

# Examining the Impact of Company Size, Ownership Structure, Liquidity, and Industry Type on Continuous Innovation Capability in Companies Listed on the Tehran Stock Exchange

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## ABSTRACT

**Objective:** The main objective of this research was to examine the effects of company size, ownership structure, liquidity, and industry type on the continuous innovation capability of companies listed on the Tehran Stock Exchange.

**Methodology:** Given the structure of the data studied in this research, which included the time dimension (2011 to 2022), the panel data method was used. The statistical population of this study is the Tehran Stock Exchange and all companies listed on it. A purposive sampling method was used in this research. Using this method, the research sample included manufacturing companies listed on the Tehran Stock Exchange during the period from 2011 to 2022. Additionally, EVIEWS software version 12 was used to analyze the data.

**Findings:** The findings showed that the coefficient of the variable company size on companies' innovation capability was 0.088 and the estimated T-statistic was 2.58. Therefore, it can be stated that company size has a positive and significant effect on companies' sustainable innovation capability. Additionally, the coefficient of the variable ownership structure on companies' innovation capability was 0.077 and the estimated T-statistic was 3.17, which indicates that ownership structure has a positive and significant effect on companies' sustainable innovation capability. The variable stock liquidity on companies' innovation capability had a coefficient of 0.1035 and an estimated T-statistic of 2.43. Finally, the coefficient of the variable industry type on companies' innovation capability was 0.1035 and the estimated T-statistic was 2.43. Therefore, it can be stated that industry type has a positive and significant effect on companies' sustainable innovation capability.

**Conclusion:** It can be concluded that the larger the companies and the more transparent the ownership structure, the higher the companies' innovation capability.

**Keywords:** *Sustainable Innovation, Company Size, Ownership Structure, Stock Exchange*

## 1 Introduction

Innovation refers to the use of knowledge, ideas, methods, and new capabilities to create unique skills and improve organizational competitiveness (Antunes et al., 2017; Chen et al., 2020). Kim et al. (2012) mention that innovation can be divided into management innovation and technological innovation. Considering the degree of innovation, technological innovation can be classified into incremental innovation and radical innovation (Kim et al., 2012). The characteristics of incremental innovation can be summarized as short-term innovations that are not significant, creating small changes in existing technologies to meet the needs of existing customers (Tarí & García-Fernández, 2020). Radical innovation (also known as successful innovation) refers to a sudden change that requires the use of new knowledge to develop new products or processes that can meet the needs of new customers or emerging markets (Mikalef et al., 2019).

Innovation can be viewed as the implementation of ideas originating from creative processes. Innovation embodies, combines, and integrates knowledge into new, original, relevant, and valuable products, processes, or services. It can be defined as the process of translating a novel and creative idea or invention into a good or service that creates value or for which customers will pay. Creativity is a process used to improve problem-solving. Therefore, until your creative efforts produce a product, service, or process that addresses a primary need or solves a problem initially identified, your work is not complete. This relates to the commercialization of the creative invention, which occurs if someone significantly improves or contributes to existing products, processes, or services (Liu & Buck, 2007; Seyed Kalali & Heydari, 2021).

In economic development, innovation is the driving force of economic growth. Innovation is defined as a knowledge base for producing something useful and involves modifying or discovering ideas so that they can be developed commercially. Innovation plays a crucial role in modern social progress, considered in some research as an innovation-based economy. Innovation can be described as the commercial ability to introduce new things in a better way and to compete in new or existing markets (García-Quevedo et al., 2018).

