behaviour. Greater the intentions, stronger the motivation to engage in entrepreneurial behaviour (Ajzen, 1991). Therefore, investigating what factors determine entrepreneurial intention is crucial to entrepreneurship research. For example, Raposo (2006; 2008) found that individuals who evidence more propensities for creating start-ups seem to possess self-confidence and leadership capacity. The independent variable classified in this study is that of the software developer's capabilities, having the components of Technical Skills (TS), Industry Knowledge (IK), Creativity (CR), Cooperation and Communication (CAC) and Benchmarking (BM). The dependent variable is the Entrepreneurial Intention (EI). Entrepreneurial Self-Efficacy (ESE) and motivation are mediating variables. Table 1 summarises the operational definitions of the variables in this study.

Table 1
SUMMARY OF DEFINITION

Constructs	Descriptions	References
Technical skills	Skill, expertise or technical competence acquired through training and education or learned on the job and that are specific to each work setting related to the specific field.	Medina, 2010; Damooei et al., 2008.
Industry knowledge	Information acquired through sensory input about foundation knowledge and entrepreneurship. It markedly increases an individual's or a group's capacity for effective action.	Huber, 1991; Nonaka, 1994; Massad and Tucker, 2009.
Creativity	The process involving ability, orientation, state of mind or set of skills to make something new.	Cropley, 1999; Ward et al.,1995; Zarefard and Cho, 2018.
Cooperation and communication	The process of transfer, exchange of information, and coordination that takes place between partners for agreeing on common goals and for the coordinated achievement of common work results among the participants.	Bauknecht, 1995; Suchman, 1987; Lee and Jones, 2008.
Benchmarking	A systematic approach through which organisations can measure their performances against the best-in-class organisations. It is a powerful and effective tool to learn from others and thereby achieve excellence.	Attiany, 2009; Leibfried and McNair, 1992; Besterfield, 2011.

Entrepreneurial self-efficacy	The confidence an individual has in his or her competencies to successfully fulfil various entrepreneurial tasks throughout the different developmental stages of a start-up.	Izquierdo and Buelens, 2011; Zarefard and Cho, 2018; Chen, 1998.
Entrepreneurial motivation	Entrepreneurs' perceptions of their own abilities and the relevant business environment, the specific business idea, and the feeling of being activated, driven, incentivised, and inspired by goals of the entrepreneur.	Estay et al., 2007; Naffziger et al., 1994.
Entrepreneurial intentions	Individual's desire and attitudes with regard to starting a business or forming a new organization in the future.	Zarefard and Cho 2017: 2018; Cho and Gumeta, 2015; Kim and Cho, 2014; Gartner, 1988; Ajzen, 1991; Krueger et al., 2000.

Developing Hypotheses

Technical skills (TS)

Technical skills are defined as "*those skills acquired through training and education or learned on the job*" and are specific to each work setting. Technical skills are a skill, expertise or technical competence related to the field of engineering or technology of the developer (Medina, 2010). Technical skills or '*hard skills*' are often associated with the use of tools, equipment related to working properly and efficiently, and those related to all technical matters. Such skills are more easily recognised with the naked eye (Yahya and Rashid, 2001). Software developers can encounter numerous problems and difficulties in their jobs that challenge their technical skills. Thus, most have some programming capability; however, they also recognise that the industry is constantly changing and that the codes used today may not necessarily be the same as those used in the future. In terms of entrepreneurship, Ashley-Cotleur et al. (2009) state that there are a number of individual factors that motivate a person's decision to become an entrepreneur; these include technical skills, experiences and knowledge. These factors will make some people more self-efficient and more motivated. Papulova and Makros (2007) found that most entrepreneurs are technicians, yet they require management skills, and these skills seem to be lacking when it comes to business development. Papulova (2007) recognised four areas of managerial skills imperative for entrepreneurs working at small and medium-sized enterprises, including technical skills among others. Additionally, Freel (1999) identified technical skills in the workforce that have an impact on the successful entrepreneur. Based on this logic, the authors formulated the following hypotheses:

H1a: Technical skills required of a software developer positively affect entrepreneurial self-efficacy with regard to entrepreneurial intention in the ICT industry.

