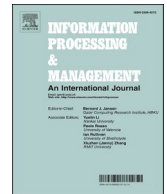




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## Investigating the business intelligence capabilities' and network learning effect on the data mining for start-up's function

Yi Xu<sup>a</sup>, Xiaojuan Li<sup>a,\*</sup>, Fajaruddin bin Mustakim<sup>b</sup>, Fahad M. Alotaibi<sup>c</sup>, Nabaz Nawzad Abdullah<sup>d</sup>

<sup>a</sup> School of Business Administration, Hunan University of Finance and Economics, Changsha, 410205, China

<sup>b</sup> Faculty Civil Engineering and Built Environmental, University Tun Hussein Onn Malaysia, 86400 Parit Raja, Batu Pahat, Johor, Malaysia

<sup>c</sup> Department of Information Systems, Faculty of Computing and Information Technology (FCIT), King Abdulaziz University, Jeddah, Saudi Arabia

<sup>d</sup> Department of Business Administration, College of Administration and Economics, Lebanese French University, 44001 Erbil, Kurdistan Region, Iraq

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### ABSTRACT

In recent years, Startups are new concepts in the tech world and are meant to be temporary organizations designed to find a repeatable, scalable business model, while offering a new solution to the problem. What matters most about the success of startups is the right and reasonable targeting. This is something that is usually overlooked by a large percentage of such businesses, causing them to fail within a short period of time. Production of new product or service delivery is not possible without planning. The purpose of this study is to look deeper into how startups should identify and prioritize issues and problems when launching a new product or service. First, startups and subject-related businesses reviewed and then novel and emerging issues, including the status of data mining on startups' performance, the topics of Business Intelligence (BI), innovation and networked learning, and also their role in startups business discussed. Results showed that BI can provide a competitive advantage to startups. With this in mind, these businesses may adapt to the diverse needs of customers in the market and continue to survive, as well as gain greater market share over their competitors. Further, employing technology tools helps companies make their data available seamlessly or securely and by analyzing it, giving managers a better way of making decisions. According to the hypotheses, it was found that BI as a powerful tool in the field of information technology, creates a competitive advantage and it is necessary for start-up managers to accept this tool.

### 1. Introduction

Organizations, companies, and their environments are changing rapidly, fewer companies today behave traditionally, and most businesses have come to accept that continuous profitability alone does not mean survival and should be pursued (Goodyear et al., 2006). Competition and related tools, and in order to stay competitive in the market, they must learn new rules. Taking advantage of new opportunities and implementing effective strategies can bring a competitive market advantage and long-term sustainability (Kannan and Munday, 2018). Organizations and companies, when actively monitoring and monitoring the market, usually face inevitable changes, so they must always be properly prepared to respond to customer demand (Steeple and Jones, 2012).

\* Corresponding author.

E-mail address: [lixiaojuan@hufe.edu.cn](mailto:lixiaojuan@hufe.edu.cn) (X. Li).

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### Abbreviations

RMR	RESTING Metabolic Rate
GFI	Goodness-of-fit index
AGFI	Adjusted goodness-of-fit
NFI	Normed fit index
TLI	Task Load Index
CFI	Comparative fit index
RMSEA	Root mean square error of approximation
RFI	request for information
PNFI	Parsimony Normed Fit Index
PCFI	Parsimony Comparative Fit Index

Business intelligence is a set of methods, processes, and technologies used to turn raw data into meaningful results. There is always a deep gap between the information required by managers and the large amount of data that is collected during the daily operations of organizations in its various departments (Anders, 2018). Maybe some information is provided outside of operating systems and even outside the organization and through competitors' information. Business intelligence uses large amounts of information to identify and develop new opportunities (Caseiro and Coelho, 2019). The maximum benefit of business intelligence is that it provides direct access to data to decision makers at all levels of the organization. In this way, decision makers will be able to interact with the data and analyze it and be able to better manage the business, discover opportunities and improve efficiency (Kurnia, 2018, Rahardja and Harahap, 2019). Business intelligence has been a priority for IT executives for the favorable circumstances for companies looking to advance their business (Liang and Liu, 2018).

In the conventional concept of management, decision support has executed a significant part in the efficiency of organizations (Choi et al., 2020, Yiu et al., 2021). The favorable circumstances derived from info and their analysis have led to a great deal of interest in business intelligence and data analysis in organizations, and users to make business-related decisions in a timely manner (Bhatiasevi and Naglis, 2020).

