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Business innovation in emerging markets – analysing innovative enterprises using the PLS-SEM and NCA methods

Abstract

The study entails an examination of the factors needed for the emergence of business innovation, in the context of a developing economy, based on representative data from the Global Entrepreneurship Monitor 2021. Drawing on the theories in the literature, the impact mechanism of the entrepreneurial innovation development in our model has been assumed to involve a three-sided impact. The study builds on the entrepreneurial side effects, based on the classical Schumpeterian theory as well as incorporating the enterprises' productive-side effects into the model, defining the model as resultant from socioeconomic macrocontext effects. The analysis of our model has been tested and analyzed using partial least squares - structural equation modeling and the necessary condition analysis. Our results show that business innovation requires not one factor, but a combination of factors. The system needs visionary entrepreneurs, who can stimulate innovation, along the concept of sustainability. An economically prosperous business with international connections which views challenges as opportunities, however, also constitutes an important factor providing proper framework for new products and services. Adequacy of the socio-economic macro-context is essential as well, as it too contributes to the development of entrepreneurship and thus to the creation of entrepreneurial innovation.

Keywords: business innovation, entrepreneurial innovation, technological innovation, developing economy, PLS-SEM, NCA.

Innowacje biznesowe na wschodzących rynkach – analiza innowacyjnych przedsiębiorstw przy użyciu metod PLS-SEM i NCA

Streszczenie

W artykule przedstawione zostały czynniki potrzebne do pojawienia się innowacji biznesowych w krajach rozwijających się, na podstawie reprezentatywnych danych z Global Entrepreneurship Monitor 2021. Opierając się na teoriach zaczerpniętych z literatury przedmiotu, Autorzy zakładają, że mechanizm oddziaływania rozwoju innowacji biznesowych w zaprezentowanym modelu ma charakter trójstronny. Z jednej strony model opiera się na efektach ze strony przedsiębiorcy, bazujących na klasycznej teorii Schumpetera, z drugiej – do modelu włączone są produkcyjne

efekty przedsiębiorstw, a z trzeciej – model można zdefiniować jako wynik skutku makrokontekstu społeczno-ekonomicznego. Model jest testowany i analizowany przy użyciu metody cząstkowych najmniejszych kwadratów – modelowania równań strukturalnych i analizy warunków koniecznych. Zaprezentowane w artykule wyniki pokazują, że tworzenie innowacji biznesowych nie opiera się wyłącznie na jednym czynniku, ale jest wynikiem ich kombinacji. System potrzebuje wizjonerskich przedsiębiorców, którzy potrafią stymulować innowacje zgodnie z koncepcją zrównoważonego rozwoju. Jednak dobrze prosperujące gospodarczo i ekonomicznie przedsiębiorstwo z międzynarodowymi powiązaniami, które postrzega wyzwania jako szanse, jest również ważnym czynnikiem, mogącym zapewnić odpowiednie ramy dla tworzenia nowych produktów i usług. Duże znaczenie ma jednak społeczno-ekonomiczny makrokontekst, który również przyczynia się do rozwoju przedsiębiorczości, a tym samym do tworzenia innowacji przedsiębiorczych.

Słowa kluczowe: innowacja biznesowa, innowacja przedsiębiorcza, innowacja technologiczna, gospodarka rozwijająca się, PLS-SEM, NCA.

Introduction – Business Innovation

Enterprises are complex drivers of economic growth[1]. Thus, enterprises' ability to innovate is a key factor in stimulating economic growth[2]. Consequently, the study of innovation has always played a key role in business research. Recently, however, an even greater increase in research on "innovative" or "productive" enterprises has been noted[3]. However, most studies explore entrepreneurial

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innovation in developed economies; thus, we know little about the extent to which enterprises in developing economies implement innovation-driven entrepreneurship. To this end, in our paper, we examine the factors that contribute to the emergence of innovation among enterprises in the context of a developing economy. We supplement the results of the literature from two sides: 1) on the one hand, we place the development of innovation in a cause-and-effect system in the case of a semi-peripheral country, 2) on the other hand, based on the theories of the literature, we determine which theoretical directions can be used to describe the development of innovation in the given country. With all of this, our aim is to provide an answer to the process of the development of innovation in the case of a semi-peripheral country, and to explain of our results in accordance with existing theories.

Linking innovation and business is, by no means, a new idea. The classical theories of enterprise theory have all given prominence to the concept of innovation. Schumpeter's entrepreneurial theory has defined innovation as a central concept of entrepreneurs[4]. It creates "creative destruction", which can underpin long-term economic growth. Innovation, in this sense, is a necessary condition for the action of the "cultural innovator", that is, the entrepreneur. Contradict Schumpeter's theory, Baumol did not interpret business innovation from the demand side of entrepreneurs but from supply the side of enterprises and from the competition among them[5]. According to his theory, productive enterprises are the ones primarily encouraging entrepreneurs to innovate and not the other way around. Moreover, in Kirzner's theory, the exploration of opportunity as a source of innovation is a central element of entrepreneurship[6].

In our paper, we work with a complex definition of entrepreneurial innovation. Based on this, business innovation in our research is a successful realisation and materialisaton of something new; this can refer to gradual, radical, or revolutionary changes in techniques, products, processes, ways of thinking, or organisations[7]. Innovation is about creating positive change, which reduces costs and maximises productivity[8]. Additionally, we focus on technological innovation, technology change, and technology development. However, we make

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a distinction between an idea and an innovation, the latter of which is the first successful implementation of an idea in practice.

Based on the literature, the emergence of entrepreneurial innovation is assumed to be a three-sided effect. It is assumed, in line with the classical Schumpeterian theory, as an effect from the entrepreneur side (individual); as an effect from the enterprise itself (micro-context); and as a result of socio-economic mechanisms (macro-context).