Innovations are categorized into three types: product innovation (designing more unique products or creating products), process innovation, and service innovation. Innovation is vital, as shown in previous research for enhancing product superiority, competitiveness, profitability, and efficiency. Achieving sustainable innovation requires norms and values to be considered alongside technological and innovation procedures (Oh et al., 2011; Seyed Kalali & Heydari, 2021). According to researchers, technology enables a product to be quickly imitated; hence, an entrepreneur must maintain their unique design quickly with good quality and artistry, similar to fashion products characteristic of Bali's local products. The Governor of Bali emphasized that women entrepreneurs in Bali should be able to combine innovation with local culture (Altomonte et al., 2016; Antunes et al., 2017; Chen et al., 2020; Chen et al., 2014; Deloof, 2003; Ebrahimi et al., 2023; Oh et al., 2011; Shin & Soenen, 1998).

Many factors influence innovation. Company size refers to the size and scale of a company's operations, measured by various parameters. Various parameters for measuring company size include the number of employees, revenue, profit, assets, and cash. Company size may also vary based on the industry and target market of the company. Company size is considered one of the essential factors in determining a company's success in the market. Larger companies may have significant investment capabilities and can better compete with smaller companies, but due to their size and structural complexity, quantity may sometimes be prioritized over quality (Kim et al., 2012; Liu & Buck, 2007).

Ownership structure refers to how shares and company control are distributed among its owners. Essentially, ownership structure shows who owns the shares of a company and how these shares are distributed. Ownership structure can include one or several owners. In a single-owner structure, all company shares are owned by one individual or institution. In a multi-owner structure, company shares are distributed among several individuals or institutions. Generally, ownership structure can be divided into two major categories: family ownership and public ownership. In family ownership, most company shares are owned by a family or an individual, and company control is exercised within the family. In public ownership, company

shares are publicly distributed among the general population, and control is exercised by a board of directors (Gill et al., 2010).

Several studies have been conducted on innovation in companies. Chen et al. (2014) examined the impact of liquidity and corporate governance variables on innovation capability in 345 selected companies from 1990 to 2008 using panel data. Findings indicated that stock liquidity and corporate governance variables had a positive and significant impact on innovation capability in the studied companies during the examined period (Chen et al., 2014). Altomonte et al. (2019) explored the relationship between financial constraints, stock liquidity, total factor productivity, company size, investment in research and development, and exports among companies in France, Italy, and Spain. Findings showed a positive and significant correlation between total factor productivity, the size of the studied companies, their liquidity, and research and development expenditures as an innovation indicator (Altomonte et al., 2016). Tang et al. (2022) examined the impact of company size, industry type, and ownership structure on the relationship between sustainable innovation capability and stock liquidity in a sample of Chinese companies using panel data from 2010 to 2019. Results showed that higher stock liquidity weakened the level of sustainable innovation, especially in state-owned companies. Other results indicated that company size and industry type moderated and reduced the relationship between stock liquidity and innovation levels in the studied companies (Tang et al., 2022).

However, it is expected that companies with substantial investments in innovative activities will fundamentally perform better in the future and provide higher returns for investors. Given the research gap in this area in Iran and the need to address this gap, this study aims to examine the impact of company size and ownership structure on sustainable innovation capability in companies listed on the Tehran Stock Exchange from 2011 to 2022 using panel data methodology.

## 2 Methods and Materials

Given the structure of the data studied in this research, which included the time dimension (2011 to 2022), the panel data method was used. When panel data is utilized, various tests must be conducted. The Chow test was used to examine whether the sample is pooled or panel, and the Hausman test was used to examine fixed effects versus random effects.

The statistical population of this study is the Tehran Stock Exchange and all companies listed on it. A purposive sampling method was employed in this research. Using this method, the research sample included manufacturing companies listed on the Tehran Stock Exchange during the period from 2011 to 2022. Additionally, EViews software version 12 was used for data analysis.

## 3 Findings and Results

The model used in this research is as follows, which was adapted from the study by Tang et al. (2022):

$$PATENT = \beta_0 + \beta_1 LIQ_{it} + \beta_2 Size_{it} + \beta_3 IND_{it} + \beta_4 LEV_{it} + \beta_5 ROA_{it} + \beta_6 HHI_{it} + \beta_7 INDU_{it} + YEAR_{it} + FIRM_{it} + \varepsilon_{it}$$

The conceptual and operational definitions of the above variables are as follows:

**PATENT:** Innovation involves selecting the right ideas and correctly executing the process of transforming these ideas into services, products, or processes to achieve profit and growth in the company or organization. The innovation index is the number of patents registered annually or the new products produced in the company.