Companies seeking internationalization use business intelligence to create strategy and technology, collect and analyze foreign market information, and predict future market attractiveness and new foreign markets (Sun et al., 2018, Trakadas et al., 2020). By employing business intelligence systems, companies are supported in creating important and vital information of their business and their transparent and intelligent processing. As a result, employees may be able to make finer decisions, reach the outcomes they need quicker, and continually advance them (Jayakrishnan et al., 2018, Moreno et al., 2019).

In the world today, the connection of intellectual capital to entrepreneurship is slowly expanding. Entrepreneurial genius plays an important role in creating new businesses (Verma et al., 2021, Jelonek et al., 2019, Jaklič et al., 2018, Huang et al., 2022). It can be argued that in addition to cost and quality, which are vital factors for competition, there are other factors that play an important role in achieving and maintaining a company's competitiveness (Caseiro and Coelho, 2018, Kurniawan et al., 2021, Nazari et al., 2022). To successfully evaluate the future of a new venture, stakeholders, campaign committees, and potential investors, such as bankers, explicitly need to provide a business model to consider financing a new business (Garbuio and Lin, 2019, Cautela et al., 2019, Tadayon et al., 2019, Khan et al., 2020). That's why business modeling is now one of the institutionalized activities for any new entrepreneur (Cheng et al., 2020, Jooste et al., 2018, Ramakrishnan et al., 2020).

Start-ups are a good opportunity to move between traditional and modern businesses, and improving their conditions by creating a culture and changing conditions, as well as increasing the workforce in technology development sectors, will increase the welfare of society and improve economic conditions, all of which they are deeply dependent on start-ups (Lederer and Schmid, 2021, Sanasi et al., 2019, Ilieva et al., 2021).

In the study of Rahiminasab et al. (2020) by employing multi-factor decision-making, a suitable cluster head was selected. Compared to BCDP method, Energy reduction was 5% more, and packet loss rate was 25% less. In the study of (Ebadi and Shiri Shahraki, 2010) Banker's description of scale elasticity and returns to scale was changed. Farther, a suitable algorithm was employed to detect scale elasticity in duration of non-discretionary aspects. In the study of Heydarpour et al. (2020) an ordinary differential equations (ODEs) system was employed for prediction process. Farther, an artificial neural network (ANN) is applied to solve the ordinary differential equations system by minimizing the error function and developing parameters consisting of biases/weights. In the study of He et al. (2022) dynamical manner of model was tested numerically/analytically. the complexity analysis is employed by approximate entropy (ApEn) and  $C_0$  complexity to affirm the chaos being. In critically overloaded datasets, employing traditional binary or multi-class categorization usually cause bias towards the category with bigger values of occasions. In the study of Seliya et al. (2021) One-class classification (OCC) process was employed to expose abnormal info points compared to the effects of a known category.

The purpose of this study is to look deeper into how business startups should identify and prioritize issues and problems when launching a new product or service. First, startups and subject-related businesses reviewed and then novel and emerging issues, including the status of data on startups' performance, the topics of Business Intelligence (BI), innovation and networked learning, and also their role in startups business discussed.

Hypothesizes are: The characteristics of BI used affect the efficiency of start-up businesses; There is a significant relationship

between innovation and start-up business performance; Network learning affects the efficiency of start-ups; The business intelligence features used influence the innovation of start-ups; The business intelligence features used influence the network learning of start-ups; There is a significant relationship between innovation and network learning in start-ups.

## 2. Methods

### 2.1. Type and Method of research, Validity, Statistical sample, and Sample size

The choice of research method is one of the important stages of research that depends on the objectives, nature of the subject and its implementation possibilities. A research method is a set of valid rules, tools, and methods for investigating facts, discovering unknowns, and finding solutions to problems. The purpose of this research is to examine the effect of BI capabilities on the efficiency of start-up businesses, which is descriptive in terms of the type of research.

In this study, a questionnaire was used to collect the required information (Table 1). Before starting the questionnaire questions, first the purpose of data collection by the questionnaire and the need for cooperation of respondents in providing the required data, is stated.

Determining the statistical community is one of the necessities and principles of any research. The statistical population in this study is 1200 start-up businesses. Considering the standard readiness of 1.96, the probability of success / failure in sampling is 0.5 and the probability of measurement error is 0.08. The sample size of this research is 150 start-up businesses.

