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## Information theory of firm

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*Abstract* – The article formulates the information theory of firm, introduces the concept of firm as an operating system, which controls the firm's operation by the means of the information resources processing, in an analogy with the operating system at a microprocessor in the computing devices, represents the director as an information processing element, describes the board of directors as the electronically-scanned electronically-steered phased array radar, considers the scientific problem of strategy creation by the interlocking interconnecting overlapping directors in the boards of directors in the firms in the economic system with the induced nonlinearities. We highlight a fact that the director makes the information sensing, filtering, processing, resonant absorption, analysis, decision making, strategy creation, hence it can be empirically represented as a processing element with the Harvard or von Neumann director's mindset architectures in line with the digital signal processing science. We think that the board of directors in corporate governance system can be theoretically represented as the electronically-scanned electronically-steered phased array radar with a certain number of electronic devices (directors can be modeled as electronic devices with the active antenna elements, filters banks, digital signal processors, memory chipsets in agreement with the microwave and digital signal processing sciences). We developed the MicroITF operating system and software programs, 1) to control the firm operation by the means of the information resources processing; 2) to accurately characterize the director's performance by means of a) the filtering of the generated/transmitted/received information by the director into the separate virtual channels, depending on the information content, and b) the measurement of the levels of signals in every virtual channel with the generated/transmitted/received information by the director, in the overlapping interconnecting interlocking directors networks in the boards of directors in the firms during the Quality of Service (QoS) measurements process, and 3) to create the winning virtuous business strategies by the interlocking interconnecting directors in the boards of directors in the firms, using the patented recursive artificial intelligence algorithm.

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**Keywords:** information theory of firm, firm business strategy creation, optimal corporate governance structures, board of directors composition, interlocking directors networks, boards seats accumulation number, information flows measurements, operating systems in computing devices, digital signal processing, information absorption, econophysics, microeconomics.

## Introduction

The *foundational principles in the economics and finances* in Joseph Penso de la Vega (1668, 1996), Mortimer (1765), Bagehot (1873, 1897), von Böhm-Bawerk (1884, 1889, 1921), Hirsch (1896), Bachelier (1900), Schumpeter (1906, 1911, 1933, 1939, 1961, 1939, 1947), Slutsky (1910, 1915 1923), von Mises (1912), Hayek (1945), Ellis, Metzler (1949), Friedman (1953), Baumol (1957), Debreu (1959), Dodd (2014) created an *essential theoretical framework* for a better understanding of *economic environmental opportunities and limitations* towards the *possible business activities* by the *economic agents*, making it possible to formulate the *modern evolutionary theory of firm* in Babbage (1832), Ueda (1904, 1937), Marshall (1923), Berle, Means (1932a, b), Ohlin (1933), Coase (1937), Barnard (1938, 1948, 1949, 1958), Solow (August 1957), Modigliani, Miller (June 1958), Baumol (1959, 1962), Penrose (1959), Marris (May 1963), Telser (1963), Williamson (1964, 1975, 1988), Cyert, March (1963, 1992), Fogel (1964), Manne (1965), Stigler (1968), Mano (1968-1969, 1970-1971, 1972-1973 1975-1976, 1978, 1980-1981, 1987, 1994, 1995), Black, Scholes (1973), Black, Cox (1976), Merton (1973, 1974), Lee (1975), Jensen, Meckling (1976), Jensen, Ruback (1983), Jensen (1986, September-October 1989, 1993, 2007), Jensen, Murphy (1990), Fama (1980), Fama, Jensen (1983, 1985), Demsetz (1983, 1997), Wernerfelt (1984, 1995), Lode Li (1986), Perrow (1986), Hart, Moore (1990), Hart (2011), Sterman (2000), Williamson (2002), Kantarelis (2007), Spulber (2009), Ledenyov D O, Ledenyov V O(2013b), where the *evolution of the firm* includes the *three clearly identified stages* in Chandler (1962, 1977, 1993, 1994, 1998, 2001, 2005), Chandler, Daems (1980): 1) *Barriers to entry creation*; 2) *Strategic boundaries definition*, and 3) *Limits to growth evaluation*. The *director of firm*, who is a *Leader*, a *Catalyst*, a *Believer*, a *Visionary*, is elected or appointed to the *board of directors* to achieve the *firm's strategic business goals* during the *evolution of enterprise* in Armstrong (1977, 2006). As we know, there are the *two main conditional classifications of directors types*: 1) *Director-Leader*, who introduces the leadership attributes such as being inspirational and visionary in Covey (2004), De Vries (2006), Heyden (2006), Galunic (2006), Nicholson (2007), Rao (2007), Kirkbride (2007), Emmerik (2009), Wendt, Euwema, van Emmerik (2009), Kozlowski (2009), Eisen (2010), Pietersen (2010); 2) *Director-Manager*, who performs the management of enterprise in Dai (2007), Fryer (2009). In the *numerous founded firms in the competitive industrial clusters* in Porter (2008), there are the *one- and two-tier directors' boards systems* in Postma, van Ees (2001) with the *interlocking interlinking interconnecting directors' networks* in Dooley (1969), Mariolis (1975), Bunting (1976), Burt (1980), Pennings (1980), Mintz, Schwartz (1981), Schoorman, Bazerman, Atkin

