Entrepreneur's Human Capital and Business Model Innovation: The Meditation Role of Access to Start-Up Resources

Tran Nha Ghi[1], Nguyen Thi Phuong Anh[2], Nguyen Quang Thu[3] and Ngo Quang Huan[3]

[1]Thuy Loi University - Southern Campus, [2]Ba Ria - Vung Tau University and [3]University of Economics Ho Chi Minh City

Keywords	Abstract.
Access to start-up resources Business model innovation Entrepreneurial skills Managerial skills	Based on human capital theory, this study aims to explain start-up resources formation and business model innovation. The study examined the effect of entrepreneur's human capital (including managerial skills and entrepreneurial skills) on business model innovation via access to start-up resources as a mediator. The Partial Least Squares Structural Equation Modeling (PLS-SEM) was conducted with the size sample of 220 founders/ co-founders of start-up firms in Vietnam. The research results supported the positive links from managerial skills and entrepreneurial skills to business model innovation through the mediating mechanism of access to start-up resources. The study explored the meditation role of access to start-up resources between entrepreneur's human capital and business model innovation. In addition, the results provide practical value to entrepreneurs in improving managerial skills and entrepreneurial skills in order to facilitate the access to outside support resources and promote business model innovation. Finally, the study suggests some managerial implications for entrepreneurs, research limitations and further research directions.

1. Introduction

In the first phase of operation, most start-up firms lack the resources to operate. This is also the main reason leading to the failure of start-up firms in Vietnam. According to GEM [28], in Vietnam, the survival rate for starting a business in the first 3.5 years is 20.8%. This figure indicates that the rate of successful start-up businesses is still low. In addition, since the industry revolution 4.0 is thriving, start-up firms have many opportunities and challenges in the market. It is essential to conduct business model

innovation (BMI) in order to seize business opportunities, minimize risks and adapt to market fluctuations.

In Vietnam, the year 2016 has been identified as the year of start-up nation. Consequently, a significant number of start-up firms has been established in various areas of the country. They are provided with supporting resources from successful entrepreneurs, venture capitalists/angel investors and Government officials. The supporting resources are regulated in some issued policy documents such as Project 844 and the Law on Support for Small and Medium Enterprises. Start-up supporting resources include incentives in taxes, premises, technical facilities, capital and information related to production activities, etc. Nevertheless, the access to supporting resources of start-up firms is still limited (see Ghi et al. [17]). Therefore, the research questions are proposed: Which factors determine start-up firms' access to start-up resources? Do these factors drive the business model innovation?

The study of access to start-up resources is of great interest to many scholars around the world. A number of studies have explored access to start-up resources through the size of the network and the relationship quality in that network (see Semrau and Werner [32]), the resources gained from the relationship network (see Ju, Zhou and Wang [23]). Some other scholars argued that human capital plays an important role in entrepreneurs' success in equity crowdfunding (see Paiva and Rossi-Lamastra [29]), resources acquired in the developing period rely on the human capital of the founders (see Ko and McKelvie [24]). In addition, human capital and social capital take a critical part in firms' BMI activities (see Guo et al. [18]).

The theories of social networks and social capital that explains the formation of external resources has been used extensively in previous studies (see Ju, Zhou and Wang [23], Semrau and Werner [32]). Some studies have applied human capital theory in the field of entrepreneurship. For instance, specific human capital characteristics such as start-up experience and management experience affects equity crowdfunding (see Lim and Busenitz [25]); entrepreneurs' human capital promotes growth aspirations with the moderating role of regional entrepreneurial culture (see Capelleras et al. [9]). In addition, a number of other studies showed positive relation between entrepreneurs' human capital and firm performance (see Choi and Chang [12]; Alnoor [1]). The above study shows that the theory of human capital has been commonly used, however the theory of specific human capital in explaining access to start-up resources has not been widely applied. Moreover, applying the theory of human capital in the start-up process (for example, the process of implementing BMI) is the research direction proposed by Marvel, Davis and Sproul [27] after aggregating 109 articles in the field of management and entrepreneurship. In order to fill this research gap, this study examines the relationship between entrepreneur's human capital and BMI through the mediating role of access to start-up resources.

2. Literature Review and Research Model

2.1. Human capital theory in start-up activities

Once the theory of human capital is applied in the field of entrepreneurship, human capital contributes to the success of entrepreneurs in various ways (see Unger et al. [37]). Human capital is very important in identifying and creating business opportunities (see Marvel [26], exploring business opportunities (see Dimov [13]), accumulating new knowledge and creating competitive advantages for new businesses (see Bradley et al. [7]).

The theory of human capital includes general human capital (experience and education) and specific human capital (job-specific experience, self-employed experience and leadership experience) (see Becker [5]). The theory of human capital shows that individual characteristics help entrepreneurs get businesses in the difficult early stages (see Foss [15]). Marvel [26] has classified human capital into two categories: human capital investments (education, experience/training, recruitment) and human capital outcomes (knowledge, skills and abilities). Skills are the output of human capital. Skills applied in start-up activities can bring advantages in the start-up process (see Marvel [26]). Skills are developed through investment in training or experience. It can be developed in a combination of education and practice.

In this study, human capital is approached from Becker's view [5] which is specific human capital, referring primarily to entrepreneur's skills. Entrepreneur's skills consist of managerial skills and entrepreneurial skills (see Guo et al. [18]).

2.2. Access to start-up resources

From a resource-based view, the resource refers to all types of tangible and intangible assets such as finance, materials, labor, technology and organization (see Barney [4]). Start-up resources are not a simple combination of many different types of resources, but a set of core resources for the survival of new businesses. The research of Ju, Zhou and Wang [23] has identified start-up resources including finance, materials, technology and human capital. These resources are important components of start-up resources.