### 2.2. Information analysis method

Because the research is descriptive, descriptive and inferential statistical methods have been used to analyze the data in this research. Thus, to interpret statistical data on frequency and frequency percentage, tables and graphs, and to investigate the descriptive statistics of variables from SPSS software (Version 26: CPU i7-11600H with 32GB RAM) (Zhao et al., 2021) and to investigate the relationship between independent and dependent variables with Amos software has been done. Fig. 1 shows Conceptual model. This conceptual model is the representation of system that used in this research. It consists of concepts employed to help readers understand the subject of this model. The following conceptual model is made of 4 points, BI, NL, Innovation, and Function. Each one

**Table 1**  
Questionnaire table (Caseiro and Coelho, 2019, Yiu et al., 2021, Tadayon et al., 2019).

Questions	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
<b>Business intelligence:</b>					
<i>To what extent is data integration done in your business?</i>					
<i>To what extent have analytical capabilities been implemented in your business?</i>					
<i>To what extent is the quality of information content in your business?</i>					
<i>To what extent is the quality of access to information in your business?</i>					
<i>In your business, to what extent is information used in the business process?</i>					
<i>To what extent is there a culture of analytical decision-making in your business?</i>					
<b>Innovation:</b>					
<i>Innovations are selected in your business that will strengthen the possibility of competition.</i>					
<i>In your business, new innovations change previous products or services.</i>					
<i>In your business, new methods are used to speed up executive activities.</i>					
<i>In your business, innovations are chosen that consider customer experience in products and services.</i>					
<i>In your business, ideas for new product development or product development are constantly explored.</i>					
<b>Network Learning:</b>					
<i>In your business, employees are encouraged to communicate clearly with each other.</i>					
<i>In your business, the information of all executive levels is collected and made available.</i>					
<i>In your business, the necessary information and documents are provided with all the details for use in current affairs.</i>					
<i>In your business, employees refer to the information archive for their decisions.</i>					
<i>In your business, employees share their information and documents, such as statistics and useful information, plans, new ideas, etc.</i>					
<i>In your business, company employees do not show resistance to new working methods.</i>					
<i>In your business, news about new changes and developments reaches people through official and defined channels.</i>					
<i>In your business, if the internal capabilities of the organization become inefficient, the company will solve the needs by using the facilities outside the company.</i>					
<b>Function:</b>					
<i>How responsive is your business to the needs of customers?</i>					
<i>How much has your business increased in sales?</i>					
<i>How much has your business increased market share?</i>					
<i>To what extent has your business improved its competitive position in the market?</i>					

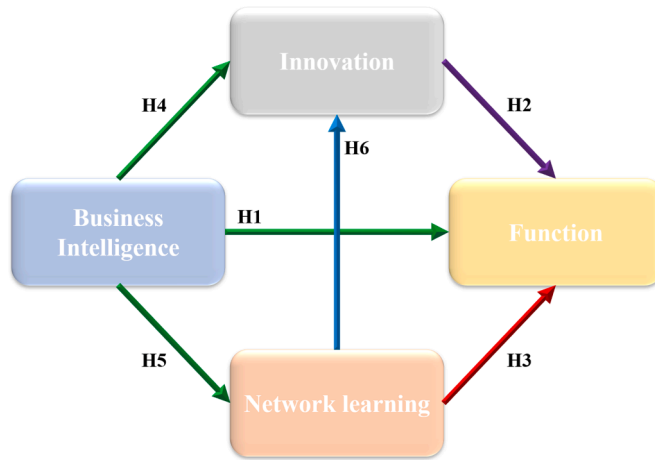


Fig. 1. Conceptual Model (Han, 2006).

of the points are connected to each other by a logical process.

### 3. Results

Today, the managers of any business need to collect and process information properly. The rapid growth of information and the expansion of its domains of influence in human life has left a vague space for scientists. The pace of change is such that thinkers try to evaluate and monitor the extent of its impact. The effects of this factor on the business environment have created an indescribable prosperity in the world.

#### 3.1. Descriptive analysis

Fig. 2 shows Business establishment by time. 129 (86%) of the statistical sample had an activity period of less than five years and 3 (2%) of the statistical sample had an activity period of more than ten years. Also, 18 (12%) of the statistical sample had an activity period of five to ten years.