Attempts to understand business innovation from the side of the entrepreneur can be traced back to the classical theories of Schumpeter and Weber[9]. In these theories, the understanding of the entrepreneur's personality, innovation attitude, and psychological and sociological characteristics are key elements for the creation of business innovation. Schumpeter, in his theory, linked innovation to the person (the entrepreneur) inextricably, through which the economic activity that changes the functions of production (the enterprise) is created. Innovation is, thus, assumed to be the key function of the sociological archetype of an entrepreneur[10]. Kirton's high-impact theory is strongly related to this. His adaptation and innovation theory explores the styles, cognitive elements of creativity, decision-making, and problem-solving processes and outlines the profile of an innovative entrepreneur. In Kriton's adaptation and innovation theory, the innovator is constructed as the opposite of the adapter. The innovator reinterprets structural and cognitive frameworks with relatively high risk-taking. In our research, we use parts of Kriton's theory, as in the mapping of the innovation capacity of a business, we emphasise the entrepreneur's personality as playing a key role. Thus, we focus on what visions can be related to entrepreneurs, how they can be placed in a creative-cognitive context, what their incentives are, why they started their business, how they perceive problems, and how they respond to them[11].

According to the literature, business innovation occurs mainly in firms that combine multiple abilities, knowledge, resources, and skills[12]. Therefore, in the analysis of the implementation of innovation, the impact of the entrepreneur and that of the enterprise are worth examining. Higher levels of economic activity, for example, create new business opportunities, which means that entrepreneurs may become interested in entering new markets and exploiting new business opportunities by creating more competitive products. Therefore, the enterprise's economic activity positively affects innovation. Consequently, en-

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trepreneurship will be the micro-context in which the realisation of innovation can can take place along with the right combination of factors[13]. Since the 1960s, several studies have addressed the in-house research and development (R&D) department as a successful basic criterion for innovation[14]. The literature shows that the size of the R&D department is a stronger factor in the emergence of business innovation than the type of market in which the business is operating[15]. The basic tool for measuring innovation, present value benefit/cost analysis, has emerged from this research direction. This is because the present value costs of developing, deploying, and operating a new technology can be used to evaluate the decision to introduce a new technology in a given enterprise[16]. Of course, this does not mean that the type of market and market entry cannot be key factors in the emergence of innovation. Numerous studies have shown that new and small firms can gain rapid entry into new markets due to their excellent innovation performance, which has an incentive effect on innovation[17].

Since the 2000s, certain segments of innovation research that emphasise the role of enterprises in the innovation process have begun to build their theories on the typology of the sustainable enterprise[18]. Indeed, the market system has seen the emergence of sustainable development companies that have created innovative techniques, products, or processes that drive environmental or social goals and succeed in the consumer market. In these enterprises, environmental and social goals are an integral part of these businesses' economic strategy[19]. As a result, the weight of entrepreneurial approaches to achieving social

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and environmental goals in changing market contexts has strengthened in theoretical research as well. These theories build on the fact that behind the achievement of social goals and the emergence of entrepreneurial activities for environmental development are specific market failures that firms seek to address through innovation[20].

Importantly, neither the individual (entrepreneur) nor the enterprise itself is constantly in an innovative spirit. Rather, innovation implies that when an opportunity arises, entities can seize it. This suggests that the socio-economic environment plays a key role in the mechanism of action of innovation. Agreeing with Stevenson and Jarillo, we believe that the emergence of innovative enterprises is not merely an entrepreneurial skill or exclusively an attribute of a particular enterprise, but a process[21]. This process is embedded in a socio-economic-environmental context, examining which in the case of developing economies is particularly important. This is because although, ideally, an entrepreneur or a business should be innovative, in many emerging markets, the scope for innovation is often limited. For example, due to a lack of capital, imitating already developed products and services is considered more convenient and less of an investment than bringing new products and services to market. However, other contextual effects such as the monetary policy or the supportive effect of the social atmosphere on innovation are also influential[22]. Investigating developing countries in this sense is imperative due to their scarcity of important resources. Thus, for companies in developing countries opportunities for innovation and for demonstrating entrepreneurship skills are much less and rarely explored and pursued. This is supported by the fact that these companies tend to place more emphasis on the development side of R&D investment than on the research side; thus, they emphasise incremental rather than radical progress. This results in a lower expected return on business innovation value[23]. Furthermore, in most developing countries, entrepreneurs do not earn high social prestige for all the value they bring to the economy. Hence, the contextual role of culture must be included in the analysis of innovation to have

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a systemic understanding of innovative enterprises in developing markets. In this case, according to the relational, constructivist approach, culture includes cultural identities, and thus, cultural resources can be interpreted as entities created in the interactions between different social groups[24]. The constructivist approach to culture is a particularly useful for understanding the macro-context of innovation. This is because innovations are cultural and material in nature at the same time[25]; thus, technological innovations reflect sociocultural trends and introduce new cultural interpretations and practices[26].

However, the inclusion of the entire macro-context in the analysis is not an easy task due to its complexity. In addition to culture, social regulators must also take into account the analysis of social "rules of the game"[27], and the values of regulators that are rooted in social, organisational, or individual needs to be included as well[28]. Additionally, moving away from explicit knowledge, cognitive effects that explore deeper beliefs and values that unconsciously guide either the entrepreneur or company behaviour should be considered[29]. In our research, we create a simulation of the macro-context, in which we examine the effect of the macro-cotext on innovation only through cognitive, contextual beliefs.

The triple (entrepreneur–business–environment) theoretical impact mechanism is an appropriate context for exploring business innovation in developing countries. As mentioned earlier, the study of developing countries deserves special attention in the field of innovation research for several reasons. Indeed, developing countries are countries with strong entrepreneurial intensity[30],

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as the functioning of an informal economy and economic constraints strengthen the presence of small businesses. Conversely, as real incomes are low in developing countries, an entrepreneurial career is more favourable, and sometimes, it is the only option that allows individuals to earn a decent income. Furthermore, a growing trend suggests that networks are the entities that facilitate the flow of knowledge within and between regions and are key sources of innovation and economic growth[31]. According to endogenous economic growth models, the sources of regional economic growth are increasingly based on the impact of the production, distribution, and use of knowledge within and between regional economies[32]. The knowledge-based economy, which focuses on innovation, is built through the aforementioned networks[33]. Regions can become "incubators for new ideas" and create opportunities for entrepreneurship and the discovery of valuable new knowledge[34]. For this reason, it is essential to analyse developing countries in innovation research, as their interaction with developed countries outlines the process of innovation.

