# The relationship between management characteristics and firm innovation

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## Abstract

**Purpose** – The purpose of this paper is to assess the relationship between some management features (management capability, management entrenchment, agency costs and overconfidence) and the innovation of companies listed on the Tehran Stock Exchange.

**Design/methodology/approach** – The study carried out during 2009–2015. A total of 125 companies were selected from eight industries as the sample of study using the method of systematic elimination. A descriptive-correlational design was used in this study and panel data regression models were employed for developing the relationship between research variables.

**Findings** – The obtained results indicated that managerial ability could foster innovation, while managerial entrenchment could stifle innovation and agency costs and overconfidence have no effect on innovation.

**Originality/value** – The current study is almost the first project which focuses on the management characteristics and firm innovation in developing countries.

**Keywords** Innovation, Overconfidence, Agency costs, Managerial entrenchment, Managerial capability

**Paper type** Research paper

## 1. Introduction

The development of market economy along with the international economy has intensified the competition among business enterprises, accelerated product update processes and broadened the scope of research and development activities, more than ever, to survive and develop the business enterprises. Research and development is vital for manufacturing new products, possessing new markets and consequently increasing a firm profitability (Yang-hai, 2010).

Many scholars were concerned about the relationship between the board of directors and a firm performance and agency theory is one of the most significant issues in this field. According to this theory, supervision of managerial activities is the most important duty of the board to preserve the interests of shareholders and it is expected that such surveillance improves the performance of the desired firm. From agency theory point of view, the significance of corporate governance is implicit in the conflict of interests between managers and shareholders. In other words, corporate governance is working as a mechanism, which aligned the objectives of managers with that of the shareholders and caused corporate performance improvement (Fooladi and Zaleha, 2012). The global competition, which is launched basically as of the 1980s has led the companies to concentrate on business strategies, especially innovation. Innovation is defined as the development of a novel method with the aim of creating freshness in the economy. Innovation can be regarded as a tool for converting knowledge to a business value (Gandhi *et al.*, 2011; Zehir *et al.*, 2015). Innovation is the main prerequisite for competition in the twenty-first century. Growing competition, extreme environmental agitations, technological alterations, and environmental uncertainties have made the organizations promote innovation as a leading section of their strategies

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(Jimenez-Jimenez *et al.*, 2008). Abdulai Mahmoud and Hinson (2012) categorized the innovation into three general classes of innovation in product, innovation in process and innovation in management. To measure the innovation, companies often spend from the funds of research and developments (Chakraborty *et al.*, 2014). Although a research and development fund is among investment decisions taken by the companies, such costs have a peculiar characteristic, which make them significantly different from other investment decisions. In contrast to tangible investments, such as capital expenditure, the implicit data in research and development costs not only comprise the tangible ones, but reflect intangible information concerning future cash flows (Chen *et al.*, 2014).

On the other hand, it is proven that innovation, as one of the most important components of competitiveness, could improve the performance of companies. In fact, the reason why companies use the innovation is to achieve better business performance and to increase the competitiveness (Gunday *et al.*, 2011). Based on different reasons (such as, a need for manufacturing new product, use of organizational methods and the creation of a character, better market performance and better understanding the customers), we could substantiate that innovation is one of the basic strategies of each company, in that innovation today is an essential tool for entering new markets, increasing the existing market share and enhancing competitive advantages. Such a great concentration on innovation is the result of more competitiveness in national and international markets. These facts indicate that innovation is an essential component of organizational strategies (Karlsson and Tavassoli, 2016). When the innovation flow is no longer operational in a company, the economic structure will be abandoned in a passive situation and its growth will be limited. Therefore, innovation plays a significant role in creating a difference between the performance of various companies and even countries. Companies that develop innovations frequently and quickly enjoy from a high-quality staff, pay more and provide special future plans for them. Hence, the impact of innovation on performance comprises a variety of aspects from sales and market share to profitability and efficiency (Gandhi *et al.*, 2011). Innovation enables the company to create value for itself and to preserve its competitive advantages in today's chaotic and complex situation. In general, innovation not only causes the company to utilize the current resources appropriately and improve its value and efficiency, but brings some intangible assets to the company. Companies with higher innovations are more successful in responding customers' needs and are more capable of achieving the leading performance and more profitability. Innovation is vital for implementing operational efficiency and increasing the quality of services (Wang and Wang, 2012). The experimental evidences revealed that the board characteristics, including size and independence, in addition to performance, could affect the innovative activities, as well (Chouaibi *et al.*, 2010; Zhao and Wen, 2011). Studies on innovation have been on two main topics, so far. Some were concerned about the effect of innovation on market value (i.e. Connolly and Hirschey, 2005; Bae and Kim, 2003) and some were on the realization of effective factors, such as cash flow, corporate size, industry classification, etc., on innovation (Cumming and MacIntosh, 2000). The focus of the present study is on the latter, such that, the effect of some other factors of board characteristics (such as, entrenchment, agency costs, competency and overconfidence) on innovation is assessed companies listed on the Tehran Stock Exchange. Thus, the research question is proposed as follows:

*RQ1.* To some extent do the board characteristics could affect the innovation of companies listed on the Tehran Stock Exchange?