(1981), Palmer (1983), Ornstein (1984), Meeusen, Cuyvers (1985), Stearns, Mizruchi (1986), Mizruchi, Stearns (1988), Mizruchi (1996), Postma, van Ees (2001) Rommens, Cuyvers, Deloof (November 2007), Santella, Drago, Polo, Gagliardi (2009), Uddin (2012). In this empirical condensed research essay, the authors would like to do the following things: 1) to create the information theory of the firm, 2) to review the interconnecting interlocking directors networks configurations in the boards of directors of publicly traded and non-traded firms, and 3) to research the strategy creation problem by the interlocking interconnecting directors in the boards of directors in the firms during the strategic governance of firms in the challenging time, when the innovation breakthrough processes originate the creative innovative disruptions appearances during the capitalism evolution in Schumpeter (1911, 1939, 1947), Christensen (Christensen (June 16, 1977; Fall, 1992a, b; 1997; 1998; December, 1998; April, 1999a, b, c; 1999a, b; Summer, 2001; June, 2002; 2003; March, April, 2003; January, 2006), Bower, Christensen (January, February, 1995; 1997; 1999), Christensen, Armstrong (Spring, 1998), Christensen, Cape (December, 1998), Christensen, Dann (June, 1999), Christensen, Tedlow (January, February, 2000), Christensen, Donovan (March, 2000; May, 2010), Christensen, Overdorf (March, April, 2000), Christensen, Bohmer, Kenagy (September, October, 2000), Christensen, Craig, Hart (March, April, 2001), Christensen, Milunovich (March, 2002), Bass, Christensen (April, 2002), Anthony, Roth, Christensen (April, 2002), Kenagy, Christensen (May, 2002; 2002), Christensen, Johnson, Rigby (Spring, 2002), Hart, Christensen (Fall, 2002), Christensen, Verlinden, Westerman (November, 2002), Shah, Brennan, Christensen (April, 2003), Christensen, Raynor (2003), Burgelman, Christensen, Wheelwright (2003), Christensen, Anthony (January, February, 2004), Christensen, Anthony, Roth (2004), Christensen, Baumann, Ruggles, Sadtler (December, 2006), Christensen, Horn, Johnson (2008), Christensen, Grossman, Hwang (2009), Dyer, Gregersen, Christensen (December, 2009; 2011), Christensen, Talukdar, Alton, Horn (Spring, 2011), Christensen, Wang, van Bever (October, 2013)). The authors will apply the sophisticated econometrical econophysical techniques with the purpose to accurately characterize the firm within the information theory of the firm, achieving the strategic research goals in Schumpeter (1906, 1933), Bowley (1924), Fogel (1964), Box, Jenkins (1970), Grangel, Newbold (1977), Van Horne (1984), Taylor S (1986), Tong (1986, 1990), Judge, Hill, Griffiths, Lee, Lutkepol (1988), Hardle (1990), Grangel, Teräsvirta (1993), Pesaran, Potter (1993), Banerjee, Dolado, Galbraith, Hendry (1993), Hamilton (1994), Karatzas, Shreve (1995), Campbell, Lo, MacKinlay (1997), Rogers, Talay (1997), Hayashi (2000), Durbin, Koopman (2000, 2002, 2012), Ilinski (2001), Greene (2003), Koop (2003), Davidson, MacKinnon (2004), Cameron, Trivedi (2005), Vialar, Goergen (2009).

**Review of literature toward accurate characterization of directors in  
interconnecting interlocking overlapping directors' networks  
in boards of directors in theory of firm**

Let us make a chronological literature review to accurately characterize both the *directors* and the *interconnecting interlocking overlapping directors' networks* in the *boards of directors* in the *theory of firm*, aiming to create a coherent picture on a range of the researched problems, the obtained research results and the progress made in the field of our research interest. The authors would like to highlight the fact that the research on the *firm* (the *business enterprise*) was in the scope of responsibilities by the *National Bureau of Economic Research* in the *USA* for a long time in *Mitchell* (February 7 1921). We would like to begin with the *important fundamental research in the economics* in *Brandeis* (1915, 1933). The *corporate managers' functions*, *modern corporation structures* and *private property meaning* have been considered in *Berle* (1932), *Berle, Means* (1932). The problems on the *business administration* have been uncovered in *Selznick* (1949, 1957). The *nature of business elite's power* has been described in *Mills* (1956). The issues such as the *critical evaluation of corporate director*, the *boards of directors possible structures* and the *corporate strategy creation* have been considered in *Vance* (1964, 1968, 1983). A series of research articles by *Williamson* (1964, 1975, 1984, December 1985, 1988, 1996, 2002, 2007) has been focused on the *corporate governances problems* in the *theory of firm*. The topics on the *board of directors and effective management in the firm* have been discussed in *Koontz* (1967). *Travers* (1968), *Dooley* (1969) researched the *interlocks in the corporate management*. The research on the *state in the capitalist society* has been presented in *Miliband* (1969). The *power and functions of the boards of directors* from the theoretical synthesis point of view have been studied in *Zald* (1969). The *higher circles* have been described in *Domhoff* (1970). *Bunting, Barbour* (Autumn 1971), *Bunting* (1976) presented a study on the *interlocking directorates in large American corporations, 1896 - 1964*. The *directors, board of directors* and *president* have been precisely characterized in *Mace* (1971, 1986), *Mace* (March-April 1972). *Child* (1972) focused his research on the organizational structure, environment and performance. The *formation of the sphere of influence* has been discussed in *Levine* (1972). The *theory of organization* has been formulated in *Pfeffer* (1972, 1973, 1981, 1982, 1983, 1987, 1991), *Pfeffer, Salancik* (1978, 2003). *Bacon* (1973, 1993) discussed the *corporate directorship practices*, the *corporate boards problems* and the *corporate governance issues*. *Blumberg* (1973) presented his reflections on the *proposals for the corporate reform through change in the composition of the board of directors*. *Granovetter* (1973) highlighted the strength of weak ties.

The *economic theory of agency* has been formulated in Ross (1973). Allen (1974) described the *interlocking corporate directorates*. Doreian (1974) presented his thoughts on the *connectivity of social networks*. Zeitlin (1974) discussed the *problems on the corporate ownership and control*. Mariolis (1975) studied the *interlocking directorates in the corporations*. Buchmann (1976) researched the *organization related problems*. Burt (1976, 1983) characterized the *social networks, co-optations principles, and corporations*. Cuyvers, Meeusen (1976, 1985) discussed the *networks of corporate power in Belgium*. Wilson (1976) researched the *unlocking interlocks*. Hughes, John, Mackenzie (1977) characterized the *trends in interlocking directorships*. Freeman (1979a, b) presented his vision on the *social networks*. The *boards of directors in English and American companies through 1920 in time of the formation of the big enterprises in the 19th and early 20th centuries* have been researched in Karjala (1979). Koenig, Gogel, Sonquist (1979) created the *models of the significance of interlocking corporate directorates*. Mokken (1979) investigated the *cliques, clubs and clans nature in the society*. Andrews (November-December 1980) studied the *directors' responsibility for corporate strategy*. Andrews (May-June 1981a) researched the *board's role in formulating strategy*. Andrews (Nov-Dec 1981b) characterized the *creation of the corporate strategy as a vital function of the board*. Burt (1980) presented a *reconsideration of interlocking directorates, involving American manufacturing, in frames of the cooptive corporate actor networks*. Burt (1997) highlighted the *contingent value of social capital*. Pennings (1980) characterized precisely the *interlocking directorates*. Provan (1980) investigated the *board power and the organizational effectiveness among the human service agencies*. Radcliff (1980) presented an *analysis of the impact of the internal structure of the capitalist class on the lending behavior of banks, considering the banks and corporate lending problems*. Boje, Whetten (1981) investigated the *interorganizational networks*. Linderberger, Ross (1981) researched the *industrial organizations*. The characterization of the *interlocking directorates in American businesses* has been done in Mintz, Schwartz (1981, 1985). The *interlocking directors networks in American corporations* have been researched in Mizruchi, Bunting (1981), Mizruchi (1982, 1983, 1992, 1996), Stearns, Mizruchi (1986), Mizruchi, Schwartz (editors) (1987), Mizruchi, Stearns (1988, 1994), Byrd, Mizruchi (2005). Schoorman, Bazerman, Atkin (1981) studied the *interlocking directorates*. Hirsch (1982) considered the *culture of interlocking directorates*. Mariolis, Jones (1982) discussed the *centrality in the corporate interlock networks*. Andrews (1983) highlighted the *directors' responsibility for the corporate strategy, researching the strategic management*. Barnes (1983) formulated the *graph theory in the network analysis*. Bazerman, Schoorman (1983) created a *limited rationality model of interlocking directorates*. Burt (1983) considered the *corporate profits and the cooptation*.