1. Methodology: Process Tracing, PLS-SEM, and NCA

Our research fits into the methodological framework of process tracing, which is primarily an inductive methodological approach useful in theory development[35]. Our theoretical framework includes hypothetical, interrelated events and processes that require the (re)constitution of agents through social and economic structures, and an analysis of cognitive processes and process tracing was performed to examine complex mechanisms of action[36]. In our research,

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process tracing was applied to investigate and test theoretical causal chains that contain both the mechanisms of action and the agents.

Process tracing analysis was performed using partial least squares-structural equation modelling (PLS-SEM). PLS-SEM is a method of analysing complex systems; it provides a system-wide interpretation. On the one hand, from a structural analysis point of view, it approaches the data points with substantive hypothesis testing to explore the relationships between exogenous and endogenous latent variables, and on the other hand, it builds on and analyses system theory at the system level[37]. When examining complex systems such as business innovations[38], examining the explanatory variables separately is insufficient; analysing them at the system level would be more worthwhile. The effects in the model of business innovations form a nonlinear[39], third-order system[40], which is far from the equilibrium[41] and has multiphase correlations[42] that can be described by autopoiesis[43], structure, hierarchy[44], and control parameters, respectively. Therefore, being a multivariate technique that can capture latent dimensions and examine their combined effects at a systemic level, SEM is an appropriate method for researching business innovations in developing economies[45]. It allows the simultaneous examination of the whole set of equations and, where appropriate (e.g., when evaluating interactions), the correction of errors in the equations, as it simultaneously estimates the model

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parameters and the fit of the model[46]. All this enables it to compare the coefficients simultaneously. SEM, thus, provides a uniform framework for fitting and flexibly testing a number of linear and nonlinear models.

PLS-SEM seeks to maximise the full explained variance of endogenous constructs/indicators when estimating model parameters[47]. Meanwhile, it does not make a priori distribution assumptions; thus, it does not work based on pre-determined ("thumb") statistics[48]. As a result, it treats the constructs as a complex system and uses the full variance to estimate the parameters of the model and not to explain it. PLS-SEM is a two-layer modelling process. The first layer (measurement model) consists of the latent variables that are generated from the measured variables. Thus, the first layer captures the relationship between the manifest and the latent variables. The creation of measurement models can be reflective or formative.[49] The second layer (structural model) identifies the causal relationships between the latent variables. The evaluation of the measurement models is based on the value of multicollinearity (variance inflation factor [VIF]) developed for determining the reliability of internal consistency, the reliability of indicators (average variance extracted [AVE]), the convergence validity, and the heterotrait-monotrait ratio (HTMT)[50]. In the case of reliable and valid measurement models, it is possible to move on to the evaluation of the structural model, for which several metrics were used as well. In the models, we measured the direct, indirect, and total effects, and their strength is expressed as the standardised path coefficients (βs) and their significance[51]. Path coefficients range from -1 to +1, where higher absolute values indicate stronger (predictive) relationships between constructs. The commonly used p value and the explanatory force f^2 were also used to evaluate the model. Perhaps the best-known statistic to quantify the magnitude of the prediction error for the whole model is the root mean square error of predictions (RMSE), but this measure is rarely used for PLS-SEM. Rather, the PLS-SEM methodology uses the standard-

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ised root mean square residual (SRMS) and the Bentler and Bonett index, also known as the normed fit index (NFI). SRMS converts both the sample covariance matrix and the theoretical covariance matrix into correlation matrices. The SRMS allows the measurement of the differences between the average magnitude of observed and expected correlations as an absolute measurement for the model's fit criterion. The NFI uses the Chi^2 value from the null model as a measure of fit of the model[52].

To further explore the mechanisms of effects in our model, we supplemented our PLS-SEM study with necessary condition analysis (NCA), which is a methodology developed to complement multiple regression and structural equation modelling[53]. NCA helps identify specific bottleneck criteria; in other words, NCA can show which predictors are essential and to what extent, to achieve a given outcome variable. For each observed variable, NCA uses a rectangular coordinate system to represent the values of the predictor (X-axis) and the outcome variable (Y-axis). The size of the empty area in the upper left corner of the coordinate system (drawn by the ceiling line) determines the need for the *X* predictor for the *Y* output[54]. Although different techniques can be used to calculate the ceiling line[55], the most robust method is the application of ceiling envelopment with free disposal hull (CE-FDH), which is the result of a piecewise linear function. According to the NCA, the bottleneck table summarises the extent to which the X_n predictors limit the *Y* result. Therefore, the bottleneck analysis shows the magnitude of the effect (d_n) and the ratio of the observed area (S_n) to the unobserved area (C_n), which can be expressed by the following equation: $d_n = C_n / S_n$. Dul introduced the general thresholds for interpreting the effect sizes *d*.[56] In addition to measuring the effect size, NCA also provides an opportunity to test statistical significance using bootstrapping, thereby also allowing screening for false positives[57].

2. Sample and Variables

Our research sample is based on the 2021 Hungarian Global Entrepreneurship Monitor (GEM) data. The Hungarian sample was developed by random multi-

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[54] Dul J., *Necessary condition analysis…*, pp. 10–52.

[55] Ibidem, pp. 10-52.

[56] 0 < d < 0.1 "small" effect size, 0.1 ≤ d ≤ 0.3 "medium" effect size, 0.3 ≤ d ≤ 0.5 "large" effect size, 0.5 ≤ d ≤ 1 "very large" " effect size.