## 2. Theoretical issues, related literature and hypotheses development

### *2.1 The relationship between management competency and firm innovation*

The significance of innovation as one of the most important determining factors of organizational performance is approved (Sun, 2015). More specifically, innovative activities

are conducted in order to reach market objectives and production, including improving product quality, controlling production costs, increasing market share, accessing new markets, production flexibility, etc (Anderson *et al.*, 2014; Bigliardi and Galati, 2016). Innovation could motivate the company to achieve high competitive standards and hold the position. Since innovative activities could strengthen both executive and technological innovations of a company, they could fuel growth and profitability (Nicolau and Santa-María, 2013).

In Van de Ven points of view, four problems contribute to innovation management:

(1) Human problem: people in companies are more concentrated on their daily routines and this could bring about less attention to development and production of new ideas. The question rises here is that whether the leadership intervention could center the attention of organization members to innovative activities instead of daily routines or not (Nicolau and Santa-María, 2013).

(2) Process problem: although the concept of new ideas may be considered as an individual activity, it should be noted that implementing new ideas ask for a collective effort to reach a broader and better admissibility (Nicolau and Santa-María, 2013).

(3) Structure problem: ideas may derive from different sections of a company. Thus, various resources and missions should be undertaken to implement an innovative idea. So, the question here is that how we could gather such "components" together to achieve a "complete one" (Nicolau and Santa-María, 2013).

(4) Strategic problem: there is a consensus about the effect of organizational leadership on innovation, especially when the company should adopt an alternative method to deal with current affairs (Nicolau and Santa-María, 2013).

According to Kelley *et al.* (2011), companies use the performance-based evaluation in selecting their project managers and those would be appointed, who first, are experienced enough and second are well equipped with the required skills for innovation. Vaccaro *et al.* (2012) indicated that due to the leading role of management in an organization, it could contribute significantly to innovation management. Lampikoski (2012) declared that the interface company, due to its investment on management abilities, could benefit from green innovations and gain stable competitive advantages, because management abilities allowed the company to direct the required research plans, realize investment opportunities and revolutionize the carpet industry. Yuan (2013) assessed the effect of CEO's prior experiences on firm innovation in active American companies in the biotechnological industry and found that a certain type of experience is not necessarily effective on innovation, but a set of experience could contribute to the issue.

Fitjar *et al.* (2013) by working on Norwegian companies reported that intellectual managers and good relationship with international companies could affect the corporate innovation, significantly. Boermans and Roelfsema (2013) stated that work experience has no significant effect on the innovation of Indian companies and among the variables of educational record the one that is related to foreign trade has only a significant effect on firm innovation. Chen (2014) reported that the level of education and work experience related to CEO industry has a positive effect on innovation in these countries. Furthermore, CEO power could modify such relationship, positively, such that, by introducing a competent CEO, managers with human capital allocate more resources for innovative activities. Custodio *et al.* (2015) declared that managers that picked up general managerial skills during their career come up with more innovations and recorded more inventions, in that managers are equipped with some skills which are used for the revival of failed innovation projects. Finally, Sariol and Abebe (2017) found that powerful CEOs are more inclined

toward pursuing exploratory innovations, such that there is a positive relationship between CEO power and exploratory innovations:

*H1.* There is a significant relationship between management competencies and firm innovation.

### *2.2 The relationship between management entrenchment and firm innovation*

Driver and Guedes (2012) described the possibility of existence of a relationship between the mechanisms of corporate governance (and as a result management entrenchment) and the costs of research and development through three channels and said that first, corporate governance could decrease the cost of investment in long-term projects and by uncertainty could become like innovative investment. Second, corporate governance could reduce self-interested behaviors. The third channel, however, nullifies the effect of corporate governance on research and development and cancels out the advantages of alignment of interests between managers and shareholders. This is due to the fact that some scholars, such as Aghion and Tirole (1997) introduce over-monitoring as one of the dangerous factors that reduce management autonomy. Since owners prefer liquid assets to uncertain assets, the interests of owners and shareholders are in conflict with innovative investments. At the national level, macro-corporate governance, like legally developed systems and financial development outweighed the agency costs and this is where the investment efficiency enhances in research and development activities (Chu *et al.*, 2016).

The existence of information asymmetry between managers and other beneficiaries is one way to facilitate the entrenchment. The strategic position of managers enables them to control the information access and limit the access of others. Managers behave in a way to further the information asymmetry between themselves and other beneficiaries and to facilitate their discretionary behaviors. Managers by investing in assets, which are more informed of, extend the information asymmetry. This could make the information and understanding of them more complicated for shareholders and potential managers. Accordingly, shareholders become more dependent and this is where discretionary behaviors are provided for managers. Investing in innovative activities is among those investments that increase the information asymmetry, in that research and development (R&D) comprises a huge bulk of knowledge, which is hard to transfer and this could limit the control of shareholders on the behaviors of shareholders. Therefore, it is predicted that the increase in research and development costs could facilitate management entrenchment (Dhaoui and Jouini, 2011).