H1b: Technical skills required of a software developer positively affect entrepreneurial motivation with regard to entrepreneurial intention in the ICT industry.

Industry knowledge (IK)

Knowledge is the justified belief that increases an individual's or a group's capacity for effective action (Huber, 1991; Nonaka, 1994). The knowledge of developers is the knowledge of computer science fundamentals, including object-oriented programming, design patterns, algorithms and data structures, how computers work at a low level, hardware, operating systems, networking and databases. In our study, we divided industry knowledge into the three parts of

foundation knowledge, market knowledge and entrepreneurial knowledge. The foundation knowledge of developers has been discussed above. Market knowledge requires an understanding of the market context in which a business operates. Capabilities in market knowledge are usually a requirement of the leadership competencies of strategic orientation, commercial orientation and customer impact. Finally, entrepreneurial knowledge refers to an individual's appreciation of the concepts, skills and mentality expected of an entrepreneur (Jack and Anderson, 1999). Massad and Tucker (2009) indicate that this knowledge can be acquired and developed through consistent exposure to entrepreneurship activities. However, greater study of and training in markets and entrepreneurial knowledge would provide a platform for developers to act in ways such as identifying social problems (projects) in communities and determining entrepreneurial solutions through an entrepreneurial approach, or identifying competitors in a market or targeting a market for IT projects. These actions would help individuals appreciate the entrepreneurship process more fully. Linan (2004) explains that exposure to the business environment makes people more self-efficacious about their own abilities to become entrepreneurs. Moreover, Martin (2013) found a statistically significant relationship between knowledge and skills with entrepreneurship intention. Previous studies have proposed that knowledge provides the entrepreneur with the capacity to identify opportunities (Shane and Venkataraman, 2000). Entrepreneurial motivation enables individuals to use the knowledge that they have constructed through their experiences and social interactions to guide their decision making and behaviour in different stages of the entrepreneurship process. Thus, the following hypotheses were formulated:

H2a: Industry knowledge positively affects entrepreneurial self-efficacy with regard to ntrepreneurial intention in the ICT industry.

H2b: Industry knowledge positively affects entrepreneurial motivation with regard to entrepreneurial intention in the ICT industry.

Creativity (CR)

Many researchers have studied creativity in the systems development process. They usually consider creativity to be an important asset of a software developer but are challenged when it comes to explain exactly why this should be the case. For a software developer, creativity can be understood as a set of personal competencies, in the same way that professional skills such as object modelling, algorithm design and experience with a particular programming language are understood as competencies. Thus, a developer or project manager could understand their existing creativity competencies and set out to improve them. Several studies have identified a relationship between Self-Efficacy (SE) and the creativity of individuals. For example, Phelan and Young (2003); Tierney and Farmer (2002) established that some people are more creative than others and they will feel more self-efficacious or confident about themselves. Finally, the creativity process can differ. Entrepreneurial creativity leads to self-employment that provides individuals with a platform to express their creativity and to build their own business enterprise (Feldman and Boleno, 2000). A high level of creativity in an individual has a strong positive influence over entrepreneurial intention (Hamidi, 2008). Based on the above discussion, we present the following hypotheses:

H3a: Creativity positively affects entrepreneurial self-efficacy with regard to entrepreneurial intention in the ICT industry.

H3b: Creativity positively affects entrepreneurial motivation with regard to entrepreneurial intention in the ICT industry.