[57] Dul J., Conducting necessary condition analysis, SAGE, Los Angeles-London-New Delhi- Singapore-Washington DC-Melbourne 2020.

stage stratified sampling, as a result of which the sample is representative of the regional location of Hungarian small and medium sized enterprises (SMEs) and the age and gender of Hungarian entrepreneurs. The sample constituted 2016 responses. However, for the present analysis, we further narrowed our sample to those respondents who had businesses or planned to start a business. Therefore, we worked with a sample of 366 responses after data cleansing.

In our analysis, we sought a causal explanation of the enterprises implementing innovation, for which we used the space stretched by 16 measured variables (Table 1). The 16 measured variables plotted eight latent variables, which were grouped according to the theoretical categories (entrepreneur–enterprise–environment). Based on this, we measured the effect of individual entrepreneurial innovation with three latent variables, the effect of entrepreneurship with three latent variables, and the effect of the cognitive macroenvironment on the development of innovation with one latent variable. We measured the effect of the entrepreneur on innovation, as well as the extent to which the goal of the entrepreneur was to change the world and achieve high income and wealth (ROB), the extent to which the entrepreneur can be considered creative and visionary (CV), and the extent to which the entrepreneur makes decisions based on sustainability goals (BDES). We measured the effects of the company on he innovation, as well as the extent to which the company sees a crisis as an opportunity (CO), if the company has a new product or service or if it has renewed itself in some other way in the past year (EOIPS), and whether the company is on a turbulent, growing trajectory economically and has international connections (OITB). We measured the effect of the macro-context from the cognitive side, and we considered in the analysis whether the entrepreneur is convinced that the media gives a prominent role to entrepreneurs in the socio-economic context and whether the entrepreneur is convinced that the businesses in the socio-economic environment address social problems (OB). As an outcome variable, we used the emergence of innovative technology (IT), which embodies business innovation, as it includes whether a particular enterprise has a new technology, process, product, or service.

Table 1. Measured and Latent Variables Included in the Analysis.

Variable name	Question	Latent variables	Abbre-viation	Theory-based catego-ries
sumotiv1	Please tell me the extent to which the following statements reflect the reasons you are trying to start a business. To make a difference in the world.	Reason for business: make a difference and high income	ROB	Individual/ innovator context
sumotiv2	Please tell me the extent to which the following statements reflect the reasons you are trying to start a business. To build great wealth or have a very high income.			
creativ	Other people think you are highly innovative.	Creative Visionary	CV	
vision	Every decision you make is part of your long-term career plan.			
susdg_env	When making decisions about the future of your business, you always consider environmental implications such as preservation of green areas, reduction of the emission of pollutants and toxic gases, selective garbage collection, and conscious consump-tion	Environmental and Social Impact of Busi-ness Decisions	BDES	
susdg_soc	When making decisions about the future of your business, you always consider social implications such as access to education, health, safety, inclusive work, housing, transporta-tion, quality of life at work, etc.			
omcstnat	Do you have any customers in the following locations? Elsewhere in your country?	Crisis as an opportunity	CO	Context of business innova-tions
sucpne-wopp	The coronavirus pandemic has pro-vided new opportunities that you want to pursue with this business.			
omnewprod	Are any of your products or services new to people in the area where you live, people in your country, or the world?	An enterprise that offers an innovative product or service.	EOIPS	
suacts	Over the past twelve months, have you done anything to help start this new business?			

Variable name	Question	Latent variables	Abbre-viation	Theory-based catego-ries
omcrgrow	And compared to one year ago, are your expectations for business growth much lower, somewhat lower, about the same as a year ago, somewhat higher, or much higher?	Owned interna-tional turbulent business	OITB	Context of business innova-tions
omcstexp	Do you have any customers in the following locations? Outside your country?			
omown	Do you personally own all, part, or none of this business?			
nbmedia	In my country, you will often see stories in the public media and/or the Internet about successful new busi-nesses.	Observation of the business context	OB	Socio-economic context
nbsocent	In my country, you will often see businesses that primarily aim to solve social problems.			
omnewproc	Are any of the technologies or proce-dures used for this product or service new to people in the area where you live, the people in your country, or the world?	Innovative technology	IT	Innovation

The measured variables were characterised as having a small, random amount of missing data (3–5%). Therefore the missing data were replaced with the artificial intelligence-based bagging methodology. In the machine learning bag-ging method, different training databases were generated for each joint occur-rence, which were randomly generated by sampling from the original sample set[58]. Then, the algorithm estimated the missing values on these, selecting the most appropriate values.

Of the sampled enterprises, 18.7% have implemented some form of technologi-cal innovation (omnewproc), and only 15.1% of enterprises have developed a new product or service (omnewprod). This means that only about one-fifth of businesses are innovative businesses. Of these innovative businesses, 38.3% are young businesses. Surprisingly, the vast majority of them operate in the low-tech sector (91.5%), and all are SMEs (100%). Innovative enterprises op-erate mostly in the capital (27.7%) and county capitals (25.5%), as well as in the developed regions of the country (36.6%). There is a particularly high pro-portion of men (78.7%) and those who have a high level of education (72.3%)

[58] Friedman J. H., Popescu B. E., *Importance sampled learning ensembles*, "Journal of Ma-chine Learning Research" 2003, 94305, pp. 1–32.

among their CEOs. The CEOs of the enterprises are middle aged on average (44.3 years std: + - 11.61) and earn several times the average income of a Hungarian.

3. Hypotheses

In our research, we aim to determine the factor effects that distinguish innovative companies in the emerging market of a developing country from the needs-based companies. Based on the literature, we assume a triple-side framework for our innovation model in which the impact of the individual, that is, the entrepreneur, the impact of business performance, and the macro-context (i.e. the cognitive socio-economic environment) are identified as factors that affect the emergence of innovation. Thus, our hypothesis system explores the relationship between entrepreneurship and innovation in a developing country.