Entrepreneurs often have to rely on external resources to set up and develop a start-up project successfully. Access to start-up resources includes access to financial capital, knowledge, information and additional partners (see Semrau and Werner [32]). In this study, start-up resources are applied based on the views of Semrau and Werner.

2.3. Business model innovation

BMI indicates "the conceptualization and adoption of new ways of conducting economic exchanges" (Zott and Amit [39]). Rapid advances in technology have allowed businesses to fundamentally change the way of doing businesses. Therefore, business model designing becomes an important source of innovation; better business models would defeat better ideas or technologies (see Chesbrough [11]). Today, the chaotic market and fierce competitive environment have challenged businesses to compete and gain

competitive advantages. In a dynamic market, BMI implementation is necessary to replace the existing business model in order to cope with threats (see Chesbrough [11]; Heij, Volberda and Van den Bosch [20]) and create compliance with the new environment.

In this study, based on the definition of Zott and Amit [39] on novelty-centered business model design, BMI is to create or recreate existing business models by providing new value propositions, designing novel value-creation systems and building original value-capturing mechanisms.

2.4. Hypotheses development
2.4.1. Managerial skills and business model innovation

Human capital is required for enterprise innovation. Entrepreneur's managerial skills refer to the ability to organize, allocate and configure business resources. Entrepreneurial skills refer to the ability of entrepreneurs to sense and recognize business opportunities. Managerial skills help businesses to strengthen their competitive advantage by making the most of recognized opportunities; entrepreneurial skills allow businesses to build new competitive advantages by capturing new business opportunities (see Guo et al. [18], Ireland et al. [22]).

Managerial skills have the potential to drive BMI activities (see Guo et al. [18]) for some reasons. First, managerial skills relate to the coordination and reform of enterprises' resources, thus supporting the business model (see Sirmon et al. [33]). Managerial skills allow entrepreneurs to integrate, build and reformat resources to support the implementation of the strategy; entrepreneurs can design new business models as a mechanism for performing business strategies (see Casadesus-Masanell and Ricart [10]). Second, the business model requires enterprises to interact with the environment to achieve a combination of knowledge and resources (see Sirmon et al. [33]). Third, enterprises design new business models to seize business opportunities (see George and Bock [16]). Entrepreneur's managerial skills help enterprises achieve their goals by combining internal and external resources to exploit business opportunities (see Zott and Amit [39]). Therefore, hypothesis H_1 is proposed:

Hypothesis H_1: *Entrepreneur's managerial skills are positively related to business model innovation*;

2.4.2. Entrepreneurial skills and business model innovation

Entrepreneurial skills motivate businesses to recreate an existing business model. The business model reflects the organizational structure design to take advantage of commercial opportunities; firms create new business models to seize business opportunities (see Bock et al. [6]). Entrepreneurial skills are especially useful for sensing and shaping opportunities (see Tang and Murphy [35]). When entrepreneurs recognize new opportunities via their entrepreneurial skills, they will strive to take advantage of those opportunities through new products, processes or services, so businesses need to invent a creative business model (see Guo et al. [18]). Therefore, hypothesis H_2 is proposed:

Hypothesis H_2: *Entrepreneur's entrepreneurial skills are positively related to business model innovation*;

2.4.3. The mediating role of access to start-up resources

The entrepreneurs' skills mentioned include managerial skills and entrepreneurial skills (see Guo et al. [18]). These two skills have important roles in persuading investors to get funding for start-up resources. The major cause of failure of start-up firms in Vietnam is lack of human capital (skills, experience and expertise). In practical applications, human capital is frequently used as a selection criteria by venture capitalists when assessing the potential of start-up projects (see Zacharakis and Meyer [38]). Therefore, entrepreneur's human capital will help start-up firms in access start-up resources.

In addition, entrepreneurs' skills create a good signal and a strong impression to venture capitalists/angel investors and Government officials supporting local start-ups or other start-up support organizations. Thus, they will feel convinced and have confidence in entrepreneurs for the development potential of start-up projects and help facilitate start-up supporting resources such as information, financial capital, knowledge, and connecting partners. This is an important criterion to help start-up firms easily access the support resources from start-up support organizations.

In the first stage of operation, start-up firms lack financial capital, human capital and social capital to operate, which possibly leads to start-up failure. In the dynamic market with the outbreak of industrial revolution 4.0, it is essential to conduct BMI so that businesses can adapt to the environment and seize business opportunities. In order to implement BMI, start-up firms need internal and external resources. Through entrepreneur's skills, start-up firms gain information, financial resources, knowledge and increasing support/partnership from start-up support organizations. Access to new information, resources and knowledge will affect enterprise innovation (see Breuer and Ldeke-Freund [8]). To implement BMI, start-up firms certainly require financial capital (see Anwar and Ali Shah [2]). Designing a new business model requires firms to have a lot of information about customers, suppliers and competitors (see Timmers [36]). Therefore, the start-up resources acquired will help start-up firms implement BMI. Therefore, hypotheses H_3 and H_4 are proposed:

Hypothesis H_3: *Access to start-up resources mediates the relationship between entrepreneur's managerial skills and business model innovation*;

Hypothesis H_4: *Access to start-up resources mediates the relationship between entrepreneur's entrepreneurial skills and business model innovation*;