Xiao (2010) indicated that when overinvestment is probable in a company, the relationship between protecting the rights of shareholders and investing in research and development activities becomes negative. Hillier *et al.* (2011) expressed that an effective support is provided for investors in countries with advanced financial systems and powerful corporate control mechanisms are less sensitive to local cash flows for the costs of research and development. Further, those mechanisms of corporate governance, which simplify the investment in the fields of research and development include, protecting minority shareholders, proper law enforcement, bank-based financial system and effective board control. According to the results of this study, we could conclude that the mechanisms of corporate governance are of the utmost importance in investing in research and development. Humphery-Jenner (2011) by expressing that managers are risk-averse in general and over risk-aversion could decrease shareholders' wealth evaluated the impact of anti-control measures of managers on innovative activities and value creation. The obtained results showed that anti-control measures may encourage the managers to create value, increase innovation and at the same time enhance agency differences derived from management entrenchment. Driver and Guedes (2012) noticed that corporate governance

could bring about more decrease of research and development activities (either for individual indices or for collective ones).

Chemmanur and Tian (2013) revealed that companies with more anti-control measures are more innovative, as well. They justified such an effect by saying that the increase of anti-control measures could alleviate short-term pressures from the market side on managers and allow them to concentrate solely on long-term value creation. Aghion *et al.* (2013) reported that institutional ownership could lead to the growth of innovation. They declared that the positive effect of institutional ownership on innovation is due to job concerns of managers, such that institutional ownership could elevate managers' motivation for innovation, because risky projects lower their professional risk.

Bingxiang *et al.* (2014) declared that there is a negative and significant relationship between managerial entrenchment and research and development. Their results indicated that such a negative relationship could be inhibited through increase of managerial compensation and ownership concentration, though the increase of board dependence could intensify such a relationship. Chakraborty *et al.* (2014) discovered that the increase of anti-control managerial measures could reduce the number inventions and awards. However, this negative relationship was evident in low-tech industries. Such a relationship is not statistically significant in high-tech industries. Hasan *et al.* (2015) declared that more appropriate corporate governance may higher the costs of research and development. Their results illustrated that the relationship between corporate governance and research and development become stronger, especially in countries with weaker governance. Finally, Amore and Bennedsen (2016) reported that companies with weak governance design less green innovations. This negative relationship between weak corporate governance and green innovation become stronger, especially in companies with smaller institutional ownership:

*H2.* There is a significant relationship between managerial entrenchment and firm innovation.

### *2.3 The relationship between agency cost and firm innovation*

According to the agency theory introduced by Jensen and Meckling in 1976, the principal (shareholder) appoints the agent to run a company. Obviously, it is logical to imagine that managers follow certain objectives, which are basically different from that of the shareholders. In fact, instead of maximizing the wealth of shareholders, they pursue their own interests. Shareholders are more willing to see that the manager makes some decisions, which elevate the stock value, while the manager is intended to increase the business of the company and his/her interest, which does not necessarily increase the stock value (Ammari *et al.*, 2016). The agency theory predicts that the existing differences between the shareholder and manager could lead to agency costs and this, in turn, is detrimental to shareholder's value (Chang *et al.*, 2016). Information asymmetry and conflict of interest are two major factors, which cause agency costs (Zhang and Cao, 2015). Information asymmetry in financial markets means that one of the parties to the deal has better information than the other. Theoretical models foresee that the quality of higher disclosure could decrease the information asymmetry between the involved parties in the capital market and consequently lower the capital cost (Bhattacharya *et al.*, 2013). Conflict of interest among managers and shareholders, especially in the time of entrenchment, is more intensified (Elyasiani and Zhang, 2015).

Firm innovation contributes significantly to the stability and value enhancement. Investing in innovative activities, however, entails more risk, compared with investing in capital expenditures, in that such investments are mostly subject to failure (Bhagat and Welch, 1995). Innovation is time-consuming and this is the salient feature of investment,

which could cause the cash flow deriving from such investments to be longer than the tenure of managers (Gibbons and Murphy, 1992). Therefore, risk-averse managers may not be leaning toward investment in innovation. In total, companies with no innovation would lose their market value (Chakraborty *et al.*, 2014).

Agency costs would lower the investment value in research and development and would decline its functionality, as well. For example, when an information asymmetry exists between managers and shareholders, managers are more inclined toward self-interested efforts, rather than performing efficient research and development activities. Thus, agency costs could increase uncertainty in innovation activities (Chu *et al.*, 2016).

O'Connor *et al.* (2013) carried out a research on the sensitivity of research and development costs about financial market frictions. They believed that in the world without friction, all companies will pursue investment projects with positive net present value. So, the level of research and development costs will not be influenced by the CEO compensation. By agency costs, however, companies would not be able or are not willing to follow all investment projects. Hence, companies with considerable agency costs will spend less on research and development:

*H3.* There is a significant relationship between agency costs and firm innovation.

### *2.4 The relationship between managerial overconfidence and firm innovation*

Studies conducted on the realization of contributing factors to research and development costs can be classified into two groups. A group of them are concerned about some external factors, including market system, state behavior, right of ownership and the other group is about the internal factors, like management characteristics, firm size, business performance, capital structure, profitability and corporate governance mechanisms, which affect the costs of research and development. Most of such research studies suffer from a major defect, that is, managers' irrational behaviors. However, most of the economic resources approved that people are not usually logical and factors, involving loss aversion, time preference and overconfidence could bring about some shortcomings in the process of decision making (Yong-hia, 2010). As declared by scholars, three factors contribute significantly to the overconfidence of managers: the illusion of control, a high degree of commitment to particular outcomes, abstract reference points. Managers believe that the situation is under control. Moreover, they are fully committed to the firm performance, in that their wealth and their value of human capital are different from the firms' share price. Finally, investment decisions of a company are complicated and their prosperity is under the influence of several factors. Under the influence of abstract reference points, financial managers are prone to exaggeration and overestimation in evaluating their capabilities to realize lucrative investment opportunities (Chen *et al.*, 2014). Many conducted studies emphasized on the ways the managers' overconfidence may affect the investment decisions.