Cooperation and communication (CAC)

Communication encompasses the process of the transfer and exchange of information that takes place between communication partners. If the exchange of information serves to coordinate activities among team members, then this type of communication serves as the basis for the coordination of processes. Much of a software developer's time is spent communicating with others: with clients, peers, managers, suppliers, and others. Communication is indeed an essential requirement. Good communication skills can help one to become a better team player and reduce communication overhead, but good communication skills are not enough. Cooperation is the manner of coordination that is necessary for agreeing on common goals and for the coordinated achievement of common work results among the participants. Cooperation has become an essential part of software development, and distributed software engineering has emerged as an important research subfield (Suchman, 1987). Moreover, while researching the relationship between skills of software developers and entrepreneurial intention, we noticed that communication and cooperation are important in every step of business development, especially in the early entrepreneurial phases (Holt and Macpherson, 2010; Lee and Jones, 2008; Roodt, 2005). Davidsson (1991) stated that exposure and education are highly interrelated during the start-up of a new business venture. Furthermore, Papulova (2007) recognised four areas of managerial skills imperative for entrepreneurs working at small and medium-sized enterprises: technical skills, cooperation skills, conceptual skills, and communication skills. Therefore, we make the following hypotheses:

H4a: Cooperation and communication positively affect entrepreneurial self-efficacy with regard to entrepreneurial intention in the ICT industry.

H4b: Cooperation and communication positively affect entrepreneurial motivation with regard to entrepreneurial intention in the ICT industry.

Benchmarking (BM)

In business, benchmarking is a technique used by managers to improve the operations of their own department or organisation (Leibfried and McNair, 1992). Using the benchmarking process, organisations try to find the best practices applied in a business and identify ways to increase their performance and competitiveness. Benchmarking studies are often used in the commerce, real estate and industry and high-tech software businesses. In the IT industry, the benchmarking capability of a developer is the capability to compare and evaluate the abilities of a software application with other developers in their company and competitors in other companies. The Theory of Planned Behaviour (TPB) can be used to identify and compare the relationship between the benchmarking capability of developers and that of managers or entrepreneurs (Ajzen, 1985; Madden et al., 1992). Benchmarking is different from other behaviours previously investigated using the TPB. Benchmarking is done within a dynamic organisational environment in which there are multiple stakeholders. The complex nature of benchmarking when compared with behaviours usually investigated under the TPB provides a novel application of the theory into the area of management. In this way, prior experience with benchmarking was predicted to increase the overall predictive power of the three TPB factors (attitude, subjective norm and SE) and the relative influence of attitude on the intention to do business. Doll and Ajzen (1992) found that the power of TPB to predict intention was greater among people who had prior experience with the behaviour under examination. We surmised

that this principle would also apply to developers having benchmarking capability. Moreover, TPB factors that have a positive effect on entrepreneurial intention have been identified. Based on this discussion, the overall power of the three TPB factors to predict entrepreneurial intention is expected to be greater for people who have been involved in benchmarking projects than for people lacking experience in benchmarking. Additionally, the experience of entrepreneurial success can inspire entrepreneurial motivation to improve entrepreneurial capacity and cultivate ESE. Entrepreneurs should learn from the entrepreneurial experiences of others' successful benchmarking to enhance their entrepreneurial motivation and improve their ESE (Ana and Domingo, 2018). Thus, we propose the following hypotheses:

H5a: Benchmarking positively affects entrepreneurial self-efficacy with regard to entrepreneurial intention in the IT industry.

H5b: Benchmarking positively affects entrepreneurial motivation with regard to entrepreneurial intention in the IT industry.

Entrepreneurial self-efficacy (ESE)

Self-efficacy is the primary focus of social learning theory (Bandura, 1997). It explains an individual's behaviour based on the trust they have in their self-assessed abilities, which affects their intentions and efforts in relation to a planned activity (Chen, 1998; Naktiyok, 2010). Entrepreneurial self-efficacy refers to the confidence an individual has in his or her competencies to fulfil successfully various entrepreneurial tasks throughout the different developmental stages of a start-up (Izquierdo and Buelens, 2011). An important influential factor of SE is the preference for certain behaviour (Zarefard and Cho, 2018). Many studies have identified a significant relationship between ESE and entrepreneurial intention, signifying that individuals with higher ESE tend to show a higher level of entrepreneurial intention (Boyd and Vozikis, 1994; Jung et al., 2001; Piperopoulos and Dimov, 2015; Scott and Twomey, 1988; Tsai, 2016). Zhao (2005) revealed that individuals choose to become entrepreneurs most directly because they are high in ESE, that is, the belief that they can succeed in this role. Additionally, their results supported the critical mediating role of ESE in entrepreneurial intentions. Analysis of the influence of SE on entrepreneurial intentions requires a different approach to clarifying entrepreneurial efficacy; consideration of the broader human competencies associated with new venture development are needed. Based on this logic, we argue that high levels of ESE positively affect entrepreneurial intentions by fomenting positive capabilities of individuals with regard to entrepreneurial intention. Thus, we derived the following hypothesis:

H6: Entrepreneurial self-efficacy positively affects entrepreneurial intentions in the ICT industry.

Entrepreneurial motivation (EM)

Motivation is a desire to obtain a goal or value (Locke, 2000; Ryan and Deci, 1990; Crumbaugh and Maholick, 1964). The motivational process is something that happens every day and everywhere, as is it a natural process of the brain. In every decision or action, the brain subconsciously evaluates the opportunities and motivates a decision or action. Everyone who works or socialises with others is motivated, although the question remains of how motivated they are for certain tasks. Everyone faces the task of fostering, or more or less motivating, oneself and those surrounding them. Motivation is a broad and complex field with many theories (Ryan and Deci, 1990). Motivation has been classified as a "*unitary phenomenon*" (Ryan and

Deci, 1990) that varies from low to high levels. Motivation was identified as one of several driving forces behind entrepreneurs and their ventures (Amabile et al., 1996). Interest in entrepreneurial traits has also increased among psychology-based researchers (Baum and Locke, 2004). Due to its importance, researchers have examined a number of factors that influence the outcome of a venture (Collins et al., 2004) and motivation is argued to be one of these factors (Carsrud and Bränback, 2009). The presence of a link between intention and motivation has been widely recognised (Ryan, 2000) and it has been argued that the relationship between motivation and intention is not unidirectional (Carsrud, 2011). Elfving (2009) proposed a revised model of entrepreneurial intentions in which motivations, together with goals and opportunity evaluation, represent a main antecedent. Jordaan (2014) reported the presence of a causal relationship between motivation and entrepreneurial intention. The above considerations led us to formulate the following hypothesis:

H7: Entrepreneurial motivation positively affects entrepreneurial intention in the IT industry.

Research model

Our model, shown in Figure 1, was developed based on the research hypotheses noted above.

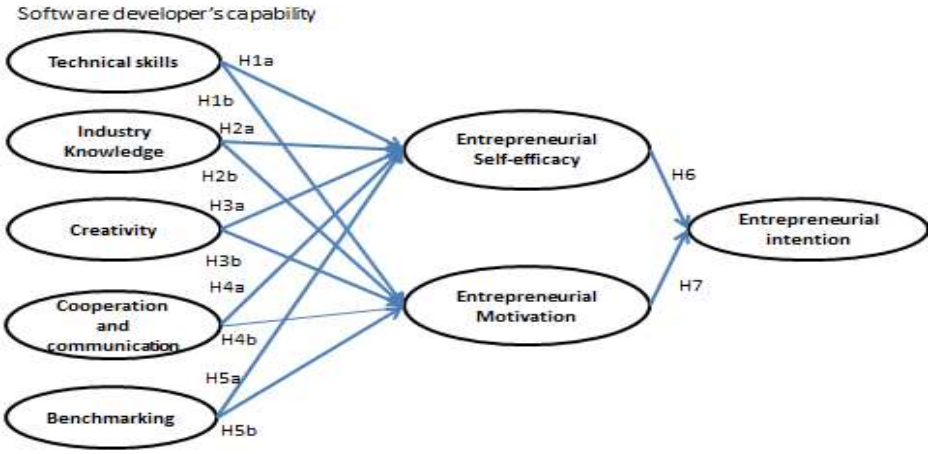

FIGURE 1
SOFTWARE DEVELOPERS CAPABILITY

METHODS

Data Collection

The data were collected using standard questionnaires. Our research subjects were entrepreneurs and software developers in small to large IT companies located in the north of Vietnam in Hanoi, the provinces, and municipalities. The survey was carried out during June 2018.