Figure 1 summarizes theoretical model combining the relationships among the constructs advanced by the above hypotheses (H_1-H_4). In this theoretical model, the study anticipates managerial skills to predict business model innovation (H_1). Entrepreneurial skills are further expected to positively relate to business model innovation (H_2). The study anticipates access to start-up resources as mediator to link managerial skills, entrepreneurial skills to business model innovation (H_3 and H_4).
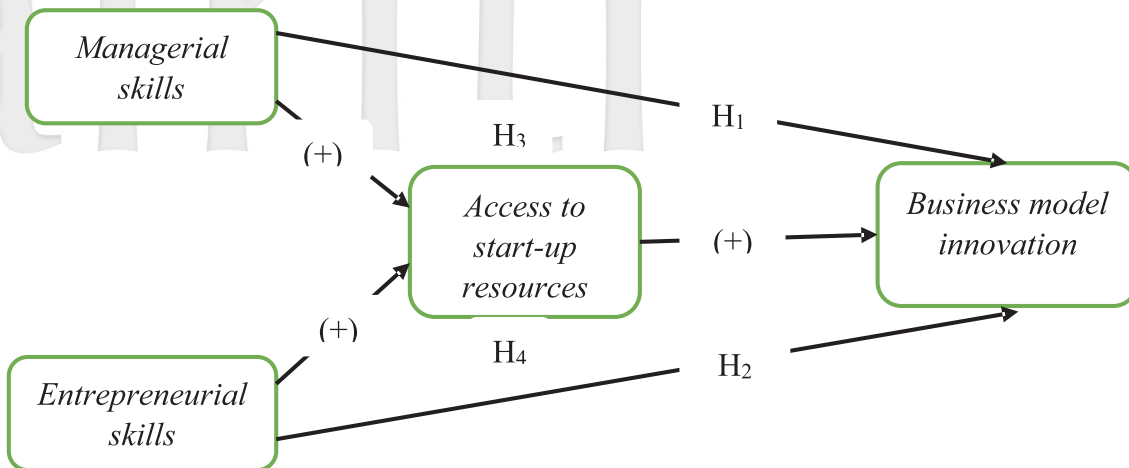
Figure 1: Proposed research model.

3. Research Methodology

3.1. Research process

This study comprised two phases: a pilot study and a main survey.

3.1.1. Pilot study

The pilot study consists of two main stages. Firstly, in-depth interviews with 7 experts who are founders/co-founders of start-up firms were conducted. The purpose of this stage is to adjust the terms from original scales to be suitable for the specific research context of this study. Secondly, the pilot study was undertaken by surveying 50 founders of start-up firms. In this phase, Cronbach's alpha reliability (α) and exploratory factor analysis (EFA) were used to preliminarily assess the scales. The results showed that all scales in the study satisfied the requirement for Cronbach's alpha reliability. Specifically, Cronbach's alphas of the scales measuring managerial skills, entrepreneurial skills, access to start-up resources and business model innovation were 0.929, 0.929, 0.865, and 0.907, respectively. Note that there were no items measuring the scales were deleted due to high item-total correlation (> 0.3). EFA (principal components with promax rotation) extracted four factors from the items measuring four constructs in the model with 73.662% of variance extracted at an eigen-value of 1.552. In addition, all factor loadings were high (≥ 0.5). In conclusion, the results of the preliminary assessment indicated that all the scales used in this study satisfied the requirements for reliability and validity. Thus, these measures were used in the main survey.

3.1.2. Main survey

The purpose of this main survey was to validate the measures and to test the structural model. In this study, SmartPLS 3 (see Ringle, Wende, and Becker [31]) was employed to estimate both the measurement and structural research model. Partial least squares structural equation modelling (PLS-SEM) is suitable for the study because it

allows processing data of a relatively smaller sample size, and does not demand normally distributed data (see Hair et al. [19]).

The measurement model is assessed by testing the Cronbach's alpha, composite reliability, convergent validity, unidirectional and discriminant validity of the scales. The structural model is evaluated through determination coefficient (R^2), predictive relevance (Q^2) and effect size (f^2). Furthermore, the Bootstrapping procedure of 5000 samples was applied to examine the hypotheses. Cohen's Indicator (f^2) was used to measure the effect sizes with the values of 0.35, 0.15, and 0.02 to signify large, medium, and small effects, respectively (see Henseler et al. [21]).

3.2. Measurement

In the model, four unidimensional constructs were investigated: managerial skills, entrepreneurial skills, access to start-up resources, and business model innovation. Managerial and entrepreneurial skills were measured by five items, adapted from Guo et al. [18]. Access to start-up resources was adjusted from Semrau and Werner [32], and was measured by three items. BMI was measured by nine items, adapted from Zott and Amit [39]. All items were measured by a 5-point Likert: (1) Strongly disagree, (2) Disagree, (3) Neutral, (4) Agree, and (5) Strongly agree (Table 1). All the measures were initially prepared in English and then translated into Vietnamese by an academic fluent in both languages. Back-translation ensured the reliability of the translation.

Table 1: Conceptual model.

Construct	No. of observed variables	Sources
Entrepreneur's human capital		
1. Managerial skills	5	Guo et al. [18]
2. Entrepreneurial skills	5	Guo et al. [18]
Access to start-up resources	3	Semrau and Werner [32]
Business model innovation	9	Zott and Amit [39]

3.3. Sampling

Sample selection criteria: founders/co-founders of start-up firms having four characteristics: (1) operating time does not exceed 5 years, (2) start-up projects applying technology/intellectual property, (3) a fast growth rate (e.g., revenues, customers) and (4) a different business model from available ones in the market. The main survey was conducted by using face-to-face interviews and online survey. A convenience sample of 220 founders/co-founders of start-up firms was interviewed in this survey.

In Vietnam, the government's start-up organizations regularly open short-term free training courses for entrepreneurs. Through researcher's relationships with start-up organizations, we were connected directly with founders/co-founders at training courses.