Malmendier and Tate (2005) by concentrating on future cash flows (as one of the sources overconfidence) indicated experimentally that managerial overconfidence could cause investment decision bias (merger and acquisition). According to the findings of Ben-David *et al.* (2012), compared with other managers, overconfident managers are more inclined toward investment activities. Galasso and Simcoe (2011) expressed that overconfident managers (who concede less possibility for bankruptcy) are more enthusiastic about innovative activities. Such an impact is increasing in competitive industries, as well. Yong-hia (2010) showed that managerial overconfidence has some positive effects on research and development costs. Shanhui *et al.* (2013) indicated that managerial overconfidence has some positive and significant effects on investment in innovative activities, such that this impact is only existed in high-tech industries and companies with state ownership. Herz *et al.* (2014) stated that the relationship between managerial

overconfidence and innovation is more complicated than those results, which are obtained in prior studies. They claimed that how overconfidence affects the innovation depends on the type of managerial overconfidence. Their results illustrated that judgmental overconfidence has negative effect on innovation:

*H4.* There is significant relationship between managerial overconfidence and firm innovation.

## 3. Research methodology

The present study is practical in terms of objective and descriptive-correlational in terms of method. Type of data used in this study was quantitative and even the qualitative variables, such as managerial overconfidence, managerial entrenchment, etc., were turned into quantitative using innovative models and methods in similar foreign studies and were applied in the research models. The statistical population comprises all listed companies on the Tehran Stock Exchange active in one of the following industries:

(1) automotive and parts;

(2) pharmaceutical;

(3) cement, lime and plaster;

(4) chemicals;

(5) food, except sugar;

(6) basic metals;

(7) rubber and plastic; and

(8) machineries and equipment.

The statistical sample of study is selected using systematic removal sampling and based on the following criteria:

(1) being listed in Tehran Stock Exchange before the fiscal year of 2009;

(2) having financial year-end on March 20;

(3) having no change in their fiscal years during the period of study (2009–2015);

(4) having presented the required information for calculating research variables; and

(5) not being affiliated with holding, investing, and insurance companies.

Given the above-mentioned criteria, a total of 125 companies were selected as the sample of study. The highest frequency was related to "Automotive and parts" industry with 21 companies and the lowest was for "rubber and plastic" industry and "machineries and equipment" industries, each with nine companies.

### *3.1 Research model and definition of variables*

The research model designed concerning the hypotheses of the study as follows:

$$\text{INNO} = a_0 + b_1\text{MANABI} + b_2\text{MANENT} + b_3\text{AGENCY} + b_4\text{OVER} + b_5\text{SIZE} + b_6 IO + b_7\text{BH} + b_8\text{LEV} + e,$$

where INNO is innovation, MANABI is managerial ability, MANENT is managerial entrenchment, AGENCY is agency costs, OVER is overconfidence, SIZE is firm size, IO is institutional ownership, BH is substantial ownership and LEV is financial leverage.

Desired regression coefficients are $b_1$, $b_2$, $b_3$ and $b_4$, which are corresponding to the research hypotheses. Statistical hypotheses related to each regression coefficient proposed as follows:

$$\begin{cases} H_0: & \beta_i = 0 \\ H_1: & \beta_i \neq 0 \end{cases}, \quad i = 1, 2, 3, 4.$$

$H_0$ hypothesis expresses that there is no significant relationship between respective independent variable and firm innovation. It is obvious that in case of rejection of $H_0$ hypothesis, the respective hypothesis with the regression coefficient being tested is rejected, as well.

In this paper, innovation has the role of dependent variable. To measure innovation based on Chakraborty *et al.* (2014), the following index is used:

$$\text{INNO} = \frac{\text{CITATIONS} + \text{INNOVATION}}{\text{AVERAGE}},$$

where, CITAIONS is the number of awards, INNOVATION is the number of registered inventions and AVERAGE is the average number of awards and registered inventions in the related year-industry.

In this study, four variables of managerial ability, managerial entrenchment, managerial overconfidence and agency costs were used as independent variables:

(1) Managerial ability (MANABI): Demerjian *et al.* (2012) method is employed to examine the managerial ability. In this method, first, the amount of firm efficiency is calculated as follows:

$$\text{EFFICIENCY} = \frac{\text{SALES}}{\text{COGS} + \text{SGA} + \text{PPE} + \text{OPLEASE} + \text{RD} + \text{GOODWILL} + \text{INTAN}},$$

where EFFCIENCY is the firm efficiency, SALES is the amount of sales, COGS is the cost of goods sold, OPLEASE is the cost of operating lease, RD is the cost of research and development, PPE is the property, machinery and equipment value, INTAN is intangible net assets, GOODWILL is the purchased goodwill and SGA is general, office and sales costs. Then, a part of firm efficiency, which is controlled by its intrinsic features, is isolated from management ability using the following regression model and the residuals are defined as management ability:

$$\text{EFFICIENCY} = a_0 + a_1\text{SIZE} + a_2\text{MARKETSH} + a_3\text{FCF} + a_4\text{AGE} + a_5\text{FCI} + e,$$

where SIZE is the firm size (natural logarithm of assets), MARKETSH is the market share (the proportion of sales to total sales in the related industry), FCF: free cash flow marker (1 for year-companies with positive cash flows, otherwise 0), AGE is the firm age (natural logarithm of number of differences of current year from the year the firm established) and FCI is export marker (1 for companies with export, otherwise 0).