*Burt (2000) studied the network structure of social capital in his research in the field of the organizational behavior. Dodd, Warner (1983) wrote a research work on the corporate governance. Donaldson, Lorsch (1983) researched the decision-making techniques at the top to shape the strategic direction. Fama, Jensen M C(1983b) studied the separation of ownership and control. McAvoy, Conter, Dona, Peck (1983) considered the proposals for the increased control on the corporation by the board of directors in frames of their econometric analysis research. Palmer (1983) investigated the interlocking directorates and the inter-corporate coordination. Roy (1983) documented the interlocking directorate structure in the United States. Tashakori, Boulton (1983) looked at the board's role in the strategic planning. Vance (1983) accessed the corporate leadership at the boards and directors levels. American Bar Association (1984) presented its vision on the interlocking directorates. American Bar Association (2011) made some additional comments on the interlocking directorates. Caswell (1984) presented an institutional perspective on the corporate control and the network of interlocking directorates. Hambrick, Mason (1984) studied the organization as a reflection of its top managers. Lease, McConnell, Mikkelson (1984) researched the market value of differential voting rights in the closely held corporations. Ornstein (1984) considered the interlocking directorates in Canada. Scott, Griff (1984) reviewed the British corporate networks 1904–1976. Tricker (1984) made a research on the corporate governance. Tricker (1994a) considered the cases in the international corporate governance. Tricker (1994b) made an international review on the corporate governance. Tricker (2000) documented the history of management thought, researching the corporate governance. Tricker (2009) studied the principles, policies and practices toward the corporate governance. Useem (1984) wrote a research on the inner circle. Ziegler (1984) investigated the people integration network in the Austrian firms. Baysinger, Butler (1985) studied the corporate governance and the board of directors, focusing on the performance effects of changes in the board composition. Baysinger, Hoskisson (1990) researched the composition of the boards of directors and strategic control, paying attention to the corporate strategy. Baysinger, Kosnik, Turk (1991) considered the effects of board and ownership structure on the corporate R&D strategy. Bearden, Mintz (1985) studied the regionality and integration in the American interlock network of corporate power. Chaganti, Mahajan, Sharma (1985) considered the corporate board size, composition and corporate failures in retailing industry. Charreaux, Pitol-Belin (Novembre 1985) created the contractual theory of organizations, applying his findings to the board of directors of French firms. Charreaux, Couret, Joffre, Koenig, De Montmorillon (1987) reviewed the new theories to manage the firm. Charreaux, Pitol-Belin (1989) characterized the boards of directors in France. Charreaux, Pitol-Belin*

(1990) researched the *boards of directors in France*. Charreaux, Pitol-Belin (October 1991) considered the *board of directors as a scene of confrontation between the managers and the shareholders*. Charreaux (October 1993) researched the *board of directors as a mechanism inside the corporate governance system*. Charreaux, Debrieres (1998) considered the *corporate governance issues*. Charreaux (2000) studied the *board of directors from the corporate governance perspective*. Charreaux (2002a) investigated the *financial aspects in the corporate governance problem*. Charreaux (2002b) considered a *shareholder as a shareholder of cognitive resources*. Cochran, Wood, Jones (1985) made the research on *the composition of the boards of directors and the incidence of golden parachutes*. Demsetz, Lehn (1985) accessed the *structure of corporate ownership, deriving the possible causes and consequences*. Demsetz, Villalonga (2001) described the *ownership structure and evaluated the corporate performance*. Galaskiewicz, Wasserman, Rauschenbach, Bielefeld, Mullaney (1985) estimated the *influence of the corporate power, social status, and market position on the corporate in a regional network*. Meeusen, Cuyvers (1985) investigated the *interaction between the interlocking directorships, the economic behaviour of companies, researching the networks of corporate power in the ten countries*. Stockman, Wasseur (1985) accessed the *national networks of corporate power by the means of comparative analysis of ten countries in 1976*. Stockman, Ziegler, Scott (editors) (1985) edited a *collection of research papers on the networks of corporate power in the ten countries in 1976*. Stockman, van der Knoop, Wasseur (1990) focused their research attention on the *interlocking directorships and corporate networks in the Netherlands in the period 1960-1980*. Waldo (1985) investigated the *boards of directors with their changing roles, structure and information needs*. Anderson (1986) characterized the *new corporate directors*. Norburn (1986) compared the *directors in the firms* and evaluated the *industry performance*. Shleifer, Vishny (1986) wrote a well known research paper on the *large shareholders and the corporate control*. Shleifer, Vishny (1997) conducted a *survey of corporate governance*. Tirole (1986) Hierarchies and bureaucracies: On the role of collusion in organizations. Aghion, Tirole (1997) identified the *formal and real authority in the organizations*. Tirole (2001) researched the *corporate governance problems*. Tirole (2006) created the *theory of corporate finance*. Grossman, Hart (1986) estimated the *cost and benefit of ownership in the theory of vertical and lateral integration*. Glatthard (1987) characterized the *state of development of firms in Switzerland in 1929 - 1983*. Kosnik (1987) conducted a *study on the board performance in the corporate governance*. Richardson (1987) characterized the *directorship interlocks and the corporate profitability*. Mathile (1988) presented a *business owner's perspective on the outside boards*. Hermalin, Weisbach (1988) described the *determinants of board composition*. Weisbach (1988)