Table 2
PROFILE OF RESPONDENTS

Measure	Value	Frequency (Percentage)	Measure	Value	Frequency (Percentage)
Gender	Male	175 (67.8%)	**Position in company**	Entrepreneur or co-founder	38 (14.7%)
	Female	83 (32.2%)		Director or high-level manager	61 (23.7%)
Age	< 30	96 (37.2%)		Middle manager and employee	159 (61.6%)
	30–39	81 (31.4%)	**Size of company (person)**	< 10	27 (10.4%)
	40–49	39 (15.1%)		10–19	7 (30.2%)
	≥ 50	42 (16.3%)		20–29	33 (12.8%)
Education level	High school	37 (14.3%)		30–39	52 (20.2%)
	Undergraduate	160 (62%)		40–49	20 (7.8%)
	Master	42 (16.3%)		≥ 50	48 (18.6%)
	PhD	19 (7.4%)			
Major before	Computer or software related	128 (49.6%)	**Time running company (years)**	< 5	138 (53.5%)
	Engineering related	74 (28.7%)		5–10	72 (27.9%)
	Natural science	11 (4.3%)		> 10	48 (18.6%)
	Business	45 (17.4%)	**Location**	Hanoi	116 (45%)
	Human and social science	0		Thai Nguyen	42 (16.2%)
Occupation	Programmer/ developer	126 (48.8%)		Hai Phong	30 (11.6%)
	Analyst	13 (5%)		Bac Giang	25 (9.7%)
	Software architect	13 (5%)		Quang Ninh	18 (7%)
	Software engineer	66 (25.6%)		Bac Ninh	14 (5.4%)
	Consultant	40 (15.5%)		Yen Bai	11 (4.3%)
Type of company	Software industry	95 (36.8 %)		Lang Son	2 (0.8%)
	Manufacturing	10 (3.9%)	***Total number of respondents = 258**		
	Other service industries	51 (19.8%)			
	IT services	102 (39.5%)			

The questionnaire used a seven-point Likert scale ranging from 1 to 7, where 1 corresponded to '*strongly disagree*' and 7 to '*strongly agree*'; the questionnaire was launched via the web for ease of data collection. The population size was about 600, which was divided into three parts representing three different target groups: entrepreneurs-bosses, middle managers, and employees. There were 12 questionnaires sent to a total of 50 companies ranging in size from small to large. A total of 258 people (43%) completed the questionnaire. We excluded all cases where data were missing and also did not consider those people who did not state their field of study. For the final analysis, 258 questionnaires were used.

Measurement Model

The definitions and measures of each construct used for this research were primarily adopted from previous studies (refs). Tables 1 and 3 summarise the operational definitions and measurement items, respectively. Each measurement item was rated using a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree) in the questionnaire, with the exception of recommendation sidedness, which was calculated by the ratio of positive/negative reviews over the total number of reviews. The 258 responses sufficed to conduct a Confirmatory Factor Analysis (CFA) and Structural Equation Modelling (SEM) because they exceeded the minimum sample size of 200; 10 per estimated parameter appears to be the consensus (Schreiber et al., 2006). Normality and multicollinearity were examined using SPSS software to avoid any issues in the SEM analysis (Kline, 2005). A two-stage SEM methodology was completed. Confirmatory factor analysis is the first process in the two-step approach suggested by Byrne (2012). The initial analysis was attempted using all 24 independent variables, 13 mediating variables, and six dependent variables in the model. However, the results displayed unsatisfactory fitness indices. Having considered the modification indices generated as an output by the AMOS 21 program, variables having modification indices higher than 10 were excluded in descending order in an attempt to improve the goodness of fit. Through this procedure, four variables from the four independent factors including technical skills, industry knowledge and creativity and benchmarking were excluded. Five variables from the mediating factors and two dependent variables were also excluded. The resulting measurement model consisted of 24 variables across three independent factors (four for each variable: technical skills, industry knowledge, creativity, cooperation and communication and benchmarking), eight variables across two mediating factors (four for each of the ESE and entrepreneurial motivation variables), and four dependent factor variables (entrepreneurial intentions).