**LIQ:** Measuring stock liquidity is usually done using various methods. In this study, the trading volume will be used. Trading volume refers to the number of shares bought and sold within a specific time frame. If the trading volume is high, stock liquidity is higher. In other words, an increase in trading volume in the stock market indicates an increase in stock liquidity. Generally, stock liquidity means that investors can easily and quickly buy and sell stocks and quickly access cash. Accurate measurement of stock liquidity depends on stock market conditions and various variables, including trading volume, market spread, the number of marketers, and buyers, etc.

**ROA:** Return on Assets is one of the most important performance metrics of a company and is calculated by dividing net profit by total assets. Lower ratios indicate that the company earns less net income per unit of asset, indicating poor performance. In this study, the return on the company's assets is calculated by dividing net profit by the book value of the company's assets.

**Size:** Company size is defined as the total monetary value of all shares issued by the company in the stock market. In this study, company size is equal to the logarithm of the company's assets.

LEV: A company's leverage refers to the amount of debt used to finance the company's assets. In this study, company leverage is calculated by the ratio of total company debt to total company assets.

To examine the effect of industry type, the sample will be chosen such that the industry includes a large number of companies, allowing analysis of the relationship between liquidity and innovation capability in various samples. Companies are divided into two groups, large and small, and a dummy variable is defined based on this classification.

HHI: Ownership structure is defined as the distribution of ownership (company shares) among the owners of the business unit. In this study, the Herfindahl-Hirschman Index (HHI) is used to indicate ownership structure, showing ownership concentration. This index is obtained by summing the squares of the percentage of shares owned by the company's shareholders. The Herfindahl-Hirschman Index increases with ownership concentration.

IND: Inventory turnover ratio is defined as the average number of times inventory is sold during the financial

period. In this study, the inventory ratio of materials and goods is measured by the total inventory of materials and goods divided by the company's assets.

INDU: Industry type. In this study, based on previous studies, to show the effect of the industry and considering that larger companies are expected to have more innovation due to broader financial resources and higher research and development expenses than smaller companies, the sample is classified according to the definition of the Statistical Center of Iran. Companies with 50 or fewer employees are classified as small and medium-sized enterprises, while companies with more than 51 employees are classified as large companies. To show the effects of large companies, a value of 1 is assigned if the company is large, and a value of 0 if it is small or medium, to calculate the effect of industry type on innovation.

Table 1 presents the expected sign of the independent variables on the dependent variable.

**Table 1**

*Expected Signs of Variables on the Dependent Variable*

Symbol	Variable	Expected Sign
LIQ	Stock Liquidity	+
SIZE	Company Size	- / +
IND	Inventory Turnover Ratio	+
ROA	Return on Assets	+
LEV	Leverage	- / +
HHI	Ownership Structure	- / +
INDU	Industry Type	- / +

The null hypothesis of the unit root or non-stationarity can be rejected for all research variables except for ownership structure (HHI) and leverage (LEV). Hence, these variables are stationary at level (I(0)). Ownership structure (HHI) and leverage (LEV) became stationary after first differencing (I(1)). Given that these variables are non-stationary, cointegration tests should be conducted in models that include these variables to avoid spurious regression. The Kao cointegration test confirms the cointegration relationship between the dependent and independent variables in the studied model. After confirming cointegration, model estimates can use level variables without concern for spurious regression.

Next, diagnostic tests for model identification are necessary. The first diagnostic test is the Chow test. In the Chow test, the null hypothesis indicates equal intercepts (confirmation of pooled data), while the alternative

hypothesis indicates different intercepts (confirmation of panel data). The F-statistic falls within the rejection region of the null hypothesis, confirming panel data over pooled data. Therefore, panel data should be used for estimation.