discussed the *outside directorships and the CEO turnover problems*. Hermalin, Weisbach (1991) discussed the *effects of the board composition and direct incentives on the firm performance*. Hermalin, Weisbach (1998) researched the *endogenously chosen boards of directors and their monitoring of the CEO*. Hermalin, Weisbach (2001, 2003) presented a survey of the *economic literature on the board of directors as an endogenously determined institution*. Hermalin, Benjamin (2005) described the *trends in the corporate governance*. Hill, Snell (1988) presented their research on the *external control, corporate strategy, and firm performance in the research intensive industries*. Kesner (1988) compiled a *list of the directors' characteristics during his investigation of the directors' type, occupation, tenure and gender*. Zahra, Stanton (1988) stressed on the *possible implications of the board of directors composition on the corporate strategy and performance*. Zahra, Pearce (1989) conducted a review and created an *interactive model of the boards of directors and the corporate financial performance interdependence*. Zahra (1990) highlighted an *increasing necessity for the board's involvement in the strategy formulation in the firm*. Pearce, Zahra (1991) described the *relative power of the CEOs and the boards of directors, making some associations with the corporate performance*. Pearce, Zahra (1992) described the *board composition from a strategic contingency perspective*. Zajac (1988) conducted a *test of the critical assumptions on the interlocking directorates as an inter-organizational strategy*. Zajac, Westphal (1996) discussed the *director reputation, CEO-board power, and the dynamics of board interlocks*. Connors (1989) characterized the *outside board members as a breath of fresh air in the firm*. Fosberg (1989) researched the *outside directors influence on the managerial monitoring in the firm*. Lorsch, MacIver (1989) documented the *reality of America's corporate boards*. Lundstrom, Ottoson (1989) discussed the *bank-industry relations in Sweden, including the problems of the ownership and the interlocking directorates*. Nelson (1989) studied the *strength of strong ties, considering the social networks and intergroup conflict in organizations*. Rechner, Dalton (1989) evaluated the *impact of CEO as board chairperson on the corporate performance*. Rechner, Dalton (1991) presented a *longitudinal analysis on the CEO duality and the organizational performance*. Schellenger, Wood, Tashakori (1989) researched the *board of director composition, shareholder wealth and dividend policy*. Singh H, Harianto (1989) studied the *management-board relationships, takeover risk, and the adoption of golden parachutes*. Carver (1990) focused his research on the *boards that make a difference*. Carver (2002) researched the *corporate boards that create value for the company*. Donaldson (1990) contributed to the *organizational economics and management theory*. Donaldson, Davis (1991) studied the *agency theory, accenting his attention on the CEO governance and shareholder returns*. Gilson (1990) collected the *evidences on the changes in the*

corporate ownership and control, when firms default. Glaes (1990) researched the control of the firms by the Swiss boards of directors. Kaplan, Reishus (1990) analyzed the outside directorships and corporate performance. Kaplan (1994a) evaluated the top executives rewards and firm performance, making a comparison of Japan and the United States. Kaplan (1994b) considered the top executives, turnover, and firm performance in Germany. Kaplan, Minton (1994) studied the problems, connected with the appointments of outsiders to Japanese boards. Kaplan (1997) researched the corporate governance and corporate performance, comparing Germany, Japan and the U.S. Lorsch, MacIver (1989) described the reality of America's corporate boards. Powell (1990) researched the networks form of organizations. Rosenstein, Wyatt (1990) characterized the outside directors, board independence, and shareholder wealth. Rosenstein, Wyatt (1994) described the shareholder wealth effects when an officer of one corporation joins the board of directors of another. Rosenstein, Wyatt (1997) looked into the inside directors, board effectiveness, and shareholder wealth problems. Barnhart, Rosenstein (1998) considered the board composition, managerial ownership, and firm performance. Burris (1991) studied the director interlocks and the political behavior of corporations and corporate elites. Davis (1991) researched the spread of the poison pill through the intercorporate network. Davis, Greve (1997) documented the corporate elite networks and governance changes in the 1980s. Davis, Yoo, Baker (2002) created the network topography of the American corporate elite 1982-2001. Davis, Yoo, Baker (2003) investigated the small world of American corporate elite, 1982-2001. Davis, Yoo, Vast (December 2003) characterized a small world of big corporations. Goodstein, Boeker (1991) proposed the new perspectives on the governance structure changes and the strategic change. Israel (1991) described the capital structure and the market for corporate control. Israel (1992) wrote on the capital and ownership structures, and the market for corporate control. Byrd, Hickman (1992) answered the question: Do outside directors monitor managers? Daily, Dalton (1992) established a relationship between the governance structure and the corporate performance in the entrepreneurial firms. Daily, Dalton (1993) focused on the board of directors leadership and structure, considering the control and performance implications. Daily, Dalton (1994a) researched the corporate governance problems, describing an impact of the board composition and structure. Daily, Dalton (1994b) made an empirical assessment of the corporate governance and the bankrupt firm. Daily (1995) investigated the relationship between the board composition and the leadership structure and bankruptcy reorganization outcomes. Johnson, Daily, Ellstrand (1996) completed a review and presented a research agenda on the boards of directors. Daily, Dalton (1997) described the CEO and board chair roles, held jointly or separately. Daily, Johnson (1997) conducted a