Fig. 3 shows Job position and Education level. 61 respondents (40.6%) of the statistical sample were senior managers. Also, 62 respondents (41.4%) were supervisors, while 27 respondents (18%) were employees. 19 respondents (12.6%) of the statistical sample had a Ph.D. degree. 79 respondents (52.6%) of the statistical sample had a Master’s degree. Also, 51 respondents (34%) of the statistical sample had a Bachelor’s degree.

Fig. 4 shows History of activity in this business. 102 respondents (68%) of the statistical sample had an activity period of less than five years in this business. 38 respondents (25.4%) of the statistical sample had an activity period of between five and ten years in this business. Also, 10 respondents (0.66%) of the statistical sample had an activity period of more than ten years in this business.

Fig. 5 shows Descriptive statistics of research variables. For the variable of business intelligence, 7 (5%) samples answered low, 18 (12%) samples answered medium, 72 (48%) samples answered much, and 53 (35%) samples answered very much. For the variable of innovation, 7 (5%) samples answered low, 6 (4%) samples answered medium, 54 (36%) samples answered much, and 83 (55%)

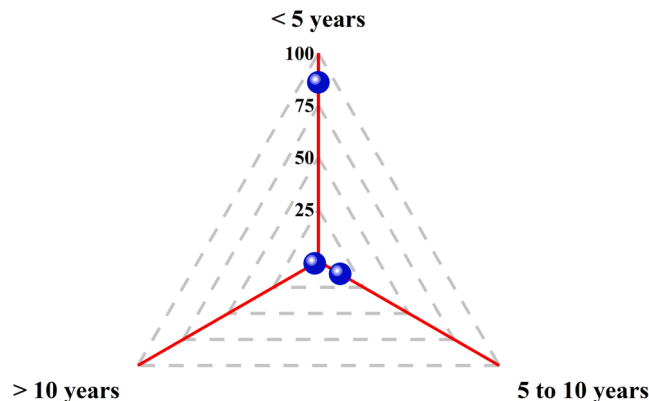


Fig. 2. Business establishment by time.

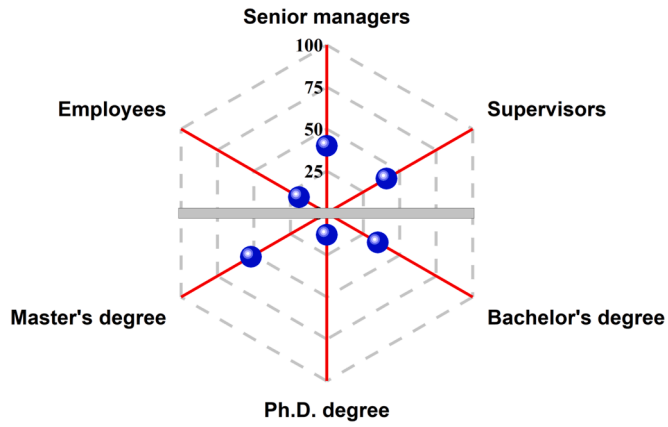


Fig. 3. Job position and Education level.

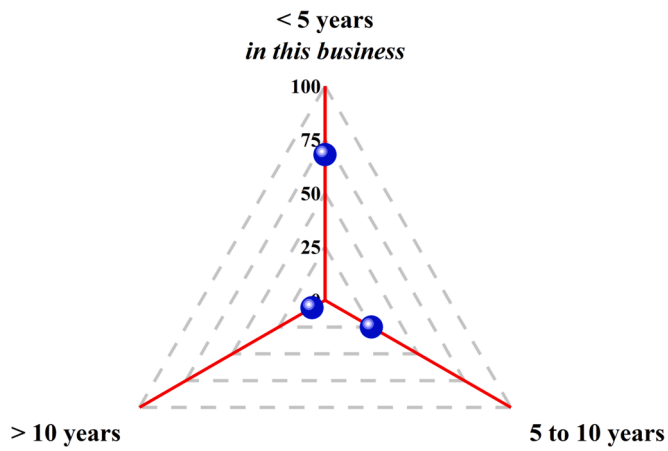


Fig. 4. History of activity in this business.