Therefore, hard-copy questionnaires were distributed directly to the respondents. In addition, founders/co-founders joined start-up clubs through social networks (e.g., Facebook and Zalo) in the localities. We contacted each member in the start-up club in advance. After receiving their consent, the link of online survey questionnaire was sent directly to founders/co-founders of start-up firms. Collected data will be entered SPSS 23 software and cleaned before official analysis.

4. Data Analysis and Results

4.1. Sample characteristics

The sample size is 220 founders/co-founders selected in Ho Chi Minh City, Ba Ria - Vung Tau province, Dong Nai province, Binh Duong province and some other neighboring provinces. In the sample, start-up firms operate mainly in the form of limited liability company (47%) and private enterprise (42%). In terms of operating field, start-up firms operate primarily in services sector (39%), trading (30%) and manufacturing (29%). Regarding the labor size, small-scale start-up firms with fewer than 10 people account for 35and from 31 to 50 people account for 24%. Due to the convenient data collection method, the number of start-up firms has not been evenly distributed among provinces. The most surveyed start-up firms are in Ba Ria - Vung Tau province (40%) and other neighboring provinces (24%) (Table 2).

Table 2: Sample characteristics.

	Characteristics	Frequency	%
Type of business	Private enterprise	93	42%
	Limited liability company	103	47%
	Joint stock company	20	9%
	Others	4	2%
Field of operation	Manufacturing	64	29%
	Services	86	39%
	Trading	65	30%
	Others	5	2%
Labor scale	< 10	78	35%
	11 − 30	87	40%
	31 − 50	52	24%
	> 51	3	1%
Location	Ba Ria - Vung Tau	88	40%
	Ho Chi Minh City	34	15%
	Dong Nai	21	10%
	Binh Duong	24	11%
	Others	53	24%

4.2. Measurement validation

Table 3 presents Cronbach's alpha reliability, composite reliability, average variance extracted (AVE), and factor loadings of all items of the scales. The results show that the factor loadings of all items all the constructs in the model were high (≥ 0.685). The composite construct reliability coefficients and AVE values were employed to assess the reliabilities of the constructs and scales. Composite reliabilities varied from 0.744 (for business model innovation) to 0.938 (for managerial skills and entrepreneurial skills), exceeding the 0.70 cutoff threshold (see Bagozzi and Yi [3]). AVE values, which ranged from 0.621 (for business model innovation) to 0.73 (for access to start-up resources), surpassed the 0.50 benchmark (see Fornell and Larcker [14]). These findings indicate that the scales measuring these constructs were unidimensional and the within-method convergent validity was achieved.

Variables	M	SD	Factor loadings	Cronbach's Alpha	Composite reliability	Variance extracted
Entrepreneurial skills				0.918	0.938	0.753
1. I enjoy thinking to find new ways of doing business.	3.48	1.04	0.866			
2. I regularly identify new business opportunities.	3.47	0.962	0.846			
3. I regularly identify ideas to convert into new products/ services.	3.45	1.003	0.887			
4. I am always willing to pursue untapped business opportunities.	3.53	1.018	0.901			
5. I see myself as a business opportunities creator.	3.49	1.018	0.838			
Managerial skills				0.914	0.938	0.753
1. One of my strengths is organizing and motivating the staff.	3.79	1.159	0.859			
2. One of my strengths is organizing resources and coordinating the performance of tasks.	3.79	1.100	0.879			
3. One of my strengths is authorizing the work effectively.	3.86	1.136	0.874			
4. One of my strengths is supervising, influencing and leading the staff.	3.61	1.074	0.834			
5. One of my strengths is allocating limited resources in order to achieve the best results.	3.65	1.190	0.866			

Note: M: mean value, SD: standard deviation.

The discriminant validity of constructs was firstly assessed by the Fornell and Larcker [14] criterion. Accordingly, since the square root of each construct's AVE value was greater than the correlations between the variable and the other variables (Table

Table 3: Measurement items and loadings.

Variables	M	SD	Factor loadings	Cronbach's Alpha	Composite reliability	Variance extracted
Access to start-up resources				0.848	0.908	0.766
1. I have received financial support from start-up support organizations.	3.56	0.961	0.888			
2. I have received relevant information/ knowledge from start-up support organizations.	3.54	0.957	0.876			
3. I have been introduced to new business partners by start-up support organizations.	3.55	1.03	0.862			
Business model innovation			0.924	0.936	0.744	0.621
1. Our business model offers a new combination of products, services and information.	3.69	0.939	0.742			
2. Our business model attracts many new customers.	3.47	1.21	0.819			
3. Our business model attracts many new suppliers and partners.	3.56	1.228	0.838			
4. Our business model connects partners in a new way.	3.58	1.197	0.789			
5. Our business model links participants to transactions in a new way.	3.38	1.166	0.685			
6. We often apply new ideas and innovations in our business model.	3.43	1.193	0.780			
7. We often apply new operating processes, procedures and standards to our business model.	3.57	1.22	0.833			
8. We are at the forefront of innovating our business models.	3.53	1.136	0.817			
9. In short, our business model is an innovation.	3.45	1.103	0.780			

4), it could be concluded that the discriminant validity of all research constructs was acceptable.

Table 4: Discriminant validity testing (Fornell − Lacker).

		M	SD	1	2	3	4
1.	Access to start-up resources (AR)	3.5485	.86018	**0.875**			
2.	BMI	3.5162	.91144	0.270	**0.788**		
3.	Managerial skills (MS)	3.7391	.97630	0.380	0.295	**0.862**	
4.	Entrepreneurial skills (ES)	3.4836	.87518	0.366	0.256	0.337	**0.868**

Note: M: mean value, SD: standard deviation.

Moreover, Table 5 presents the cross-loading factors of the observed variables. The results show that all factor loadings are greater than cross loadings in the same row. Therefore, the computed values provide further support for discriminant validity among the scales.