longitudinal assessment on the sources of the CEO power and the firm financial performance. Dalton, Daily, Ellstrand, Johnson (1998) made the meta-analytic reviews of board composition, leadership structure, and financial performance. Dalton, Daily, Johnson, Ellstrand (1999) completed a meta-analysis on the research issues such as a number of directors and the financial performance of firm. Daily, Dalton, Cannella (2003) described the decades of dialogue and data on the corporate governance. Dalton, Daily, Certo, Roengpitya (2003) prepared the meta-analyses of the financial performance and equity. Daily, Dalton (2005) accurately characterized the boards of directors, utilizing the empirical evidence in the practical prescriptions development. Demb, Neubauer (1992a) listed the confronting the paradoxes in the corporate boards. Demb, Neubauer (1992b) defined the “job” of the board of directors. Finkelstein (1992) accurately characterized the power in the top management teams, considering the dimensions, measurement, and validation issues. Finkelstein, D’Aveni (1994) explained the problem: *How do the boards of directors balance the entrenchment avoidance and the unity of command?* Finkelstein, Mooney (2003) answered the question: *How can the board process be used to make the boards better?* Fligstein, Brantley (1992) solved the problem: *Who controls the large modern corporation?, considering the bank control, owner control, and organizational dynamics issues.* Fligstein (1995) precisely characterized the networks of power or the finance conception of control, commenting on the Palmer, Barber, Zhou, and Soysal conceptual proposal. Gerlach (1992) completed a blockmodel analysis on the Japanese corporate network. Judge, Zeithaml (1992) proposed the institutional and strategic choice perspectives on the board involvement in the strategic decision making process. Lee, Rosenstein, Rangan, Davidson (1992) conducted the research on the board composition and shareholder wealth in the case of management buyouts. Davidson, Pilger, Szakmary (1998) described the golden parachutes, board and committee composition and shareholder wealth. Judge, Zeithaml (1992) suggested the institutional and strategic choice perspectives on the board involvement in the strategic decision process. Lincoln, Gerlach, Takahashi (1992) characterized the Keiretsu networks in the Japanese economy. Lipton, Lorsch (1992) made a modest proposal for the improved corporate governance. Mallette, Fowler (1992) provided the characterization of the effects of board composition and stock ownership of the adoption of “poison pills”. Milgrom, Roberts (1992) wrote about the organization and management. Ottoson (1992) made the research on the network analysis and interlocking directorships in Sweden. Pearce, Zahra (1992) argued about the board composition options from a strategic contingency perspective. Pettigrew (1992) studied the managerial elites. Pettigrew, McNulty (1995) researched the power and influence in and around the boardroom. McNulty, Pettigrew (1999) described a role of the strategists in the board. Pye, Camm (2003)

concentrated on the *non-executive directors' study*. Pye, Pettigrew (2005) researched the *board context, process and dynamics, identifying some challenges for the future*. Smith, Watts (1992) wrote on the *investment opportunity set and corporate financing, dividend, and compensation policies*. Wang, Dewhirst (1992) characterized the *boards of directors and stakeholder orientation*. Alexander, Fennel, Halpern (1993) described the *board-CEO relations and organizational growth and decline*. Coulson-Thomas (1993) worked on the *problem of excellence creation in the boardroom*. Jensen M C (1993) characterized the *modern industrial revolution, exit, and the failure of internal control systems*. Johnson, Hoskisson, Hitt (1993) researched the *board of directors' involvement in restructuring, focusing on the effects of board control versus the managerial control*. Johnson, Greening (1999) described the *effects of corporate governance and institutional ownership types on the corporate social performance*. Haunschild (1993) documented the *impacts of the interlocks on the corporate acquisition activity*. Haunschild, Beckman (1998) considered the *alternate sources of information and the interlock influence*. Kester (1993) studied the *perspectives and challenges of introduction of the directors from banks into the boardroom in Germany, Japan and the United States*. Mangel, Singh H (1993) researched the *ownership structure, board relationships and CEO compensation in large US corporations*. Millstein (1993) described the *evolution of the certifying board*. Shivdasani (1993) characterized the *board composition, ownership structure and hostile takeovers*. Shivdasani, Yermack (1999) conducted an *empirical analysis on the CEO involvement in the selection of new board members*. Barnhart, Marr, Rosenstein (1994) evaluated the *firm performance and board composition, presenting some new evidences*. Barnhart, Rosenstein (1998) completed an *empirical analysis on the board composition, managerial ownership and firm performance*. Beatty, Zajac (1994) conducted a study on the *executive compensation, ownership and board structure in the initial public offerings*. Boyd (1994) studied the *board control and CEO compensation*. Boyd (1996) listed the *determinants of US outside director compensation*. Brickley, Coles, Terry (1994) researched the *outside directors and the adoption of poison pills issues*. Brickley, Coles, Jarrell (1997) considered the *leadership structure, separating the CEO and the Chairman of the board*. Brickley, Coles, Linck (1999) answered the question: *What happens to CEOs after they retire?*, presenting the new evidences on the *career concerns, horizon problems, and CEO incentives*. Gales, Kesner (1994) conducted an *analysis of the board of directors size and composition in the bankrupt organizations*. Goodstein, Gautam, Boeker (1994) documented the *effects of the board size and diversity on the strategic change*. Hirshleifer, Thakor (1994) considered the *managerial performance, boards of directors, and takeover bidding*. Huse (1994) described the *board-management relations in small firms*,

describing the paradox of the simultaneous in-dependence and inter-dependence. Huse (2005) proposed a framework for exploring the behavioural perspectives of corporate governance. Huse, Minichilli, Shoning (2005) described the corporate boards as an asset in the new Europe, elaborating on the value of process-oriented boardroom dynamics. Huse (2007) conducted research on the boards, governance and value creation in the firms. Pugliese, Bezemer, Zattoni, Huse, Van Den Bosch, Volberda (2009) presented a literature review and a research agenda on the boards of directors' contribution to the strategy. Van Ees, Gabrielsson, Huse (2009) complemented the behavioral theory of boards and corporate governance. Krackhardt (1994) considered the graph theoretical dimensions of informal organizations in the frames of discussion on the computational organization theory. Li (1994) completed a multi-country test of the agency theory predictions, considering the ownership structure and the board composition. Scott, Kleidon (1994) evaluated the CEO performance, board types and board performance, researching the corporate governance issues. Wasserman, Galaskiewicz (1994) described the present advances in the social network analysis. Wasserman, Faust (1994) provided some information on the methods and applications toward the social network analysis. Wasserman, Faust, Iacobucci (1994) researched the social network analysis problems. Bathala, Rao (1995) proposed an agency theory perspective on the determinants of board composition. Benassi (1995) described the governance factors in a network process approach. Blair (1995) considered the ownership and control problems, rethinking corporate governance for the twenty-first century. Blair (1999) researched the firm-specific human capital and the theories of the firm. Blair, Stout (1999) created a team production theory of corporate law. Blair, Stout (2001) highlighted the director accountability and the mediating role of the corporate board. Blair, Stout (2006) investigated the specific investments and the corporate law. Boyd (1995) suggested a contingency model to describe the CEO duality and the firm performance. Hallock (January 1995) considered the executive pay level and the reciprocal interlocking boards of directors problems. Hart (1995) discussed the corporate governance, presenting some theories and implications. Hill (1995) discussed the social organization of boards of directors. Kini, Kracaw, Mian (1995) provided an unbiased view on the corporate takeovers, firm performance, and board composition. Klein (1995) conducted an examination of board committee structures. Klein (1998) investigated the firm performance and the board committee structure. Klein (2002) researched the audit committee, board of director characteristics, and earnings management. Lorsch (January- February 1995) investigated the problem of the boards empowering in the firms. Moerland (1995) paid his research attention to the alternative disciplinary mechanisms in different corporate systems. Moerland (1997) reviewed the theories and practices on the