Next, it must be determined whether estimates should be based on fixed or random effects. This is tested using the Hausman test, which examines the correlation between error terms and explanatory variables. If no correlation exists, the random effects model is confirmed. The null hypothesis of the Hausman test indicates no correlation between explanatory variables and error terms, while the alternative hypothesis indicates correlation. Note that the random effects model cannot be used if the number of cross-sections is less than the number of model coefficients. In the Hausman test, the random effects model is estimated first, followed by the Hausman test. Hausman test findings suggest rejecting the null hypothesis, confirming fixed

effects over random effects. Fixed effects assume correlation between error terms and independent variables, while random effects assume no correlation.

The following results of the research model estimation with fixed effects are presented. Initially, statistical results

are presented, followed by a discussion of research hypotheses. Table 2 presents the estimated model results with fixed effects.

**Table 2**

*Estimated Model Results with Fixed Effects*

Variable	Coefficient	T-Statistic
LIQ	0.1035	2.43
SIZE	0.0884	2.58
IND	0.0134	1.72
ROA	0.1192	2.90
HHI	0.0771	3.17
LEV	-0.0039	-1.40
INDU	0.0191	4.73
C	1.776	9.84

$R^2 = 0.79$

The estimated model results indicate that the model evaluation indices are statistically significant. The  $R^2$  statistic shows that 79% of the changes in the dependent variable are explained by the independent variables. Additionally, the F-statistic indicates the significance of the entire regression. In other words, the hypothesis that the coefficients of the explanatory variables could be zero is rejected, confirming the significance of the regression. The following section discusses the research hypotheses.

Based on the results in Table 7, the coefficient sign of the variable company size on companies' innovation capability is 0.088, with an estimated T-statistic of 2.58. Given that the absolute T-statistic exceeds the critical value at the 95% confidence level (1.96), it can be stated that company size has a positive and significant effect on companies' sustainable innovation capability. These results indicate that larger companies have more innovation due to greater research and development expenditures and facilities.

Based on the results in Table 2, the coefficient sign of the variable ownership structure on companies' innovation capability is 0.077, with an estimated T-statistic of 3.17. Given that the absolute T-statistic exceeds the critical value at the 95% confidence level (1.96), it can be stated that ownership structure has a positive and significant effect on companies' sustainable innovation capability.

Based on the results in Table 2, the coefficient sign of the variable stock liquidity on companies' innovation capability is 0.1035, with an estimated T-statistic of 2.43. Given that the absolute T-statistic exceeds the critical value at the 95% confidence level (1.96), it can be stated that stock liquidity

has a positive and significant effect on companies' sustainable innovation capability. The positive effect of stock liquidity on innovation can be attributed to several factors.

Additionally, based on the results in Table 2, the coefficient sign of the variable industry type on companies' innovation capability is 0.1035, with an estimated T-statistic of 2.43. Given that the absolute T-statistic exceeds the critical value at the 95% confidence level (1.96), it can be stated that industry type has a positive and significant effect on companies' sustainable innovation capability. These results indicate that the larger the company, the greater its impact on innovation.

#### 4 Discussion and Conclusion

The aim of this research was to examine the effects of company size, ownership structure, liquidity, and industry type on the continuous innovation capability of companies listed on the Tehran Stock Exchange. The findings indicated that the coefficient sign of the variable company size on companies' innovation capability was 0.088, and the estimated T-statistic was 2.58. Given that the absolute T-statistic exceeds the critical values at the 95% confidence level (1.96), it can be stated that company size has a positive and significant effect on companies' sustainable innovation capability. These results show that the larger the company, the greater the innovation, as larger companies have more research and development expenditures and facilities for innovation. These results align with the prior findings