Table 3
MEASUREMENTS OF THE CONSTRUCT MODEL

Measurements	Mean (SD)	Alpha
Technical skills (TS)	5.44 (0.75)	0.826
I have the capability to design entire application architectures.		
I have the capability to design software and networks.		
I have the capability to understand the lifecycle of IT/software development.		
I have the capability to use software development tools.		
Industry knowledge (IK)	5.53 (0.82)	0.779
I have knowledge about IT and the software industry.		
I have knowledge about target markets and target customers with my software project.		
I have knowledge about customer trends with regard to software applications.		
My knowledge can filter information overload in my project.		
Creativity (CR)	5.41 (0.84)	0.85
I think of myself as a creative person.		
I have the capability to create ideas for new software.		
I have the capability to use new development tools to execute my project.		
I have the capability to build new software ideas from other people.		

Cooperation and communication (CAC)	5.63 (0.93)	0.899
I have the capability to cooperate with different technical parts simultaneously.		
I have the capability to participate in discussions with team members.		
I have the capability to cooperate with non-technical people.		
I have the capability to communicate with customers/users.		
Benchmarking (BM)	5.54 (0.83)	0.821
I have the capability to evaluate my current software and performance.		
I have the capability to compare my software with the best kinds of similar software.		
I have the capability to know the strengths and weaknesses of the best competitor to the project.		
I have the capability to innovate based on the achievements of others.		
Entrepreneurial self-efficacy (ESE)	5.42 (0.51)	0.696
I never avoid facing difficulties.		
I am a self-reliant person.		
I possess the skills and abilities required for my business in the IT and software industry.		
I know how to use IT capabilities to develop an entrepreneurial project.		
Entrepreneurial motivation (EM)	5.61 (0.51)	0.746
Developer's capabilities positively affect my motivation to be an entrepreneur.		
Developer's capabilities positively affect my motivation to begin my own business.		
Developer's capabilities positively affect my motivation to challenge for new services?		
Developer's capabilities positively affect my motivation to innovate present business.		
Entrepreneurial intentions (EI)	5.42 (0.49)	0.769
I have a strong intention to become my own boss.		
I have a start-up intention with new and innovative ideas.		
I always try to identify new business opportunities.		
I am interested in business in the innovation industry.		

RESULTS

Reliability and Validity

Reliability of the measurements was assessed using Cronbach's alpha and Composite Reliability (CR) scores. Table 3 shows that the Cronbach's alpha scores are above the required value of 0.6 (Hair, 2010). To evaluate convergent validity, each item's loading on its underlying construct should exceed 0.70 (Chin, 2010). Additionally, the average variance extracted (AVE) for each construct should be higher than the minimum recommended value of 0.50 (Bagozzi and Yi, 1988; Fornell and Larcker, 1981). Table 4 shows that the correlation between the independent variables together is low and statistically insignificant while the independent variables and the mediating variables have a correlation coefficient greater than 0.18 at the significance level of 0.01. The mediating variables and dependent variables have a correlation

coefficient greater than 0.5 at the significance level of 0.01. Thus, the independent variables are suitable for use in the model, and the mediating variables are also able to reveal the impact on the dependent variable. Therefore, the analysis results validate the measurement model. The observed value of the AVE in Table 4 is above the threshold level, indicating satisfactory fit of the model. The discriminate validity of the scale was analysed to indicate the extent to which the measures in the model differ from other measures in the same model (Bagozzi and Yi, 1988). The analysis results demonstrate the validity of the measurement model.