corporate governance from the international perspective. Moerland (1999) explained the corporate supervision details in the Netherlands. Monks, Minow (1995) discussed the corporate governance issues. O'Neal, Thomas (1995) researched the directors networks and director selection problems, emphasizing the board's strategic role in the firm. Pfannschmidt (1995) described the multiple directorship appointments in the German firms. Wunderer (1995) researched the characteristics of the board's president, presenting the point of view on this research problem from Switzerland. Agrawal, Knoeber (1996) characterized the firm performance and described the mechanism to control the agency problems between the managers and the shareholders. Agrawal, Knoeber (2001) answered the question: *Do some outside directors play a political role?* Agrawal, Chen (2010) described the determinants and consequences of disputes, involving directors in the boards of directors. Bainbridge (1996) provided some information on the participatory management within a theory of the firm. Bainbridge (2003a), speaking on the director primacy, focused on the means and ends of corporate governance. Bainbridge (2003b) presented the board as a nexus of contracts. Beasley (April 1996) conducted an empirical analysis of the relation between the board of director composition and the financial statement fraud. Beasley, Salterio (2001) characterized the relationship between the board characteristics and the voluntary improvement in the audit committee composition and experience. Bhagat, Black (May 10-11 1996) discussed the question: *Do independent directors matter?* Bhagat, Black (1998, 1999) discussed an uncertain relationship between the board composition and the firm performance. Bhagat, Black (2000) looked into the issues of the board independence and long-term firm performance. Bhagat, Black (2002) found a non-correlation between the board independence and the long-term firm performance. Bhagat, Black, Blair (2004) accessed the relational investing and the firm performance. Bhagat, Bolton (2008) discussed the problems of the corporate governance and the firm performance. Black, Jang, Kim (2003) answered the question: *Does corporate governance predict firms' market values?*, using some evidences from Korea. Black, Jang, Kim (2006a) provided his research opinion on the problem: *Does corporate governance affect firms' market values?*, applying the evidences from Korea. Black, Jang, Kim (2006b) made the prediction on the firms' corporate governance choices, employing the evidences from Korea. Black, Khanna (2007) raised the question: *Can the corporate governance reforms increase the firms' market values?*, using the evidences from India. Black, Kim (2008, 2011) characterized the effect of the board structure on the firm value in an emerging market with the evidences from Korea. Black, Kim, Jang, Park (2011) considered the problem: *How corporate governance affects the firm value*, using the evidences from Korea. Bianco, Gola, Signorini (1996) has been interested in the

problem on the dealing with the separation between the ownership and the control in the firm, including: state, family, coalitions and pyramidal groups in Italian corporate governance. Bianco, Pagnoni (March 1997) researched the interlocking directorates across the listed companies in Italy in the case of banks. Booth, Deli (1996) worked on the factors, affecting the number of outside directorships, held by the CEOs. Booth, Deli (1999) wrote an article on the characterization of the executives of financial institutions as the outside directors. Borokhovich, Parrino, Trapani (1996) considered the outside directors and CEO selection problem. De Cecco, Ferri (1996) described the commerce banks in Italy. Doz (1996) described the evolution of cooperation in the strategic alliances. Johnson, Daily, Ellstrand (1996) presented a review and research agenda on the board of directors. La Porta, Lopez-de-Silanes, Shleifer, Vishny (1996, 1998) considered the law and finance issues. La Porta, Lopez-de-Silanes, Shleifer, Vishny (1997) defined the legal determinants of external finance. La Porta, Lopez-de-Silanes, Shleifer (1998, 1999) reviewed the corporate ownership around the world. Mueller (1996) anchored the points for the corporate directors to think about. O'Neal, Thomas (1996) considered the problem of the strategic board development. Park, Rozeff (1996) described the role of outside shareholders, outside boards, and management entrenchment in the CEO selection. Romano (1996) investigated the corporate law and corporate governance. Sundaramurthy (1996) focused on the corporate governance within the context of antitakeover provisions. Sundaramurthy, Mahoney J M, Mahoney J T (1997) described the board structure, antitakeover provisions, and stockholder wealth. Yermack (1996) emphasized the fact that the higher market valuation of companies with a small board of directors is frequently observed. Shivdasani, Yermack (1999) discussed the CEO involvement in the selection of new board members in the completed empirical analysis. West (1996) wrote an introduction to the graph theory. Windolf, Beyer (1996) discussed the corporate networks in Germany and Britain in the conditions of co-operative capitalism. Windolf (2002) presented the research on the corporate networks in Europe and the United States. Windolf (2009) investigated the coordination and control in the corporate networks in the United States and Germany, 1896-1938. Angbazo, Narayanan (1997) researched the top management compensation and the structure of the board of directors in commercial banks. Bacon, Cornett, Davidson (1997) discussed the research problems on the board of directors and the dual-class recapitalizations in the firms. Brickley, Coles, Jarrell (1997) researched the leadership structures with the separation of the CEO and the chairman of the board of directors. Cotter, Shivdasani, Zenner (1997) answered the question: Do independent directors enhance the target shareholder wealth during the tender offers? Davis, Schoorman, Donaldson (1997) presented a research toward a stewardship theory of management. Davies, Gower (1997) outlined the