(2) Managerial entrenchment (MANENT): to measure the managerial entrenchment, principal component analysis (PCA) technique of Lin *et al.* (2014) was used based on the following four variables: CEO ownership, CEO duality, board compensation and CEO tenure. Using the PCA, the above said variables of corporate governance are summarized in a numeric index.

(3) Agency costs (AGENCY): according to Wellalage and Locke (2011), the following three indices are used for evaluating agency costs:

$$SATA = SALES/TA$$
$$OESA = OE/SALES$$
$$GAESA = GAE/SALES,$$

where SATA is the asset turnover ratio, OESA is operating costs to sales ratio, GAESA is general and office costs to sales ratio, SALES is sales, TA is total assets, OE is operational costs and GAE is general and office costs.

(4) Overconfidence (OVER): according to Duellman *et al.* (2015), the ratio of capital expenditure to total assets is used to establish managerial overconfidence, such that, if the ratio is higher than the industry median that company suffers from managerial overconfidence. In such a case, the OVER variable is equal to 1, otherwise 0. In other words, the overconfidence variable is used as a marker in the research model.

In order to omit the effect of other variables, which may affect the relationship between independent variables and the dependent ones, the effect of the following variables is monitored:

- Firm size (SIZE): natural logarithm of total assets.
- The percentage of institutional shareholders (IO): a proportion of total shares, which are available for institutional shareholders (such as banks, insurances, etc.).
- The percentage of major shareholders (BH): a proportion of shares available for shareholders with more than 5 percent of the company shares.
- Financial leverage (LEV): total debts to total asset ratio.

## 4. The results

The analysis of research hypotheses conducted in descriptive and inferential level. In the descriptive level, some statistical indices like mean and standard deviation were used and in inferential level, the test of correlation coefficient and regression coefficients were used in R Software. Table I displays the descriptive indices of research variable. By comparing the mean and median values of innovation index (INNO), we could realize that the statistical distribution is skewed to the right side. In other words, the number of companies with a high rate of innovation is extremely less than those with a low rate of innovation. More accurately, most companies have medium or lower than medium innovation rate.

One of the basic hypotheses in regression models is the lack of co-linearity among descriptive variables, otherwise the regression coefficients are skewed and this could affect *t*-test statistics and consequently the test results. Correlation coefficients test could be used for this purpose. Correlation coefficients have different types. To evaluate more accurately, both Pearson and Spearman correlation coefficient is used. The former is calculated according to the actual values of variables; while the latter is achieved using the observation ranks and is more stable against outlier observations (Table II).

In this table, among the descriptive variables, the Pearson and Spearman correlation coefficients were shown above and under the main diameter. Based on these coefficients, all correlational coefficients, except the correlation coefficient between two variables of institutional ownership and major ownership, were small and less than 0.5. Therefore, if it is assumed that linearity is going to cause a problem among descriptive variables (affect the results of hypothesis testing), it is due to the linearity between variables of institutional and

| Variable | Sig. | Max. | Mean | Median | Min. | SD |
|---|---|---|---|---|---|---|
| Innovation | INNO | 6/146 | 1/000 | 0/612 | 0/000 | 1/206 |
| Firm efficiency | EFFICIENCY | 4/959 | 0/848 | 0/864 | 0/007 | 0/324 |
| Firm size | SIZE | 14/1 | 14/000 | 13/800 | 10/2 | 1/508 |
| Market share | MARKETSH | 0/812 | 0/064 | 0/030 | 0/000 | 0/108 |
| Free cash flow | FCF | 1/000 | 0/859 | 1/000 | 0/000 | 0/349 |
| Firm age | AGE | 4/140 | 3/530 | 3/690 | 2/08 | 0/419 |
| Export marker | FCI | 1/000 | 0/968 | 1/000 | 0/000 | 0/176 |
| CEO ownership | DIROWNER | 36/000 | 0/0799 | 0/000 | 0/000 | 3/461 |
| CEO duality | DUAL | 1/000 | 0/333 | 0/000 | 0/000 | 0/472 |
| CEO compensation | COMPEN | 11/22 | 3/240 | 0/000 | 0/000 | 3/547 |
| CEO tenure | TENURE | 7/000 | 2/670 | 2/000 | 1/000 | 1/542 |
| Asset turnover ratio | SATA | 5/144 | 0/894 | 0/781 | 0/007 | 0/579 |
| Operating expenses to sales ratio | OESA | 4/472 | 0/830 | 0/858 | −2/715 | 0/331 |
| General and office expenses to sales ratio | GAESA | 136/666 | 0/295 | 0/060 | 0/000 | 4/994 |
| Capital expenditure ratio | CAPEX | 0/283 | 0/036 | 0/025 | 0/000 | 0/040 |
| Percentage of institutional shareholders | IO | 100/0 | 70/300 | 80/700 | 0/000 | 27/715 |
| Percentage of major shareholders | BH | 99/5 | 72/200 | 77/600 | 0/000 | 20/139 |
| Financial leverage | LEV | 6/171 | 0/655 | 0/618 | 0/105 | 0/389 |

**Table I.**
Descriptive indices of research variables

major ownership. To control and evaluate the issue, regression models of the study are estimated once by considering the institutional ownership and once without the variable. The results obtained from the analysis of research hypotheses are presented as follows.