Table 4
CORRELATIONS

	TS	IK	CR	CAC	BM	ESE	EM	EI	C.R	AVE
TS	1								0.828	0.546
IK	-0.104	1							0.78	0.57
CR	0.029	0.019	1						0.899	0.691
CAC	-0.043	0.001	-0.065	1					0.851	0.589
BM	-0.046	0.063	0.011	0.054	1				0.747	0.526
ESE	0.362**	0.112*	0.201**	0.418**	0.004	1			0.744	0.522
EM	0.180**	0.413**	0.559**	0.166**	0.185**	0.369**	1		0.822	0.536
EI	0.350**	0.264**	0.283**	0.194**	0.164**	0.546**	0.603**	1	0.774	0.563

Model Fit

Table 5 presents all fit indices of the structural model relative to the recommended values. The ratio of X^2 to the degrees of freedom (df) is 1.346, which is below the recommended value of 3. The goodness of fit index (GFI), Adjusted Goodness of Fit Index (AGFI), Normed Fit Index (NFI), Turker-Lewis Index (TLI), and Comparative Fit Index (CFI) are 0.902, 0.883, 0.873, 0.959, and 0.964, respectively. Each of these indices exceeds the recommended value of 0.8, indicating that each is appropriate for the model. The value of the Root-Mean-Square Residual (RMSR) and Root-Mean-Square Error of Approximation (RMSEA) are less than 0.05 (0.037 and 0.033, respectively) and they are considered as acceptable values for a satisfactory factor analysis. Therefore, our structural model is a good fit to the results; this motivates the next process, i.e., hypothesis analysis.

Table 5
OVERALL MODEL FIT

X2	X2/df	GFI	AGFI	TLI	CFI	NFI	RMR	RMSEA
596.213	1.346	0.902	0.883	0.959	0.964	0.873	0.037	0.033

AMOS 24.0 software was used to test the structural model and validate the research hypotheses. The structural model involves estimating the path coefficient, which represents the strength of the relationship between the independent and dependent variables and R-squared, which is the variance explained by the independent variables (Chin and Dibbern, 2010). The results from testing the hypotheses are summarised in Table 6 and illustrated in Figure 2.

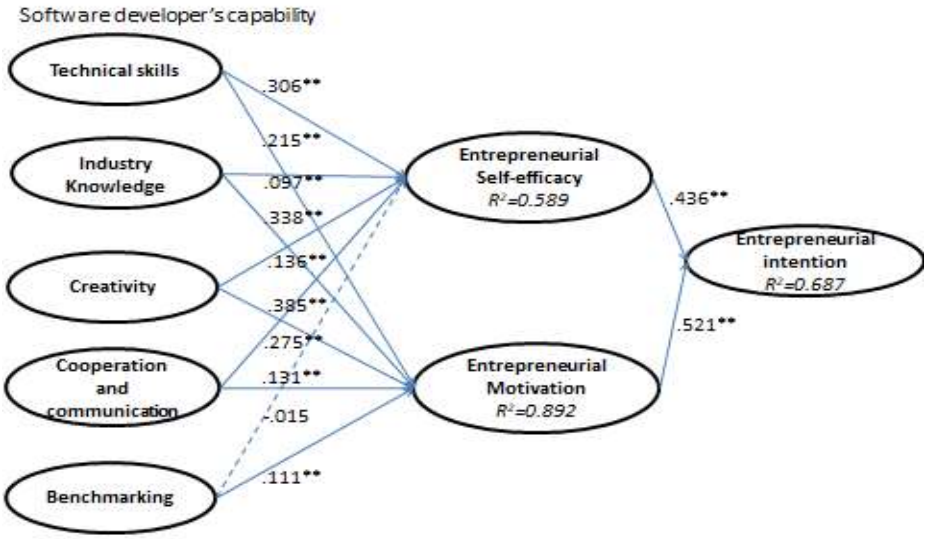

FIGURE 2
SOFTWARE DEVELOPER'S CAPABILITY (RESULTS)