Table 5: Cross loading of observed variables.

	AR	BMI	ES	MS
Accessresources1	0.888	0.278	0.32	0.351
Accessresources2	0.876	0.189	0.356	0.279
Accessresources3	0.862	0.236	0.289	0.363
BMI1	0.155	0.742	0.211	0.175
BMI2	0.154	0.819	0.172	0.184
BMI3	0.28	0.838	0.237	0.237
BMI4	0.278	0.789	0.246	0.315
BMI5	0.159	0.685	0.151	0.213
BMI6	0.263	0.780	0.194	0.202
BMI7	0.209	0.833	0.187	0.244
BMI8	0.235	0.817	0.226	0.245
BMI9	0.098	0.780	0.154	0.237
Entrepreneurialskill1	0.331	0.243	0.866	0.32
Entrepreneurialskill2	0.319	0.131	0.846	0.279
Entrepreneurialskill3	0.376	0.226	0.887	0.31
Entrepreneurialskill4	0.303	0.26	0.901	0.296
Entrepreneurialskill5	0.246	0.242	0.838	0.25
Managerialskills2	0.305	0.316	0.252	0.859
Managerialskills3	0.38	0.315	0.292	0.879
Managerialskills4	0.323	0.216	0.284	0.874
Managerialskills5	0.294	0.216	0.368	0.834
Managerialskills1	0.325	0.182	0.266	0.866

4.3. Common method bias

Because respondents provided all the information that may lead to potential common method bias (CMB) and may threaten the validity of results (see Podsakoff and Organ

[30]). To check for CMB, Harman's one factor test using EFA by extraction method of 'principle axis factoring' was performed in SPSS. The results yielded four factors with eigenvalues greater than 1, and the first factor accounted for 31.616indicating that no single factor accounted for the majority of covariance. This revealed that there is no potential problem of CMB as the first factor does not explain major variance (Podsakoff and Organ [30]). In addition, the impact of common latent factor in measurement model has assessed and ensured that there is no CMB problem in the study.

4.4. Hypothesis testing

The results of estimating the model by Bootstrapping method with sample size of 5000 are shown in Figure 2.
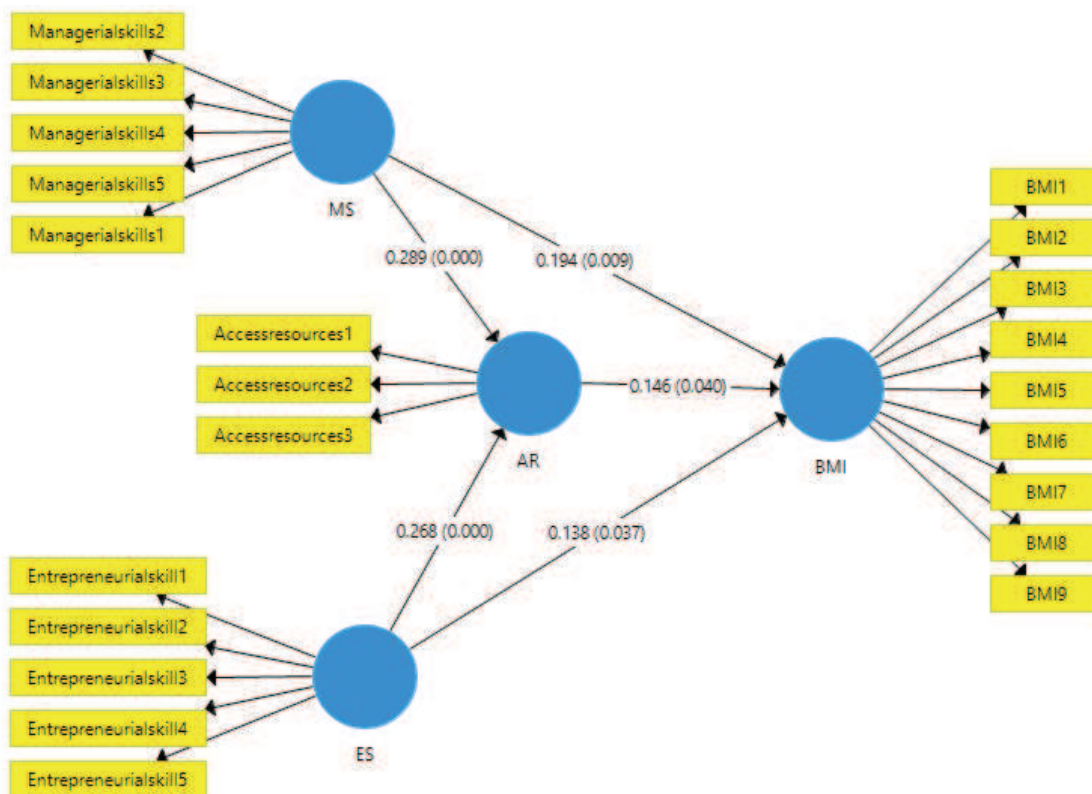

Figure 2: Estimated results of PLS-SEM.

The quality of the proposed model was assessed through R^2 values and Stone-Geisser index values (Q^2). Table 6 shows that the R^2 value of BMI is $0.132 < 0.15$, and the Stone-Geisser value from Q^2_{BMI} is $0.071 < 0.15$. According to the evaluation criteria of Henseler, Ringle and Sinkovics [21], the quality of the model is evaluated as moderate. In addition, the levels of influence between constructs are all > 0.02 and < 0.15. According to Henseler et al. [21], the influence levels between constructs are moderate.