We formulated 17 hypotheses, which are presented in Table 2. Each hypothesis assumes the presence of a particular mechanism of effect among the latent variables. The system of these mechanisms of effects outlines the business innovation model operating in the developing country, which is shown in Figure 1.

Table 2. Description of Hypotheses.

Hypothesis	
No.	**Description**
H1	Crisis as an Opportunity has a positive impact on the development of Innovative Technology.
H2	Crisis as an Opportunity has a positive impact on Business Decisions.
H3	Observation of the Business Context has a positive impact on the Reason for Business.
H4	Observation of the Business Context has a positive impact on Creative Visionary.
H5	Observation of the Business Context has a positive impact on the development of Innovative Technology.
H6	Observation of the Business Context has a positive impact on Crisis as an Opportunity.
H7	Observation of the Business Context has a positive impact on Business Decisions.
H8	Reason for Business has a positive impact on the development of Innovative Technology.
H9	Reason for Business has a positive impact on an enterprise that offers an innovative product or service.
H10	Creative Visionary has a positive impact on Business Decisions.
H11	Creative Visionary has a positive impact on an enterprise that offers an innovative product or service.
H12	Business Decisions has a positive impact on the enterprise that offers an innovative product or service.
H13	Business Decisions has a positive impact on the development of Innovative Technology.

Hypothesis	
No.	**Description**
H14	Business Decisions has a positive impact on an Owned International Turbulent Business.
H15	An enterprise that offers an innovative product or service has a positive impact on an Owned International Turbulent Business.
H16	An enterprise that offers an innovative product or service has a positive impact on the development of Innovative Technology.
H17	An Owned International Turbulent Business has a positive impact on the development of Innovative Technology.

Figure 1. The System of the Research Hypotheses, the Measured Variables, and the Latent Variables of the PLS-SEM Model.
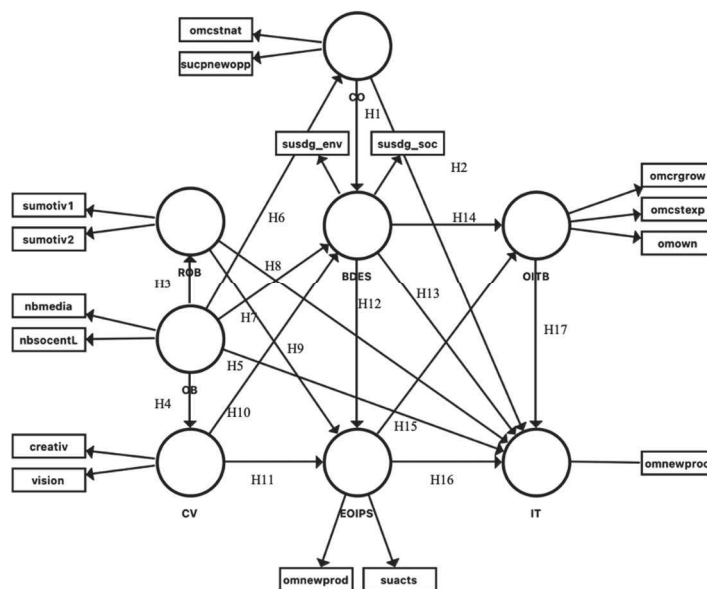
Source: Own elaboration.

The Model of Business Innovation

In the PLS-SEM-based model[59] of innovative enterprises, we used first-order latent variables, which are indicated by circles in Figure 1. The model was created from a total of eight first-order latent variables, each of which is built into the base model as a reflective measurement model. The indicators of the measured variables of the reflective models were lower than 0.095 in all cases, thus

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[59] The analysis was performed with the SmartPLS 3v software; Ringle C. M., Wende S., Becker J.-M., *SmartPLS 3,* SmartPLS, 2015.

avoiding redundancy (See Appendix Table 1). As a result, the reliability of reflective constructs is higher than the recommended minimum threshold. The AVE values for the constructs are also higher than the cut-off value (0.50); thus, the criterion for the convergence validity of the models is met. As conceptually similar indicators have been included in the measurement models, the HTMT values must be less than 0.90. All cases fulfil this requirement, which implies that the reflective models also meet the discriminant criterion. Table 2 in the Appendix summarises the factor scores and collinear statistics (VIF) of the measured variables. In our model, the VIF values for the measured variables are adequate in all cases (above 1.0), which indicates that collinearity is absent. Furthermore, reflective factor scores above 0 are also suitable.

A 5.000-sample bootstrap method[60] was used to test the significance of the path coefficients. The SRMR of the model is .10, which is a good fit[61], and the NFI is .912, which indicates an acceptable fit[62]. Our results, therefore, show that the model fits the statistical criteria.

Figure 2. PLS-SEM and Bootstrap (N = 366).
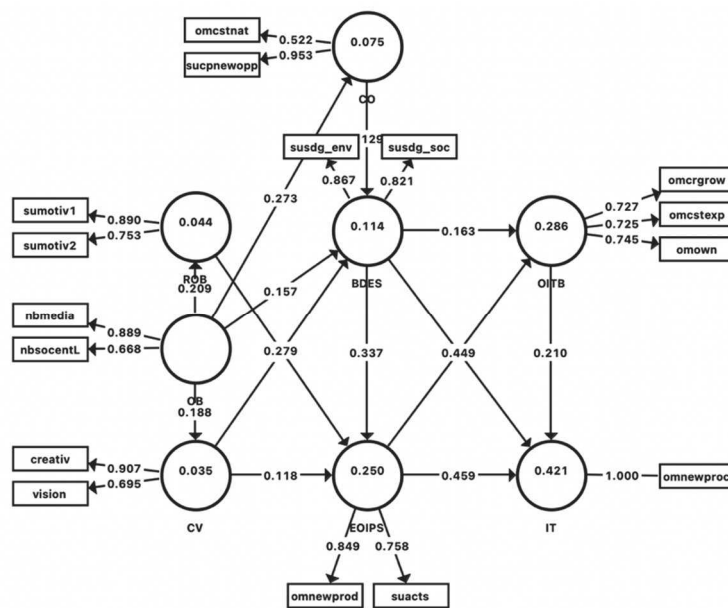
Source: Own elaboration.