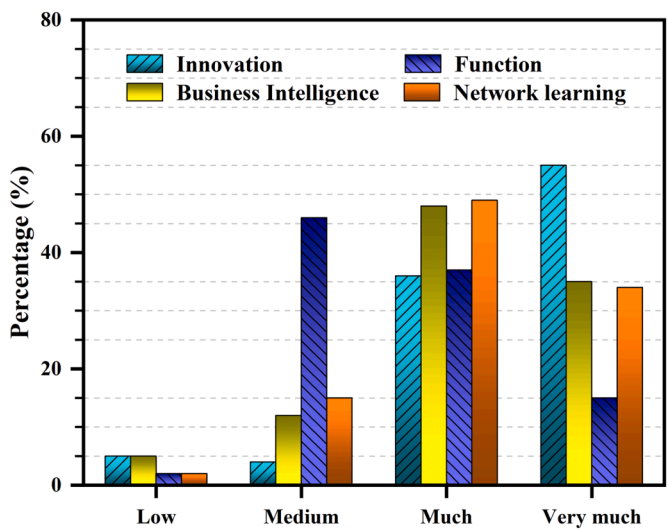


Fig. 5. Descriptive statistics of research variables.

samples answered very much. For the variable of network learning, 3 (2%) samples answered low, 22 (15%) samples answered medium, 74 (49%) samples answered much, and 51 (34%) samples answered very much. For the variable of function, 2 (2%) sample answered low, 70 (46%) samples answered medium, 55 (37%) samples answered much, and 23 (15%) samples answered very much.

Table 2 shows Comparison of descriptive statistics of research variables. Also, it shows Standard deviation.

3.1.1.1. Kolmogorov–Smirnov test to determine the normality of the distribution of scores

In order to evaluate the homogeneity of the distribution of questionnaire scores, Kolmogorov–Smirnov test was used. The results in Table 3 show that due to the fact that the significance level of the obtained indicators is less than 0.05, all the above variables have an abnormal distribution. This test quantifies a distance between experimental specimen distribution function and reference distribution cumulative distribution function, or between experimental distribution functions of two specimens. Eq. 1 calculates the K-S one sample test:

$$D = \text{Maximum}|F_o(X) - F_r(X)| \tag{1}$$

Where  $F_o(X)$  is observed cumulative frequency distribution of an accidental specimen of  $n$  observations; and  $F_r(X)$  is hypothetical frequency distribution.

3.1.1.1.1. Testing hypotheses. After descriptive findings were evaluated and tested using appropriate descriptive analysis tools, inferential analysis was used and other statistical analysis tools were used to confirm or refute the hypotheses.

In this study, because the data are abnormally distributed, non-parametric statistical test is used to analyze the data. The main research hypothesis is that BI affects the efficacy of start-up businesses. Other assumptions:

- H1. The characteristics of BI used affect the efficacy of start-up businesses
- H2. There is a significant relationship between innovation and start-up business performance
- H3. Network learning affects the efficacy of start-ups
- H4. The business intelligence features used influence the innovation of start-ups
- H5. The business intelligence features used influence the network learning of start-ups
- H6. There is a significant relationship between innovation and network learning in start-ups

3.1.1.1.2. Structural equation modeling. The structural equation is a combination of factor analysis and path analysis between variables, so in addition to testing different types of models, including regression models, path analysis, and factor analysis separately, simultaneously between the observed variables are placed factor analysis. It also tests the relationship between hidden variables while analyzing the path. Hidden or factor variables (in factor analysis) are variables that are not studied directly. These types of variables are measured indirectly through variables or questions. There are two categories of latent variables in the structural equation: independent and dependent latent variables. Independent hidden variable: directly affects other variables without affecting another variable. Hidden dependent variable: is a variable that is affected by other variables in the model. Explicit variables are used to measure hidden variables. Independent explicit variables are independent latent variable identifiers and dependent explicit variables are dependent latent variable identifiers. Fig. 6 shows the structural equation model in Amos software, in this figure, based on conceptual model, all of the obtained data is inserted and the connection between question/equation is detected:

In Table 4, there is a significant relationship between business intelligence and performance variables with a significance level of 0.035, also between business intelligence and innovation variables with a significance level of 0.051, with an acceptable significance level less than / equal to 0.05. This means that the chances of this difference or relationship being very unlikely. The results of the analysis of variables are given in Table 5,  $CMIN/DF < 3$  signify a satisfactory fit between sample data and hypothetical model. The CFI analyzes the model fit by checking out the discrepancy between hypothesized model and data, its values range from 0 to 1, where 1 referring better fit.

Table 2

Comparison of descriptive statistics of research variables (Caseiro and Coelho, 2019, Yiu et al., 2021, Tadayon et al., 2019).