The key results in this study is recapitulated in Table 5. Entrepreneurs' managerial skills demonstrated the positive association with business model innovation ($B = 0.196, p < 0.01$), which substantiated hypothesis H$_1$. Entrepreneurs' entrepreneurial skills was positively related to business model innovation ($B = 0.143, p < 0.01$), supporting hypothesis H$_2$. Entrepreneurs' managerial skill was positively and significantly related to access to start-up resources ($B = 0.293, p < 0.01$). The estimated structural path between entrepreneurs' entrepreneurial skills and access to start-up resources was significant ($B = 0.271, p < 0.01$). The relationship between access to start-up resources and business model innovation was also found significant ($B = 0.149; p < 0.05$).

Bootstrapping results revealed the significant coefficient ($B = 0.044, p < 0.1$) without zero in the range of the confidence intervals (95%, CIs = 0.001, 0.098) for the indirect effect of entrepreneurs' managerial skills on business model innovation through the mediating role of access to start-up recources, which provided evidence for hypothesis H$_3$. Hypothesis H$_4$ also received endorsement via the significant bootstrapping coefficient ($B = 0.039, 95\%$, CIs = 0.003, 0.085, $p < 0.1$) for the indirect impact of entrepreneurs' entrepreneurial skills on business model innovation via access to start-up recources as a mediator.

Table 6: Hypothesis testing results.

Hypothesis	Structural path	β	Bootstrap	SD	T	Bootstrap confidence intervals	P	VIF	Conclusion
Direct effects									
H$_1$	MS→BMI	0.194	0.196***	0.074	2.627	[0.047; 0.335]	0.009	1.234	Accepted
H$_2$	ES→BMI	0.138	0.143**	0.067	2.063	[0.011; 0.273]	0.039	1.219	Accepted
	MS→AR	0.289	0.293***	0.067	4.337	[0.157; 0.418]	0.000	1.128	Accepted
	ES→AR	0.268	0.271***	0.063	4.270	[0.151; 0.396]	0.000	1.128	Accepted
	AR→BMI	0.146	0.149**	0.072	2.043	[0.005; 0.285]	0.041	1.263	Accepted
Indirect effects									
H$_3$	MS→AR→BMI	0.042	0.044*	0.024	1.729	[0.001; 0.098]	0.084		Accepted
H$_4$	ES→AR→BMI	0.039	0.039*	0.020	1.925	[0.003; 0.085]	0.054		Accepted
R^2_{BMI}					0.132				
f^2					$f^2_{\text{MS}\to\text{AR}} = 0.094; f^2_{\text{ES}\to\text{AR}} = 0.081; f^2_{\text{MS}\to\text{BMI}} = 0.035; f^2\text{ES} \to \text{BMI} = 0.018; f^2_{\text{AR}\to\text{BMI}} = 0.019$				
Stone-Geisser's Q^2					$Q^2_{\text{AR}} = 0.149; Q^2_{\text{BMI}} = 0.071$				

Note: β: estimate loading, SD: standard deviation, T: statistic value, P: p-Value, VIF: variance inflation factor; MS: managerial skills; ES: entrepreneurial skills; AR: access to start-up resources; BMI: Business model innovation; $***: p < 0.01$; $**: p < 0.05$; $*: p < 0.1$.

The results also indicated thay managerial skills was a key factor predicting business model innovation (Btotal = 0.024, Table 7). The second important factor was

entrepreneurial skills (Btotal = 0.182, Table 7). The final factor was access to start-up resources (Btotal = 0.149). All three factors, managerial skills, entrepreneurial skills and access to start-up resources explained 13.2% of the variance of business model innovation (Table 6).

Table 7: Direct, indirect, and total effects on BMI.

Construct	Effect	Access to start-up resources	BMI
Managerial skills	Direct	0.293	0.196
	Indirect	0.000	0.044
	Total	0.293	0.240
Entrepreneurial skills	Direct	0.271	0.143
	Indirect	0.000	0.039
	Total	0.271	0.182
Access to start-up resources	Direct	–	0.149
	Indirect	–	0.000
	Total		0.149

5. Discussion

The results show that all relationships have statistical significance, so all hypotheses proposed in the research model are accepted. Previous studies have suggested that access to resources is mainly from social networks (see Ju, Zhou and Wang [23]), network size and relationship quality (see Semrau and Werner [32]). In this study, access to start-up resources depends on the skills of the entrepreneur. The human capital factor makes it easier for entrepreneurs to access supporting resources. This is a new finding that has not been mentioned in previous researches. In addition, the study results indicated that there is a positive relationship between managerial skills, entrepreneurial skills and business model innovation. The study results in the transitional market of Vietnam are similar to those of previous studies. For example, Guo et al. [18] shown that human capital, including managerial skills and entrepreneurial skills positively affects BMI.

5.1. Implications for theory and research

The study has applied human capital theory to explain access to start-up resources and BMI implementation process. Human capital refers to managerial skills and entrepreneurial skills (see Guo et al. [18]). These two important skills contribute to access to start-up resources and the implementation of BMI. Start-up supporting resources include information, knowledge and increasing partnership (see Semrau and Werner [32]) in order to promote BMI activities. The study has figured out that access to start-up sources plays an intermediary role between human capital and BMI. Rely on supporting resources, the BMI operation process is promoted. Previous studies have suggested

access to resources through social network and relationship quality between the network parties. However, its role has not been considered specifically as in this study.

5.2. Managerial implications

The research results offer practical significance for entrepreneurs and official departments. In start-up firms, the entrepreneurs need to understand the vital roles of managerial skills and entrepreneurial skills in accessing resources and promoting BMI process. Therefore, entrepreneurs need to cultivate and train these two important skills in the difficult early start-up period. To develop managerial skills, entrepreneurs should rearrange organizational structure properly and motivate staff. In the early stage of start-up, operational resources are limited, entrepreneurs should allocate resources, coordinate implementation and supervise activities. In addition, entrepreneurs should share and guide the staff to complete the tasks well in order to bring the best performance. Furthermore, in order to develop entrepreneurial skills, entrepreneurs should observe target market to identify new business ideas and new ways of doing business. Entrepreneurs should carefully evaluate and pursue untapped business opportunities. From business ideas, entrepreneurs develop into new products or services to meet the needs of customers in the target market.