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[60] The bootstrap method is a non-parametric procedure that allows testing the statistical significance of different PLS-SEM results, including the significance testing of the path coefficient, R^2 values, VIF, and HTMT values.

[61] Hu L.-T., Bentler P. M., *Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification*, "Psychological Methods" 1998, 3(4), pp. 424–453.

[62] Lohmöller J.-B., *Latent variable path modeling with partial least squares*, Physica-Verlag, Heidelberg 1989.

Figure 3. Path Coefficients and Factor Weights.
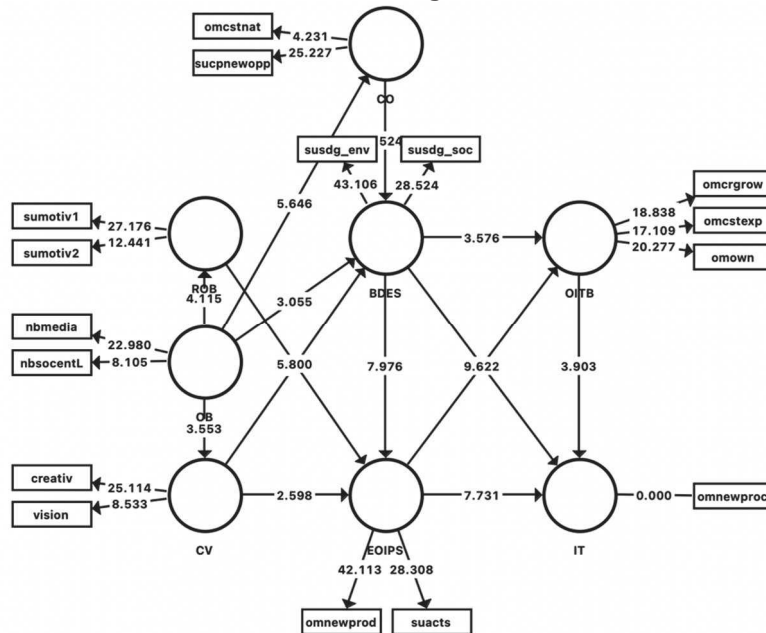
Source: Own elaboration.

The t-values for the structural model are shown in Figure 2 and Table 3. The table and the figure show only the significant path coefficients.

Table 3. Results of the Bootstrap Procedure.

	Path coefficient(β)			T Statistic	p value
	Original Sample	Bootstrap	STDEV		
BDES -> EOIPS	0,34	0,34	0,04	7,98	0,00
BDES -> IT	0,11	0,11	0,04	2,58	0,01
BDES -> OITB	0,16	0,16	0,05	3,58	0,00
CO -> BDES	0,13	0,13	0,05	2,52	0,01
CV -> BDES	0,21	0,21	0,05	4,17	0,00
CV -> EOIPS	0,12	0,12	0,05	2,60	0,01
EOIPS -> IT	0,46	0,46	0,06	7,73	0,00
EOIPS -> OITB	0,45	0,45	0,05	9,62	0,00
OB -> BDES	0,16	0,16	0,05	3,06	0,00
OB -> CO	0,27	0,28	0,05	5,65	0,00
OB -> CV	0,19	0,19	0,05	3,55	0,00
OB -> ROB	0,21	0,21	0,05	4,12	0,00
OITB -> IT	0,21	0,21	0,05	3,90	0,00
ROB -> EOIPS	0,28	0,28	0,05	5,80	0,00

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Based on our significant model (Figure 3), business innovation is shaped by all three dimensions (the entrepreneur, enterprise, and socio-economic context), but in different ways. As a direct effect, technological innovation is affected by the latent variables of Environmental and Social Impact of Business Decisions (β = .11), an innovative product or service (β = .46), and the possession of an Owned International Turbulent Business (β = .21). However, to realise these direct effects a number of other effects must be also present. Environmental and Social Impact of Business Decisions should be affected by Crisis as an Opportunity (β = .13), Creative Visionary (β = .21), and Observation of the Business Context (β = .16). For the effect of an enterprise that offers an innovative product or service to the innovative technology, the effect of Reason for Business (β = .28) is needed, as well as the effect of Environmental and Social Business Decisions (β = .34) and Creative Visionary (β = .12). The impact of an Owned International Turbulent Business requires the Environmental and Social Impact of Business Decisions (β = .16) and the impact of an enterprise that offers an innovative product or service (β = .45). Finally, it is important to highlight the impact of the Observation of Business Context on the model as it applies to Crisis as an Opportunity (β = .27), Creative Visionary (β = .19), and Reason for Business (β = .21).

In summary, the business innovation of a developing country takes place in a complex system. The environmental context does not have a measurable direct effect on the appearance of innovation, but it is an important factor in the model, as it indirectly affects both the entrepreneur's perceptions and the enterprise. It motivates the entrepreneur to create a business that changes the world and helps achieve sustainable goals and promotes the emergence of creative and visionary entrepreneurs. For the enterprise, the environment strongly influences the extent to which the business handles the crisis as an opportunity. Entrepreneurship has a direct impact on the development of innovation, as unsurprisingly, businesses with new products and services are the engines of innovation. Furthermore, we can see that businesses that are in a turbulent economic trajectory and have international connections also have a strong direct impact on business innovation. Enterprises also have an indirect impact, as businesses that see a crisis as an opportunity that drive the entrepreneur to set sustainability goals for themselves. Finally, entrepreneurs themselves directly shape the appearance of innovation, as decisions that promote sustainability goals generate innovation. Concurrently, the entrepreneur also plays an important role as an indirect influence: as the visionary, a creative entrepreneur has substantial authority over their company's decision to develop a new service or product and set sustainable goals.