According to the results obtained from Table III, the relationship between management ability (MANABI) and managerial entrenchment (MANENT) and firm innovation is significant at 0.1 error level (sig. $< 0.1$). However, the relationship between managerial overconfidence (OVER) and firm innovation is not significant (sig. $> 0.05$). Moreover, for none of the sales on asset (SATA), operating expenses on sales (OESA) and general and office expenses on sales (GAESA) indices do the agency costs have a significant relationship with firm innovation (sig. $> 0.05$). Given that, *H1* and *H2* are accepted, but *H3* and *H4* is rejected. It is noteworthy that according to the results of *F*-Limer and Hausman tests, the method of equal effects was used for estimating the hypothesis model. Further, *F*-statistics indicates that all estimated models were significant (sig. $< 0.1$) and only a tiny percentage of the variance of the dependent variable is elucidated by the existing descriptive variables in the model ($R^2 = 2$ percent). Finally, based on Durbin–Watson statistic, there is no serial correlation among model residuals ($1.5 < \text{DW} < 2.5$).

The results achieved from research model fitting were depicted in Table IV after removing the co-linearity. According to the results of *F*-Limer test, after removing co-linearity, the method of equal effects was also used for research model fitting. As can be seen, after co-linearity removal (setting the IO variable aside), fairly similar results were achieved, such that the relationship between management ability and managerial entrenchment and firm innovation is significant at 0.1 error level and the relationship of other independent variables with innovation is not considered as significant (sig. $> 0.05$). Hence, after co-linearity removal, the *H1* and *H2* are accepted and *H3* and *H4* are rejected.

## 5. Conclusion

The main objective of the present study is to evaluate the relationship between some of the management characteristics and a firm innovation. The characteristics used in this project for management are capability, entrenchment, agency costs and overconfidence. Innovation is the dependent variable of this study, which is measured by the ratio of the number of letter of appreciation received by the company to the average letter of appreciation of the

| | Management ability | Managerial entrenchment | Asset turnover | Operating expenses to sales | General and office expenses to sales | Overconfidence | Institutional ownership | Major ownership | Financial leverage |
|---|---|---|---|---|---|---|---|---|---|
| Management ability | 1 | 0/098 | 0/284 | −0/231 | −0/134 | 0/043 | 0/093 | 0/083 | −0/086 |
| Managerial entrenchment | 0/085 | 1 | −0/070 | 0/084 | −0/023 | 0/013 | −0/203 | −0/114 | 0/137 |
| Asset turnover | 0/413 | 0/006 | 1 | 0/081 | 0/009 | 0/144 | 0/001 | 0/014 | 0/007 |
| Operating expenses to sales | −0/363 | 0/065 | 0/147 | 1 | 0/040 | −0/041 | −0/131 | −0/035 | 0/335 |
| General and office expenses to sales | −0/292 | 2/025 | −0/305 | 0/191 | 1 | 0/033 | 0/004 | −0/039 | −0/016 |
| Overconfidence | 0/021 | 0/026 | 0/175 | −0/091 | −0/077 | 1 | 0/072 | −0/007 | −0/098 |
| Institutional ownership | 0/121 | −0/140 | 0/068 | −0/278 | −0/138 | 0/078 | 1 | 0/630 | −0/029 |
| Major ownership | 0/090 | −0/071 | 0/117 | −0/085 | −0/093 | 0/027 | 0/696 | 1 | 0/079 |
| Financial leverage | −0/094 | −0/017 | 0/077 | 0/480 | −0/020 | −0/050 | −0/045 | 0/105 | 1 |

**Table II.**
Pearson correlation coefficients (above the main diameter) and Spearman (under the main diameter) among descriptive variables

**Table III.**
The results model fitting of research hypotheses

| Variable | Sign | Regression coefficient | Mode (1) *t*-statistic | Significance level | Regression coefficient | Mode (2) *t*-statistic | Significance level | Regression coefficient | Mode (3) *t*-statistic | Significance level |
|---|---|---|---|---|---|---|---|---|---|---|
| Management ability | MANABI | 0/15 | 1/91 | 0/06 | 0/15 | 1/88 | 0/06 | 0/15 | 1/87 | 0/06 |
| Managerial entrenchment | MANENT | −0/07 | −1/81 | 0/07 | −0/07 | −1/89 | 0/06 | −0/07 | −1/75 | 0/08 |
| Sales on asset | SATA | 0/02 | 0/60 | 0/55 | | | | | | |
| Operating expenses to sales | OESA | | | | 0/12 | 1/65 | 0/10 | | | |
| General and office expenses to sales | GAESA | | | | | | | −0/01 | −1/48 | 0/14 |
| Overconfidence | OVER | −0/04 | −0/94 | 0/35 | −0/04 | −0/89 | 0/37 | −0/03 | −0/79 | 0/43 |
| Firm size | SIZE | 0/01 | 0/59 | 0/56 | 0/01 | 0/77 | 0/44 | 0/01 | 0/32 | 0/75 |
| Institutional ownership | IO | −0/00 | −0/18 | 0/86 | −0/00 | −0/08 | 0/93 | −0/00 | −0/04 | 0/96 |
| Major ownership | BH | −0/00 | −0/99 | 0/05 | −0/00 | −1/99 | 0/93 | −0/00 | −2/09 | 0/04 |
| Financial leverage | LEV | 0/03 | 0/59 | 0/55 | 0/00 | 0/04 | 0/97 | 0/03 | 0/57 | 0/57 |
| *F*-Limer statistic | | 0/89 | | | 0/88 | | | 0/93 | | |
| *F*-Limer significance level | | 0/77 | | | 0/80 | | | 0/70 | | |
| Hausman statistic | | – | | | – | | | – | | |
| Hausman significance level | | – | | | – | | | – | | |
| Estimation model | | Equal effects | | | Equal effects | | | Equal effects | | |
| *F*-statistic | | 1/80 | | | 2/10 | | | 2/04 | | |
| *F*-significance level | | 0/07 | | | 0/03 | | | 0/04 | | |
| Coefficient of determination | | 0/02 | | | 0/02 | | | 0/02 | | |
| Durbin–Watson statistic | | 2/05 | | | 2/07 | | | 2/05 | | |