In the context of industrial revolution 4.0, the implementation of BMI is necessary to adapt to rapid market changes. Therefore, through access to start-up resources, entrepreneurs need to promote BMI to help start-up firms seize business opportunities and minimize the risks of failure in the beginning stage. Access to resources helps start-up firms in product and technology innovation, market expanding and customer relationship development, etc. These components play important roles in the business model. In addition, start-up support organizations should consider and create appropriate policies and procedures for start-up firms to facilitate the access to supporting resources. In order to do that, start-up support organizations need to identify the needs for support from start-up firms and plan appropriate policies and mechanisms to effectively meet the needs of entrepreneurs.

5.3. Limitations and directions for future research

The limitation of this study is the use of convenient sampling method. In order to improve the overall representation of the sample, researchers need to select stratified samples and survey some other provinces such as Can Tho, Da Nang, Hai Phong and Hanoi, where the start-up movement are strongly promoted.

The sample of this research consists of start-up firms operating in many industries, so the study has not found the characteristics of each industry. Moreover, the implementation of BMI requires specifically for different industries such as technology, engineering, telecommunications, etc. Therefore, further studies need to retest the above relationships for a specific industry.

Implementing BMI requires numerous resources in order to adapt to business environmental change. This study only mentioned specific human capital of entrepreneurs and the mediating role of access to start-up resources in promoting BMI. However,

through relationship networks, entrepreneurs can access supporting resources to promote BMI. Therefore, in following studies, it is necessary to consider entrepreneur's relationship network such as political networking, business networking and financial networking (see Su, Xie and Wang [34]) in the start-up ecosystem

The theory of social networks and the theory of human capital have explained the formation of external start-up resources. The institutional theory refers to the "legitimacy" of the society for stakeholders. When social legitimacy is increasing, it is an opportunity for start-up firms to get supporting resources from other parties. Therefore, in following studies, researchers can use the institutional theory to explain the formation of external resources to implement BMI.

Acknowledgements

References

[1] Alnoor, A. (2020). *Human capital dimensions and firm performance, mediating role of knowledge management*, International Journal of Business Excellence, Vol.20, No.2, 149-168.

[2] Anwar, M. and Ali Shah, S. Z. (2020). *Managerial networking and business model innovation: Empirical study of new ventures in an emerging economy*, Journal of Small Business & Entrepreneurship, Vol.32, No.3, 1-22.

[3] Bagozzi, R. P. and Yi, Y. (1988). *On the evaluation of structural equation models*, Journal of the Academy of Marketing Science, Vol.16, No.1, 74-94.

[4] Barney, J. (1991). *Firm resources and sustained competitive advantage*, Journal of Management, Vol.17, No.1, 99-120.

[5] Becker, G. (1964). Human capital. A theoretical and empirical analysis with special reference to education, New York: Columbia University press for The NBER.

[6] Bock, A. J., Opsahl, T., George, G. and Gann, D. M. (2012). *The effects of culture and structure on strategic flexibility during business model innovation*, Journal of Management Studies, Vol.49, No.2, 279-305.

[7] Bradley, S. W., McMullen, J. S., Artz, K., and Simiyu, E. M. (2012). *Capital is not enough: Innovation in developing economies*, Journal of Management Studies, Vol.49, No.4, 684-717.

[8] Breuer, H. and Ldeke-Freund, F. (2017). *Values-based network and business model innovation*, International Journal of Innovation Management, Vol.21, No.3, 1750028(1-35).

[9] Capelleras, J.-L., Contin-Pilart, I., Larraza-Kintana, M., and Martin-Sanchez, V. (2019). *Entrepreneurs' human capital and growth aspirations: the moderating role of regional entrepreneurial culture*, Small Business Economics, Vol.52, No.1, 3-25, doi: 10.1007/s11187-017-9985-0.

[10] Casadesus-Masanell, R. and Ricart, J. E. (2010). *From strategy to business models and onto tactics*, Long Range Planning, Vol.43, No.2-3, 195-215.

[11] Chesbrough, H. (2007), *Business model innovation: it's not just about technology anymore*, Strategy & Leadership, Vol.35, No.6, 12-17.

[12] Choi, Y. and Chang, S. (2020). *The effect of social entrepreneurs' human capital on and firm performance: The moderating role of specific human capital*, Cogent Business & Management, Vol.7, No.1, 1-15.

[13] Dimov, D. (2010). *Nascent entrepreneurs and venture emergence: Opportunity confidence, human capital, and early planning*, Journal of Management Studies, Vol.47, No.6, 1123-1153.

[14] Fornell, C. and Larcker, D. F. (1981). *Structural equation models with unobservable variables and measurement error: Algebra and Statistics*, Journal of Marketing Research, Vol.18, No.3, 382-388.

[15] Foss, L. (1994). *The Impact of Human Capital, a Social Network and Business Resources on Start-up*, Ph.D. Thesis, Norwegian School of Economics and Business Administration, Bergen.

[16] George, G. and Bock, A. J. (2011). *The business model in practice and its implications for entrepreneurship research*, Entrepreneurship Theory and Practice, Vol.35, No.1, 83-111.

[17] Ghi, T., Anh, N., Thu, N. and Huan, N. (2020). *Relationship Network and Business Model Innovation of Start-Up Companies in the Context of Industrial Revolution 4.0: An Evidence from Vietnam*, in 17th International Symposium on Management (INSYMA 2020), Atlantis Press, 162-166.