Gower's principles of company law. Fernandez, Gomez, Fernandez (1997) described the effect of the board size and composition on the corporate performance. Geletkanycz, Hambrick (1997) identified the external ties of senior executives and highlighted the implications for the strategic choice and performance. Hallock (1997) characterized the reciprocally interlocking boards of directors and executive compensation. Huther (1997) conducted an empirical test of the effect of the board size on the firm efficiency. John, Senbet (1997) performed the research on the corporate governance and board effectiveness in the firm. Kojima (1997) made an international comparison on the corporate governance. Leighton, Thain (1997) discussed the boards of directors at the work in the firms. Loderer, Martin (1997) estimated the executive stock ownership and performance. Loderer, Peyer (September 5 2001, 2002) discussed the board overlap, seat accumulation, and share prices. Maug (1997) considered the alternative forms of corporate restructuring with particular interest in the boards of directors and the capital structure. Podolny, Baron (1997) described the social networks and mobility in the workplace. Rebers, Beetsma, Peters (July 1997) clarified the problem on the role of collusion between the management and the board of directors. Rowley (1997) created the network theory of stakeholder influences. Rowley (1998) conducted the social network analysis. Elms, Berman, Rowley (2000) indentified the network influences on the CEO compensation. Rowley, Behrens, Krackhardt (2000) performed an analysis of structural and relational embeddedness in the steel and semiconductor industries. Rowley (June 3 2005a, b) characterized the directors networks in the board of directors of North American corporations. Rowley, Baum (2008) made the research on the dynamics of network position. Tufano, Sevick (1997) described the board structure and fee-setting in the US mutual fund industry. Miller (March 26 1997) performed the discussion on the Interlocking directorates and the antitrust laws. Uzzi (1997) researched the social structure and competition in the inter-firm networks, highlighting the paradox of embeddedness. Vasta, Baccini (1997) described the banks and industry in Italy, 1911-36, using the new evidences on the interlocking directorates. Adams (1998, 2000) identified the dual role of corporate boards as advisors and monitors of management. Adams, Ferreira (2003a) presented a theory of friendly board. Adams, Ferreria (2003b) presented the evidences from the corporate boards research on the roles of the diversity and incentives. Adams, Mehran (2003) answered the question: Is the corporate governance different for the bank holding companies? Adams, Mehran (2004) characterized the board structure and banking firm performance. Adams, Mehran (2005, 2008) described the corporate performance, board structure and its determinants in the banking industry. Adams, Almeida, Ferreira (2005) discussed the roles of powerful CEOs and their impact on the corporate performance. Adams, Ferreria (2007) created the theory of friendly



boards. Adams, Ferreria (2009) characterized the women in the boardroom and their impact on the governance and performance of the firms. Adams, Almeida, Ferreira (2009) tried to understand the relationship between the founder-CEOs and the firm performance. Adams, Hermalin, Weisbach (2010) explained the role of the boards of directors in the corporate governance, creating the conceptual framework and survey. Adams, Funk (2011) discussed the gender problems in the boards of directors. Adams, Hermalin, Weisbach (2010) created the conceptual framework, conducted the survey, and highlighted the role of the boards of directors in the corporate governance. Adams, Gray, Nowland (2012) answered the question: Does gender matter in the boardroom?, providing the evidences from the market reaction to the mandatory new directors announcements in Australia. Adams, Ragunathan (2012) researched the Lehman Brothers firm bankruptcy and its implications on the financial industry in the USA. Aguilera (1998) researched the directorships interlocks in the comparative perspective in the case of Spain. Aguilera, Jackson (2003) provided the dimensions and determinants on the cross-national diversity of corporate governance. Aguilera, Cuervo-Cazurra (2004) described the codes of good governance worldwide. Aguilera (2005a) proposed an institutional comparative perspective on the corporate governance and director accountability. Aguilera (2005b) considered the corporate governance and labor relations in Spain. Aguilera (2006) completed a comparative study of Italy and Spain towards the national state differences and patterns of directorship interlocks. Aguilera, Filatotchev, Gospel, Jackson (2008) considered the problems of contingencies, complementarities, and costs in the corporate governance models. Aguilera, Cuervo-Cazurra (2009) listed the codes of good governance. Bollobas (1998) created the modern graph theory. Bolton, Von Thadden (1998) researched the blocks, liquidity, and corporate control. Carretta (1998) researched the role of information systems in the corporate governance models. Carretta, Farina, Schwizer (2006) researched the boards of directors of the financial intermediaries, evaluating their competencies, effectiveness and performance. Charan (1998) clarified the problem: How can the corporate boards create the competitive advantage for their firms. Collin (1998) researched the business groups in Sweden. Conger, Finegold, Lawler (1998) accessed the boardroom performance in the firms. Conyon, Peck (1998) researched the interconnections between the board size and the corporate performance, taking the evidences from the European countries. Conyon, Peck (1998) investigated the complex problems on the board control, remuneration committees, and top management compensation. Conyon, Muldoon (2006a) described the small world of corporate boards in Singapore. Conyon, Muldoon (2006b) characterized the small world of corporate boards. Conyon, He (2008) provided more information on the executive compensation and CEO equity incentives in China's

listed firms. Denis, Sarin (1998) described the ownership and board structures in the publicly traded corporations in France. De Wulf (1998) discussed the corporate governance from the Belgian perspective. Eisenberg, Sundgren, Wells (1998) identified that the larger board size results in the decreasing firm value in the small firms. Fried, Bruton, Hisrich (1998) researched the boards of directors in the venture capital-backed firms. Gispert (1998) investigated the board turnover and firm performance in Spanish companies. Goodwin, Seow (August 1998) researched the information disclosure, relating to the board members to build the investors' confidence. Gulati (1998) described the alliances and networks. Gulati, Singh H (1998) discussed the architecture of cooperation, managing the coordination uncertainty and interdependence in the strategic alliances. Gulati (1999) researched the influences by the network resources and firm capabilities on the alliance formation. Gulati, Garguilo (1999) answered the question: *Where do networks come from?* Gulati, Westphal (1999) uncovered the effects of the CEO-board relations and the content of interlocks on the formation of joint ventures. Haunschild, Beckman (1998) considered the problem: *When do interlocks matter?* Hoskisson, Hitt, Johnson, Grossman (2002) investigated the effects of institutional ownership heterogeneity and internal governance on the corporate innovation strategies. Hopt, Kanada, Roe, Wymeersch, Prigge (editors) (1998) characterized the present state of the art in the comparative corporate governance. Hopt (1998) described the German two-tier board, including the experiences, theories, reforms. Hopt, Leyens (2004) reviewed the board models in Europe, describing the recent developments of the internal corporate governance structures in Germany, the United Kingdom, France, and Italy. Hopt (2006) researched the actual problems of the boards of directors. Hung (1998) considered the theories of governing boards. Eisenberg, Sundgren, Wells (1998) noted that the larger board size may result in the decreasing firm value in the small firms. Everett, Borgatti (1998) performed an analysis of the clique overlap. John, Senbet (1998) considered the problems of the corporate governance and board effectiveness. Khanna, Gulati, Nohria (1998) measured the dynamics of learning alliances: Competition, cooperation, and relative scope. Klein (1998a) made a comparative analysis on the firm productivity and the board committee structure. Klein (1998b) characterized the affiliated directors in the firms with the particular focus on the directors' effectiveness. Klein (1998c) investigated the firm performance and board committee structure. Klein (2002) researched the audit committee, board of director characteristics, and earnings management. Klein, Shapiro, Young (2005) studied the corporate governance, family ownership and firm value, considering the Canadian evidences. Kose, Senbet (1998) researched the corporate governance and board effectiveness. Mac Canna, Brennan, O'Higgins (1998) characterized the national networks of