CONCLUSION

Summary of the Results

In the global information economy, with the development of IT, the actions and outcomes of a software developer are deeply interconnected with the actions and outcomes of entrepreneurs. By making these connections explicit, in strategy formation and in business model design, an entrepreneur needs to understand what developers are doing so that he can more efficiently interpret new information, identify opportunities more effectively, evaluate alternative courses of action and, thereby, effectively link actions with expected outcomes. It is better when entrepreneurs are developers. This article brought together insights from various sources to present evidence-based lessons learned for each factor in the capabilities of a developer having the intention of becoming an entrepreneur. In the literature review, Ashley-Cotleur et al. found that there are a number of individual factors that motivate a person's decision to become an entrepreneur. These factors provide some people with more SE and more motivation than other people. Papulova (2007) recognised four areas of managerial skills imperative for entrepreneurs working at small and medium-sized enterprises, i.e., technical skills, cooperation skills, conceptual skills, and communication skills. These skills have also been labelled social skills in previous entrepreneurship research (Baron, 2007). Additionally, Freel (1999) identified technical skills in the workforce that impact the successful entrepreneur. Benchmarking is the most useful and effective skill helping the developer as entrepreneur in decision-making, and that knowing that success in business depends on achieving these goals. Benchmarking is aimed at improving performance by identifying competitive advantages and learning about products, services, and own operations by comparison with the best. Previous research examined the meaning of benchmarking in term of entrepreneurship but few studies related the effect of benchmarking with entrepreneurial intention. Our study addressed this issue. Moreover, to analyse the

entrepreneurial intentions of software developers' capabilities, ESE and attitudes were regarded as mediating variables. It was assumed that SE and motivation of young entrepreneurs toward entrepreneurial activities positively influence their intentions to run innovative start-ups. The results indicate that a developer having a higher degree of ESE and motivation will, as a result, have more confidence in his capabilities, which leads to stronger entrepreneurial intentions. It is supposed that ESE and motivation on the part of the developer are influenced by technical skill, industry knowledge, creativity, cooperation and communication, and benchmarking. This article concludes with an analysis of the research model. Our analysis validated the proposed research hypotheses of *H1a, H1b, H2a, H2b, H3a, H3b, H4a, H4b, H5b, H6,* and *H7,* while *H5a* was rejected. Based on the obtained results, our hypothesis concerning the dependence between software developers' capabilities and entrepreneurial intention is validated. Moreover, SE and motivation operate as important contributors to the development of start-up intentions and impose their impact through an individual's confidence and beliefs. To explain the result of the rejected hypothesis *H5a,* we believe that benchmarking is not a new theory in the entrepreneurship environment but it is new in terms of the IT environment; moreover, the data were collected in the north of Vietnam where most software developers do not have adequate business environment surroundings in which to learn and experience. It is clear that if the developers in our study had benchmarking capability, they would know that this capability is necessary for entrepreneurship. This also means that they would not feel ESE. The results of this study have valuable implications for the study of entrepreneurship and for public policy makers willing to stimulate start-up intentions with developers. The results also provide insights into how to promote developers to become entrepreneurs in the IT industry.

Limitations and Future Research

There are several limitations of this study that should be considered when interpreting its findings. First, although the sample size of respondents used in this study (258) was adequate for the analysis, it cannot be considered representative of the general population. It may have a regional limitation, which limits the generalizability of the results because the sample was adopted from IT companies that were all located in a few cities in Vietnam. However, different cities in Vietnam have different study and working conditions. For example, Hanoi is the capital and other cities are in the mountains. Additionally, different countries have different cultures and economics that lead to dissimilar conditions for running and developing companies. Therefore, the results cannot be applied directly to other countries that differ in their development of IT industries. Second, the survey participants in this study who completed the questionnaire were almost all company employees. Thus, the current study findings may be limited to software developers and entrepreneurs in their own IT companies. The present survey gives clear evidence that capability in software developers forecasts entrepreneurial intention when they have more SE and motivation. More specifically, the technical skill, industry knowledge, creativity, cooperation and communication, and benchmarking skills, which are hard and soft skills on the part of people, relate specifically here to software developers. This means that promoting and training the capabilities of software developers are very important in preparing future entrepreneurs. Although our investigation focussed on self-employed software developers, enterprising spirits are needed in all walks of life to keep up with unexpected changes that continue to occur in the contemporary world.

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