	Business Intelligence	Innovation	Network Learning	Function
Number of respondents	150	150	150	150
Missing data	0	0	0	0
Min	2	2	2	1
Max	5	5	5	5
Average	4.14	4.42	4.15	3.65
Standard deviation	0.802	0.779	0.739	0.768

**Table 3**  
Test the normality of the data (Caseiro and Coelho, 2019, Yiu et al., 2021, Tadayon et al., 2019).

	Shapiro-Wilk			Kolmogorov-Smirnov		
	Significance level	Degrees offreedom	Statistics	Significance level	Degrees offreedom	Statistics
Business Intelligence	0.000	150	0.924	0.000	150	0.161
Innovation	0.000	150	0.833	0.000	150	0.217
Network Learning	0.000	150	0.932	0.000	150	0.168
Function	0.000	150	0.927	0.000	150	0.188

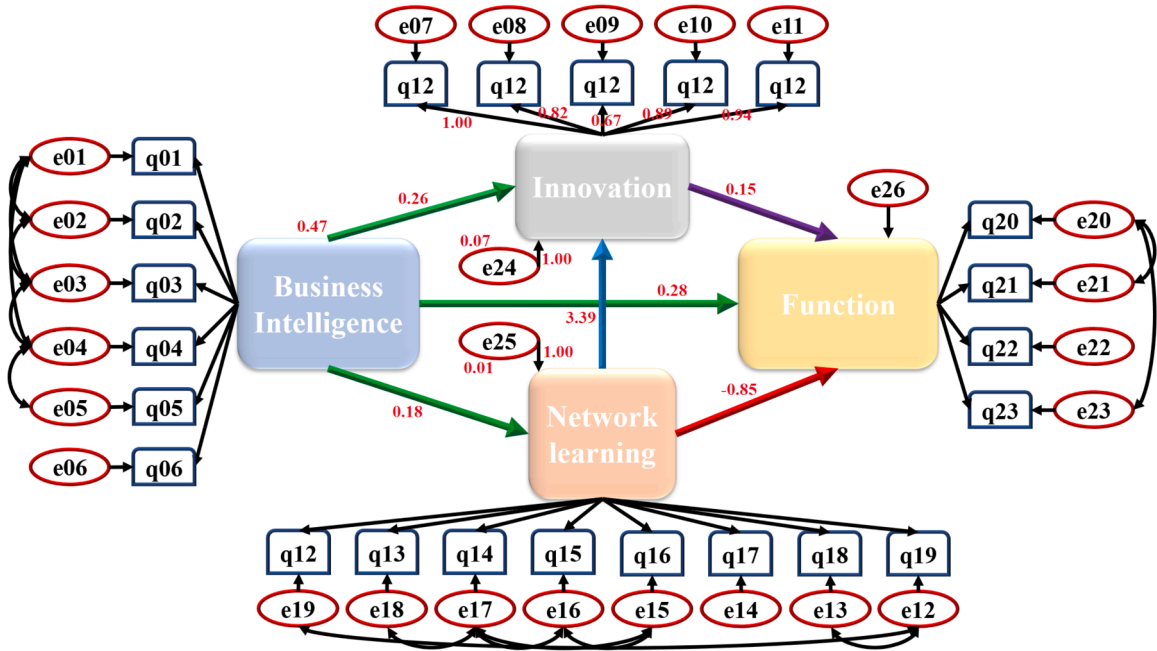


Fig. 6. Structural equation modeling.

**Table 4**  
Regression coefficients (Caseiro and Coelho, 2019, Yiu et al., 2021, Tadayon et al., 2019).

Significance level	Standardized estimates	Communication path
0.035	0.408	Business intelligence <> performance
0.509	0.235	Innovation <> Performance
0.488	-0.273	Network learning <> Performance
0.051	0.249	Business Intelligence <> Innovation
0.123	0.710	Network learning <> innovation
0.111	0.820	Business Intelligence <> Network Learning

**4. Discussion**

- The main benefits of business intelligence are better decision making, improving business processes and supporting the achievement of strategic business goals among competitors, and also by using business intelligence systems, organizations in creating important information and processing of their business, they are supported with transparency and intelligence. The results of this study also confirm the positive relationship between business intelligence and business performance. Therefore, this hypothesis is confirmed.
- Companies that provide a conducive environment for innovation and demonstrate employee innovation at different levels will be more competitive in local and global markets. Employee innovation is one of the key factors in achieving competition. A system that sees continuous growth in users and performance is defined as a successful system, and three strengths that contribute to success over time: innovation, acceptance, and scaling have been identified. The results of this study showed that there is no significant relationship between innovation and performance. Therefore, this hypothesis is rejected.