4. A Prerequisite for Business Innovation

Turning from the analysis of the mechanism of effects of our model to the necessary bottleneck conditions of innovation in our NCA, based on Richter et al.'s suggestion, we used the cross-loadings of latent variables obtained using PLS-SEM as a starting point for performing the NCA[63]. The non-decreasing CE-FDH function was generated on the scatter plot of the predictor and outcome variables[64]. The use of the CE-FDH ceiling line was also justified by the fact that the discrete data were within a relatively small range and showed a limited number of levels[65]. The NCA allowed us to separate the observation space from the non-observation space and, thus, identify the extent to which the attributes that create each innovation are necessary boundary conditions for business innovation.

According to Dul et al., for a condition to be considered necessary, it must meet three criteria: i) have a theoretical justification, ii) have an effect size $d > 0$, and iii) have a low p value ($p < .05$)[66]. Based on this, we first examined the effect sizes (d) of the latent variable scores using a significance test using the 10.000 random sample recommended in the literature[67]. The NCA results (Table 4) show that the only condition that meets all the criteria for business innovation is the OITB latent variable ($d = 0.099$, $p = .043$). The necessary precondition for innovation is, therefore, that the company has international connections, is on a turbulent growth path, and is privately owned.

Table 4. NCA Effect Sizes.

	CE-FDH	p value
BDES	0.300	0.000
CO	0.000	1.000
CV	0.114	0.180
EOIPS	0.000	1.000
OB	0.033	0.358
OITB	0.099	0.043
ROB	0.000	1.000

Figure 4 shows the scatterplot of the OITB boundary condition in a coordinate system. The upper bound (CE-FHD) indicates the minimum level of the OITB characteristic required to achieve a certain level of business innovation. The figure also shows the OLS regression line as a reference point.

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[63] Richter N. F., Schubring S., Hauff S., Ringle C.M., Sarstedt M., op. cit., pp. 2243–2267.

[64] Dul J., *Necessary condition analysis (NCA)…*

[65] Dul J., van der Laan E., Kuik R., *A statistical significance test for necessary condition analysis*, "Organizational Research Methods" 2020, 23(2), pp. 385–395.

[66] Dul J., *Conducting necessary condition analysis…*

[67] Dul J., *Necessary condition analysis (NCA)…*; Ibidem.

Figure 4. Scatterplot of the Predictor Variable OITB Versus the IT Outcome Variable.

NCA Plot : OITB - IT
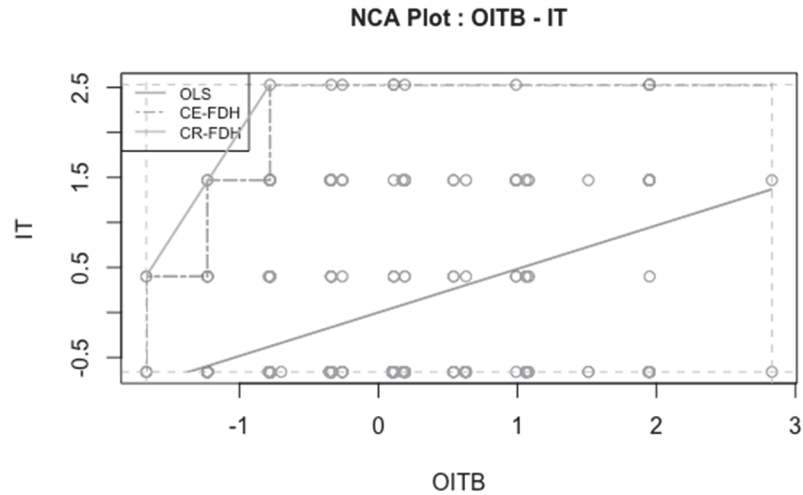
Source: Own elaboration.

Subsequently, a bottleneck analysis was performed on the data (Table 5). Table 5 shows the required minimum values for the predictive variables for the outcome variable (IT). According to Table 5, to achieve a medium level of innovation (50–70%), the level of OITB required must be at least 10.8%. Furthermore, for high-level (100%) IT, the OITB should be 19.7%. This implies that if a certain minimum degree of international networking and economic turbulence (19.7%) is not achieved by an enterprise, business innovation will not take place. According to Table 5, BDES, CV, and OB are also necessary boundary conditions for IT. However, these attributes do not have significant p values and, thus, do not meet the criteria for being considered as relevant necessary conditions[68]. Based on our analysis, they can be considered random or false positives.

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[68] Dul J., *Conducting necessary condition analysis…*

Table 5. Bottleneck Table (Percentages).

IT	BDES	CO	CV	EOIPS	OB	OITB	ROB
0	NN	NN	NN	NN	NN	NN	NN
10	4.4	NN	NN	NN	NN	NN	NN
20	9.0	NN	NN	NN	NN	NN	NN
30	13.5	NN	NN	NN	NN	NN	NN
40	18.0	NN	NN	NN	NN	2.0	NN
50	22.5	NN	NN	NN	NN	4.9	NN
60	27.0	NN	NN	NN	NN	7.9	NN
70	31.5	NN	3.3	NN	1.0	10.8	NN
80	36.0	NN	13.7	NN	3.9	13.8	NN
90	40.6	NN	24.0	NN	6.9	16.8	NN
100	45.1	NN	34.4	NN	9.8	19.7	NN

In summary, the NCA shows that a privately owned enterprise with turbulent economic growth and with international connections is the only necessary pre-condition for business innovation and that these conditions must be at least 19.7% to be able to create business innovation in a enterprise.

As a summary of our research results, Table 6 presents the verification of our hypotheses.