(Altomonte et al., 2016; Antunes et al., 2017; Chen et al., 2020; Chen et al., 2014; Ebrahimi et al., 2023; Mikalef et al., 2019; Oh et al., 2011; Seyed Kalali & Heydari, 2021; Tang et al., 2022; Tarí & García-Fernández, 2020). In explaining this result, it should be noted that company size can help increase financial resources, human resources, facilities and equipment, the ability to compete with major competitors, and financial stability, which in turn positively impacts companies' innovation capability. However, it should be noted that company size alone cannot be a criterion for innovation progress, and other factors such as ownership structure, corporate culture, creativity, and leadership and management capabilities should also be considered. Additionally, some small and startup companies can provide effective innovations due to advantages such as greater flexibility and lower costs. Therefore, to achieve successful innovation, attention should be paid to other factors besides company size, and generally, innovation depends on proper management of resources and internal and external communications.

Another finding of the research was the impact of ownership structure on innovation capability. According to the results, the coefficient sign of the variable ownership structure on companies' innovation capability was 0.077, and the estimated T-statistic was 3.17. Given that the absolute T-statistic exceeds the critical values at the 95% confidence level (1.96), it can be stated that ownership structure has a positive and significant effect on companies' sustainable innovation capability. These results align with the prior findings (Ebrahimi et al., 2023; Kim et al., 2012; Mikalef et al., 2019; Seyed Kalali & Heydari, 2021; Tang et al., 2022). The ownership structure of a company can be considered an important factor in influencing the innovation capability of companies. Overall, the ownership structure of a company can increase owners' commitment, human resources, competitiveness with major competitors, employee motivation, and attract investment, which in turn positively impacts companies' innovation capability. However, it should be noted that the ownership structure alone cannot be an effective factor in the innovation capability of a company, and other factors such as organizational culture, the approach to knowledge sharing, research and development, etc., also impact the innovation capability of companies. Therefore, to enhance companies' innovation capability, improving the ownership structure along with developing other factors influencing innovation capability is necessary.

Another finding of this research was that stock liquidity has a positive and significant impact on companies'

sustainable innovation capability. The positive effect of stock liquidity on innovation can be explained by several reasons. These results align with the prior findings (Tang et al., 2022). Stock liquidity has been considered one of the important factors influencing companies' innovation capability. It can be said that stock liquidity helps companies to obtain more financial resources and use these resources for research and development of innovation and attracting innovative talents. Therefore, stock liquidity can help companies attract the best innovation talents and engage in research and development of innovation.

Another finding of this research showed that industry type has a positive and significant impact on companies' sustainable innovation capability. These results indicate that the larger the company, the greater its impact on innovation. These results align with the prior findings (Gill et al., 2010; Kim et al., 2012; Mikalef et al., 2019; Tang et al., 2022). In explaining this finding, it should be said that the industry size can have different impacts on innovation capability compared to being smaller. Below are some of the positive effects of larger industries on innovation capability. Large companies usually have more resources to invest in innovation research and development. These resources can include capital, technology, technical knowledge, market information, and experienced human resources that help companies identify new opportunities and develop innovative products. Large companies usually have more executive capabilities that can be employed in developing and exploiting innovations. This includes managerial skills, the ability to invest in the long term, a flexible organizational structure, and the ability to execute on a large scale.

One limitation of this research is that many factors affect innovation, but due to time and financial constraints, this research only examined two factors and overlooked other factors. Also, it cannot be said with certainty that the influence of other confounding factors was controlled in the research. Hence, caution should be exercised in generalizing the results. It is suggested that small companies and startups benefit from the presence of large companies by investing in small companies and startups to develop innovation. Governments and industrial organizations can support innovation development by creating supportive policies, including providing financial and tax facilities. These policies can be applicable to both small and large companies.

#### Authors' Contributions

All authors have contributed significantly to the research process and the development of the manuscript.

### Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

### Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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### Declaration of Interest

The authors report no conflict of interest.

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### Ethical Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were observed.

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