**Table 5**  
Results of analysis of variables (Caseiro and Coelho, 2019, Yiu et al., 2021, Tadayon et al., 2019).

Index name	The amount of index interviewed	Acceptable rate of the index	Acceptable status
CMIN	402.018	0.05	
CMIN/DF	1.914	Less than 3	■
<b>Minimum Discrepancy Function by Degrees of Freedom divided</b>			
RMR (Fitness index)	0.054	Less than 0.06	■
<b>RESTING Metabolic Rate</b>			
GFI (Fitness index)	0.813	More than 0.9	
<b>Goodness-of-fit index</b>			
AGFI (Fitness index)	0.754	More than 0.9	
<b>Adjusted goodness-of-fit</b>			
NFI (Adaptive index)	0.837	More than 0.9	
<b>Normed fit index</b>			
RFI (Adaptive index)	0.804	More than 0.9	
IFI (Adaptive index)	0.915	More than 0.9	■
TLI (Adaptive index)	0.896	More than 0.9	
<b>Task Load Index</b>			
CFI (Adaptive index)	0.913	More than 0.9	■
<b>Comparative fit index</b>			
PRATIO (Economic index)	0.830	More than 0.5	■
PNFI (Economic index)	0.695	More than 0.5	■
PCFI (Economic index)	0.758	More than 0.5	■
RMSEA	0.078	Less than 0.1	■
<b>Root mean square error of approximation</b>			
HOELTER.05	150	91	■
HOELTER.01	150	97	■

- In high-tech industries such as information technology, technology-based solutions strongly affect enterprise networks on both sides of the supply chain, namely vendors and customers. The results of this study showed that network learning does not directly affect performance. Therefore, this hypothesis is rejected.
- When the basic technology in an industry changes rapidly, individuals and companies that do not change with technology quickly become obsolete. To keep up with the pace of technological change, innovation must be constantly evolving. Hence, innovation is not only a business necessity but also a vital necessity. Among the new investments, start-ups are usually associated with a high level of innovation, rapid growth, intensive knowledge activities and new technologies. Therefore, it is thought that more than other types of companies with higher potential to support the movement of the economy towards progress and advanced industries. The results of this study also showed that BI has an impact on business efficacy. Therefore, this hypothesis is confirmed.
- There is a need for a different perspective to succeed in managing business intelligence solutions and a need to focus on a digital infrastructure based on the ongoing link between humans and technology. In the information technology industry, cooperation and technology transfer in many specialized and centralized fields is done through organizational networks. In the IT industry, companies that develop IT solutions work closely with their vendors to provide new software and work closely with customers to implement new development technologies and reach the next level of customers. The outcomes of this research demonstrated that the characteristics of business intelligence do not affect network learning. Therefore, this hypothesis is rejected.
- Organizational networks can act as a fast learner, an innovation, as well as consolidate the innovation process and ultimately become competitors in innovation. When organizational networks help learn, then innovation emerges in the organization. The results of this study showed that there is no significant relationship between innovation and network learning. Therefore, this hypothesis is rejected.

## 5. Conclusion

This study seeks to enhance start-up businesses' understanding of the impact of technology, specifically BI, on their business efficacy, and to assist research that seeks to understand the impact of this technology on such businesses. In this study, a total of six hypotheses were analyzed using descriptive and inferential statistical methods. The results of the hypothesis test are as follows:

- The characteristics of BI used affect the efficacy of start-up businesses.
- There is a significant relationship between innovation and start-up business performance.
- Network learning affects the efficacy of start-ups.
- The characteristics of business intelligence used influence the innovation of start-up businesses.
- The business intelligence features used influence the network learning of start-ups.
- There is a significant relationship between innovation and network learning in start-ups.

According to the studies conducted in testing the hypotheses of this research, it was found that business intelligence as a powerful tool in the field of information technology, creates a competitive advantage and it is necessary for start-up business managers to accept this tool and always in Active IT updates. In other words, the results of this study showed that information technology has become a



strategic tool and plays an important role in advancing goals and creating a competitive advantage, as well as a factor in creating innovation in these businesses.

### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### Data availability

Data will be made available on request

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