Table 6. Verification of the Research Hypotheses.

	t-value	*P* value		Hypo-thesis	Relationship	Result
CO -> IT		.06		H1	Not significant	Not verified
CO -> BDES	2,52	.01	* * *	H2	Significant, positive	Verified
OB -> ROB	4,12	.00	* * *	H3	Significant, positive	Verified
OB -> CV	3,55	.00	* * *	H4	Significant, positive	Verified
OB -> IT		.34		H5	Not significant	Not verified
OB -> CO	5,65	.00	* * *	H6	Significant, positive	Verified
OB -> BDES	3,06	.00	* * *	H7	Significant, positive	Verified
ROB -> IT		.81		H8	Not significant	Not verified
ROB -> EOIPS	5,80	.00	* * *	H9	Significant, positive	Verified
CV -> BDES	4,17	.00	* * *	H10	Significant, positive	Verified
CV -> EOIPS	2,60	.01	* * *	H11	Significant, positive	Verified
BDES -> EOIPS	7,98	.00	* * *	H12	Significant, positive	Verified
BDES -> IT	2,58	.01	* * *	H13	Significant, positive	Verified
BDES -> OITB	3,58	.00	* * *	H14	Significant, positive	Verified
EOIPS -> OITB	9,62	.00	* * *	H15	Significant, positive	Verified
EOIPS -> IT	7,73	.00	* * *	H16	Significant, positive	Verified
OITB -> IT	3,90	.00	* * *	H17	Significant, positive	Verified

Note. $p < .001$***, $.001 < p < .01$**, $.01 < p < .05$*, $p < .05 < p < .10$.

We could not verify H_1, H_5, and H_8 among our hypotheses, but all the other hypotheses were verified.

Conclusions

In our paper, we examined, in the case of a developing country, based on representative data, the effects necessary for business innovation, and which theoretical approach can be used to explain the operation of this complex casual system. Based on the literature, entrepreneurial innovation is assumed to be a three-sided effect. First, we defined it according to the classical Schumpeterian theory as an effect from the individual, from the entrepreneurial side; as an effect from enterprises; and, finally, as a cognitive socio-economic mechanism of effect.

Our data show that the proportion of innovative enterprises is low, accounting for about one-fifth of all enterprises. These businesses are typically SMEs, located in the more economically developed parts of the country, in large cities, and the vast majority of them are run by middle-aged men with a high level of education.

To explore the impact mechanisms that lead to innovations, we analysed our data using the PLS-SEM methodology. Our results show that business innovation in a developing country results from the combined effect of a com-plex tripartite system. In this system, the entrepreneur and the enterprise itself have a direct impact on the creation of innovation, and the macro-environment has an indirect effect on the emergence of innovation through the perception of the entrepreneur and the crisis management of the enterprise. Using NCA, we then determined that the prerequisite for the creation of innovation is that the company has international connections, is on a turbulent economic trajectory, and is privately owned.

The emergence of innovation, therefore, requires the co-occurrence of a multi-lateral mechanism of effects, in which a creative and visionary entrepreneur must create an enterprise with which they "[want] to change the world" while gaining a satisfactory amount of wealth. An important result of our study is that innovation in developing countries can be closely linked to sustainable goals, as both the entrepreneur and the business must prioritise goals and decisions in keeping with social and environmental sustainability. However, not only is an entrepreneur needed for business innovation but the enterprise itself must achieve a level of economic development embedded in an international network. In addition, the enterprise needs to handle crisis issues and obstacles as opportunities. All this can create the appearance of a new product and service in the company, which has a direct positive impact on the appearance of innovation. Finally, the socio-economic environment must also be conducive to the development of innovation. While this dimension does not have a direct impact on innovation, it does have an indirect impact on both the entrepreneur and the business. It follows from all of this that the development of innovation in Hungary can primarily be explained by Schumpeter's theory.

Our study is not without limitations. For our model, we used the sample of a developing country; therefore, the study can be made completer and more accurate if other developing countries are analysed and then their results compared with these. It is easy to imagine that the innovation models of other Central-Eastern European countries are created based on a different causal system, so they can also be explained by other theories. Our research can be further refined by including additional macro-contextual variables as well. In our research, we included only cognitive variables to measure the macro-context, but this could be extended to include either performance requirements or risk-taking variables, as well as measures of context regulators, values, and institutions[69].

In summary, the materialisation of business innovation is the result of a complex three-dimensional mechanism of effects that requires not a single factor but a combination of factors. But the strongest explanatory theory among these was the Schumpeterian theory. In all of this, there is a need for entrepreneurs who can "dream" and stimulate innovation along the lines of sustainability. However, having a macro-environment is equally important, as it would allow them to implement these innovations and develop their entrepreneurial spirit. Furthermore, there is a need for an economically prosperous business with international connections, which can provide an appropriate framework for creating new products and services, and the tendency to see challenges as opportunities and not as problems. The combined effect of all this is needed for the creation of business innovation, which can lead to economic growth.

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Appendix

Table 1. Reliability and Validity of the Latent Variables.

	Composite Reliability	Average Variance Extracted (AVE)
BDES	0.83	0.71
CO	0.73	0.59
CV	0.79	0.65
EOIPS	0.79	0.65
IT	1.00	1.00
OB	0.76	0.62
OITB	0.78	0.54
ROB	0.81	0.68

Table 2. Factor Scores of Measured Variables and Their VIF (Collinear Statistics) Values.

	Factor Scores	VIF
creativ	0,91	1,12
nbmedia	0,89	1,07
nbsocent	0,67	1,07
omcrgrow	0,73	1,12
omcstexp	0,73	1,19
omcstnat	0,52	1,06
omnewproc	1,00	1,00
omnewprod	0,85	1,10
omown	0,74	1,24
suacts	0,76	1,10
sucpnewopp	0,95	1,06
sumotiv1	0,89	1,16
sumotiv2	0,75	1,16
susdg_env	0,87	1,22
susdg_soc	0,82	1,22
vision	0,69	1,12

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