[18] Guo, H., Xi, Y., Zhao, J. and Tang, J. (2013). *The role of top managers' human and social capital in business model innovation*, Chinese Management Studies, Vol.7, No.3, 447-469, doi: 10.1108/cms-03-2013-0050.

[19] Hair, J. F., Sarstedt, M., Ringle, C. M. and Gudergan, S. P. (2017). *Advanced issues in partial least squares structural equation modeling*. Sage publications.

[20] Heij, C. V., Volberda, H. W., and Van den Bosch, F. A. (2014). *How does business model innovation influence firm performance: the effect of environmental dynamism*, Academy of Management Proceedings, Vol.2014, No.1.

[21] Henseler, J., Ringle, C. M., and Sinkovics, R. R. (2009). The use of partial least squares path modeling in international marketing (New challenges to international marketing). Emerald Group Publishing Limited.

[22] Ireland, R. D., Hitt, M. A., Camp, S. M., and Sexton, D. L. (2001). *Integrating entrepreneurship and strategic management actions to create firm wealth*, Academy of Management Perspectives, Vol.15, No.1, 49-63.

[23] Ju, W., Zhou, X., and Wang, S. (2019). *The impact of scholars' guanxi networks on entrepreneurial performance — The mediating effect of resource acquisition*, Physica A: Statistical Mechanics and its Applications, Vol.521, No.9-17, doi: 10.1016/j.physa.2019.01.066.

[24] Ko, E.-J. and McKelvie, A. (2018). *Signaling for more money: The roles of founders' human capital and investor prominence in resource acquisition across different stages of firm development*, Journal of Business Venturing, Vol.33, No.4, 438-454, doi: 10.1016/j.jbusvent.2018.03.001.

[25] Lim, J. Y.-K. and Busenitz, L. W. (2020). *Evolving human capital of entrepreneurs in an equity crowdfunding era*, Journal of Small Business Management, Vol.58, No.1, 106-129, doi: 10.1080/00472778.2019.1659674.

[26] Marvel, M. R. (2013). *Human capital and search - based discovery: A study of high - tech entrepreneurship*, Entrepreneurship Theory and Practice, Vol.37, No.2, 403-419.

[27] Marvel, M. R., Davis, J. L., and Sproul, C. R. (2016). *Human Capital and Entrepreneurship Research: A Critical Review and Future Directions*, Entrepreneurship Theory and Practice, Vol.40, No.3, 599-626, doi: 10.1111/etap.12136.

[28] Monitor, G. E. (2018). GEM 2018/2019, Global Report.

[29] Piva, E. and Rossi-Lamastra, C. (2017). *Human capital signals and entrepreneurs' success in equity crowdfunding*, Small Business Economics, Vol.51, No.3, 667-686, doi: 10.1007/s11187-017-9950-y.

[30] Podsakoff, P. M. and Organ, D. W. (1986). *Self-reports in organizational research: Problems and prospects*, Journal of Management, Vol.12, No.4, 531-544.

[31] Ringle, C. M., Wende, S., and Becker, J.-M. (2015). SmartPLS 3, Bönningstedt: SmartPLS, GmbH. Retrieved from http://www.smartpls.com.

[32] Semrau, T. and Werner, A. (2014). *How Exactly Do Network Relationships Pay Off? The Effects of Network Size and Relationship Quality on Access to Start-Up Resources*, Entrepreneurship Theory and Practice, Vol.38, No.3, 501-525, doi: 10.1111/etap.12011.

[33] Sirmon, D. G., Hitt, M. A., Ireland, R. D., and Gilbert, B. A. (2011). *Resource orchestration to create competitive advantage: Breadth, depth, and life cycle effects*, Journal of Management, Vol.37, No.5, 1390-1412.

[34] Su, Z., Xie, E., and Wang, D. (2015). *Entrepreneurial orientation, managerial networking, and new venture performance in China*, Journal of Small Business Management, Vol.53, No.1, 228-248.

[35] Tang, J. and Murphy, P. J. (2012). *Prior knowledge and new product and service introductions by entrepreneurial firms: the mediating role of technological innovation*, Journal of Small Business Management, Vol.50, No.1, 41-62.

[36] Timmers, P. (1998). *Business models for electronic markets*, Electronic Markets, Vol.8, No.2, 3-8.

[37] Unger, J. M., Rauch, A., Frese, M., and Rosenbusch, N. (2011). *Human capital and entrepreneurial success: A meta-analytical review*, Journal of Business Venturing, Vol.26, No.3, 341-358.

[38] Zacharakis, A. L. and Meyer, G. D. (2000). *The potential of actuarial decision models: can they improve the venture capital investment decision*?, Journal of Business Venturing, Vol.15, No.4, 323-346.

[39] Zott, C. and Amit, R. (2007). *Business model design and the performance of entrepreneurial firms*, Organization Science, Vol.18, No.2, 181-199.

Department of Accounting and Business Administration, Thuy Loi University - Southern Campus, Vietnam.

E-mail: trannhaghi@tlu.edu.vn; writetran88@gmail.com

Major area(s): Entrepreneurship, innovation.

Department of Foreign languages and social sciences, Ba Ria - Vung Tau University, Vietnam.

E-mail: anhntp@bvu.edu.vn

Major area(s): Management resources, customer satisfaction.

School of Management, University of Economics Ho Chi Minh, Vietnam.

E-mail: ngthu@ueh.edu.vn

Major area(s): Management resources, customer satisfaction.

School of Management, University of Economics Ho Chi Minh, Vietnam.

E-mail: ngoqhuan@ueh.edu.vn

Major area(s): Financial Management, entrepreneurship.