| variable | Sig. | Mode (1) Regression coefficient | Mode (1) *t*-statistic | Mode (1) Significance level | Mode (2) Regression coefficient | Mode (2) *t*-statistic | Mode (2) Significance level | Mode (3) Regression coefficient | Mode (3) *t*-statistic | Mode (3) Significance level |
|---|---|---|---|---|---|---|---|---|---|---|
| Management ability | MANABI | 0/15 | 1/91 | 0/06 | 0/15 | 1/88 | 0/06 | 0/15 | 1/87 | 0/06 |
| Managerial entrenchment | MANENT | −0/07 | −1/82 | 0/07 | −0/07 | −1/90 | 0/06 | −0/07 | −1/75 | 0/08 |
| Sales on asset | SATA | 0/02 | 0/59 | 0/56 | | | | | | |
| Operating expenses to sales | OESA | | | | 0/12 | 1/65 | 0/10 | | | |
| General and office expenses to sales | GAESA | | | | | | | −0/01 | −1/49 | 0/14 |
| Overconfidence | OVER | −0/04 | −0/95 | 0/34 | −0/04 | −0/90 | 0/37 | −0/03 | −0/80 | 0/43 |
| Firm size | SIZE | 0/01 | 0/56 | 0/58 | 0/01 | 0/79 | 0/43 | 0/00 | 0/33 | 0/74 |
| Institutional ownership | IO | | | | | | | | | |
| Major ownership | BH | −0/00 | −2/76 | 0/01 | −0/00 | −2/67 | 0/01 | −0/00 | −2/78 | 0/01 |
| Financial leverage | LEV | 0/03 | 0/60 | 0/55 | 0/00 | 0/04 | 0/97 | 0/03 | 0/57 | 0/57 |
| *F*-Limer statistic | | 0/89 | | | 0/88 | | | 0/92 | | |
| *F*-Limer significance level | | 0/780 | | | 0/810 | | | 0/72 | | |
| Hausman statistic | | – | | | – | | | – | | |
| Hausman significance level | | – | | | – | | | – | | |
| Estimation model | | Equal effects | | | Equal effects | | | Equal effects | | |
| *F*-statistic | | 2/06 | | | 2/41 | | | 2/33 | | |
| *F*-significance level | | 0/05 | | | 0/02 | | | 0/02 | | |
| Coefficient of determination | | 0/02 | | | 0/02 | | | 0/02 | | |
| Durbin–Watson statistic | | 2/05 | | | 2/07 | | | 2/05 | | |

**Table IV.**
The results of model fitting of research hypotheses after co-linearity removal

related industry. Demerjian *et al.*'s (2012) model was used to measure the manager capability. In this method, a part of a firm efficiency, which is not expressed by its natural characteristics (including the firm size, market share, free cash flow indicator, firm age and export indicator), is considered as manager capability. To assess management entrenchment, according to Lin *et al.* (2014), we used the analysis of main components based on four variables of CEO ownership, CEO duality, the board compensation and the board tenure. To measure the agency costs, three variables of asset turnover ratio, operational costs to sales ratio and public and office costs to sales ratio are used. Finally, according to Duellman *et al.* (2015), capital costs ratio was used to determine the managerial overconfidence. Moreover, four variables of firm size, the percentage of institutional shareholders, the percentage of major shareholders and financial leverage were controlled.

The statistical population includes all companies listed in Tehran Stock Exchange during 2009–2015 active in "automotive and part" industry, "pharmaceutical ingredients," "cement, lime, and plaster," "chemicals," "foods, except sugar," "basic metals," "rubber and plastic," and "machinery and equipment." Using the systematic elimination sampling method, a number of 125 companies was selected as the sample of the study. The highest frequency was for "automotive and parts" with 21 companies and the lowest was for "rubber and plastic" and "machinery and equipment," each with 9 companies.

Most of the required data for calculating research variables were extracted from audited financial statements of companies. This information was collected via Rah Avaran Novin Software. However, to extract the information related to the innovation index, we referred to reports of the board activities, which are available at Codal website. The statistical method used for testing research hypotheses is panel data regression models. In this method, we initially investigated the statistical distribution normality of the dependent variable and lack of co-linearity among descriptive variables using the Shapiro-Wilk and correlation coefficient tests. Then, using two other tests, namely, Limer and Hausman the appropriate method for estimating each regression model was established and finally, using the significance test of regression coefficients and *t*-statistic we decided whether the hypothesis is confirmed or rejected. All statistical analyses were carried out using the R Software.

To reach the objective of the study, four hypotheses were designed, each of which describes the relationship between one of the independent variables and the dependent one.

The obtained results indicated that there is a significant relationship between management ability and the innovation of companies under study, such that regarding the positive sign of regression coefficient for the variable of management ability (MANABI) it can be inferred that by the increase of managerial ability the number of awards (as the index innovation) is increased, as well. Sariol and Abebe (2017) conducted a study on the effect of management ability on the type of innovative activities (exploration and exploitation) and found that powerful CEOs are more prone to pursue explorative innovations, such that a positive relationship exists between CEO power and explorative innovations. Further, these results are in line with that of the Custodio *et al.* (2015), Chen (2014), BarNir (2014), Fitjar *et al.* (2013), Lampikoski (2012), García-Morales *et al.* (2012), Vaccaro *et al.* (2012), Kelley *et al.* (2011), Salimzadeh *et al.* (2016), Najafi and Abbasi Menzeh (2015) and Mazloomi *et al.* (2013). The result of the present paper is in contrast with that of the Boermans and Roelfsema (2013), which assessed the impact of managerial ability on the innovation of Indian companies. According to the results achieved from this study, work experience has had no significant effect on the innovation of Indian companies. Among the variables of educational record only the one that is related to foreign trade has a significant effect on firm innovation. The reason of difference may be due to the existence of different measurement methods for management ability. The study compared has used two indices of experience and educational record (local/foreign trade), while the present study employed the Demircan method for measuring management ability. Based on the results, the increase of managerial

ability could lead to the growth of innovation in companies listed in Tehran Stock Exchange. Hence, the boards of companies, which are listed in Tehran Stock Exchange and are active in competitive industries should take this point into consideration that the existence of highly capable managers is one of the factors increasing the innovation of a company with the aim of reaching high competitive standards.

Moreover, results showed that managerial entrenchment of companies under study has a significant relationship with the innovation. Regarding the negative sign of regression coefficient of managerial entrenchment (MANENT), we could conclude that the increase of this variable could attenuate a firm's innovation.

Amore and Bennedsen (2016) carried out a research on the effect of corporate governance on environmental innovations. According to their findings, companies with weak governance come up with fewer green innovations. Such a negative relationship is stronger between weak corporate governance and green innovation, especially when companies have smaller institutional ownership. The results of this study are in line with that of the present study and the results of Hasan *et al.* (2015), Chakraborty *et al.* (2014), Bingxiang *et al.* (2014), Aghion *et al.* (2013), Chemmanur and Tian (2013), Driver and Guedes (2012), Humphery-Jenner (2011), Hillier *et al.* (2011), Dhaoui and Jouini (2011), Xiao (2010) and Varamesh *et al.* (2014). According to the obtained results, the increase of managerial entrenchment could decrease the innovation of companies listed in Tehran Stock Exchange, significantly. Hence, it is emphasized that the boards of listed companies in Tehran Stock Exchange, which are active in competitive industries, should benefit from stronger corporate governance mechanisms to prevent profiteer managers. Some managers may pursue their own personal interests by misusing the mechanisms of corporate governance and adopting anti-control measures instead of dealing with innovative activities.

In addition, based on three variables of asset turnover, operating expense on sales and general and office expenses on sales, there is no significant relationship between agency cost and firm innovation.

Such a result is in contrast with that of the O'Connor *et al.* (2013), who conducted a research in the capital market of America and evaluated the sensitivity of research and development costs compared with the frictions of the financial market. They believed that in the world with no friction, companies would follow all investment projects with positive net present value, so the level of research and development costs is not affected by CEO compensation. However, in the presence of agency costs, a firm is not able or not willing to pursue all investment projects. Therefore, companies with high agency costs incur less expense in research and development.

The number of conducted studies on the relationship between agency costs and innovation is limited and we have no such a research in Iran, so far.

In the end, results showed that the managerial overconfidence in companies under study has no significant relationship with the amount of innovation in these companies. Regarding the negative sign of regression coefficient of overconfidence (OVER), we realized that the increase of managerial overconfidence would decrease the firm's innovation. The negative relationship between managerial overconfidence and innovation in Tehran Stock Exchange is in contrast with the positive relationship of these two factors in Chinese capital market reported by Yong-hai (2010). Shanhui *et al.* (2013), Hirshleifer *et al.* (2012), Galasso and Simcoe (2011) and Ben-David *et al.* (2010) have also noticed a positive relationship between managerial overconfidence and innovation.

The findings of Herz *et al.* (2014) and Chen *et al.* (2014) showed that managerial overconfidence often destroys the value of research and development costs and has a negative effect on innovation. The reason why there is a contrast between the conducted studies and the present one may be due to the difference between governing terms and conditions of companies listed on the Tehran Stock Exchange and those of other countries.

According to the obtained results, there is no significant relationship between managerial overconfidence and innovation in companies listed on the Tehran Stock Exchange. Thus, we mention the active companies in competitive industries that though the presence of overconfident managers could improve the performance of their desired companies, it actually has no effect on firm innovation.

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