corporate power from the Irish perspective. Mak, Li (1998) researched the ownership structure, investment opportunities and board structure in Singapore. Lim, Mak (1999) investigated the ownership structure, board structure and corporate diversification in Singapore. Eng, Mak (November 21-24 1999) studied the ownership structure, board structure and corporate disclosure in Singapore. Mak, Phan (December 2000) researched the developments in the field of the corporate governance in Singapore for the next millennium. Mak, Li (2001) discussed the determinants of corporate ownership and board structure with the evidence from Singapore. Mak, Kusnadi (2005) provided the further evidences on the negative relationship between the board size and the firm value. Muth, Donaldson (1998) presented a contingency approach to the stewardship theory and the board structure. Sanders, Carpenter (1998) considered the role of the CEO compensation, top management team composition, and board structure in the firm governance. Spencer (1998) discussed the Netherlands board index. Stuart (1998) conducted an investigation of the strategic alliance formation in the high-technology industry. Vafeas, Theodorou (1998) characterized the relationship between the board structure and the firm performance in the UK. Vafeas (1999) completed a comparative analysis on the board meeting frequency and the firm performance. Vafeas (2000) considered the board structure and the informativeness of earnings. Vafeas (2003) researched the length of board tenure and the outside director independence. Karamanou, Vafeas (2005) completed an empirical analysis on an association between the corporate boards, the audit committees, and the management earnings forecasts. Wagner, Stimpert, Fubara (1998) described the board composition and the organizational performance, presenting the two studies on the insider/outsider effects. Warther (1998) presented a model of the board's relationship to the management and the shareholders, investigating the board effectiveness and board dissent problems. Watts, Strogatz (1998) discovered the collective dynamics of small-world networks. Watts (1999a) devoted his research time to the investigation on the small worlds in the corporate governance. Watts (1999b) characterized the dynamics of networks between order and randomness. Watts (1999c) described the networks, dynamics, and the small world phenomenon. Yamori (December 1998) provided the characteristics to the bureaucrat-managers in the Japanese financial institutions. Zingales (1998) discussed the problems in the corporate governance. Zingales (2000) conducted the research in search of new foundations for the corporate governance. Barabasi, Albert (1999) highlighted an emergence of scaling in the random networks. Barabasi (2002) emphasized the fact that the directors in the firms are linked. Borgatti, Everett (1999) proposed the models of core/periphery structures. Borgatti (2002) outlined the basic social network concepts. Borgatti, Everett, Freeman (2002) developed the software for social network analysis. Borgatti, Foster

(2003) described the *network paradigm in the organizational research*. Borgatti (2005) discussed the *centrality and network flow problems*. Borgatti (2006) identified the *sets of key players in a social network*. Brunello, Graziano, Parigi (January 26 1999, 2000) explained the *problem: What determines board of directors' turnover in Italy?* Carroll, Malcolm (August 1999) characterized the *networks of the interlocking directorships in Canada and Australia*. Core, Holthauser, Larcker (1999) focused their attention on the *corporate governance, CEO compensation, and firm performance*. Davies (1999) suggested a *strategic approach to the corporate governance*. Denis, Sarin (1999) researched the *ownership and board structures in the publicly traded corporations*. Fohlin (1999) described the *rise of interlocking directorates in imperial Germany*. Forbes, Milliken (1999) proposed that the *boards of directors represent the strategic decision-making groups*. Hillman, Zardkoohi, Bierman (1999) assumed that the *corporate political strategies and the firm performance are interconnected, indicating the firm-specific benefits from the personal service in the US government*. Hillman, Cannella, Paetzold (2000) stressed on the *resource dependence role of corporate directors, researching the strategic adaptation of the board composition*. Hillman, Keim, Luce (2001) considered the *board composition and stakeholder performance, answering the question: Do stakeholder directors make a difference?* Hillman, Dalziel (2003) integrated the *agency theory and the resource dependence perspectives on the boards of directors and the firm performance issues*. Maassen (1999) made an *international comparison of corporate governance models*. MacAvoy, Millstein (1999) characterized the *active board of directors and its effects on the performance of the large publicly traded corporation*. Maman (1999) investigated the *interlocking ties within the business groups in Israel, 1974-1987*. Maman (2001) researched the *social capital, the career expansion of directors of business groups in Israel*. Morck, Nakamura (1999) researched the *banks and corporate control in Japan*. Morck, Nakamura, Shivdasani (October 2000) investigated the *banks, ownership structure, and firm valuation in Japan*. Morck, Wolfenzon, Yeung (2005) wrote a *research article on the corporate governance, economic entrenchment, and growth*. Postma, van Ees, Garretsen, Sterken (1999) described the *top management team, the board characteristics and the firm performance in the Netherlands*. Renneboog (1999) considered such research topics as the *ownership, managerial control and the governance of companies listed on the Brussels stock exchange*. Rindova (1999) answered the *question: What corporate boards have to do with strategy?* Van Manen, Hooghiemstra (1999) characterized the *supervisory directors in the Netherlands*. Westphal (1999) researched the *collaboration in the boardroom, focusing on the behavioral and performance consequences of CEO-board social ties*. Westphal, Frederickson (2001) investigated the *director experience, the election of new CEOs, and change*

in corporate strategy. Carpenter, Westphal (2001) studied the strategic context of external network ties, examining the impact of director appointments on the board involvement in the strategic decision - making. Almazan, Suarez (January 2000) investigated the optimal corporate governance structures. Barbi (2000) considered the interlocking directorship networks, focusing on the problem: What is relevant for the evolution and change of the networks? Beetsmaa, Peters, Rebers (2000) tried to understand a role of collusion between the management and the board of directors. Blackhurst (2000) studied the multiple directorships. Braiotta (2000) wrote the audit committee handbook. Bryan, Hwang, Klein, Lilien (2000) completed an empirical analysis of economic determinants of the compensation of outside directors. Chen, Jaggi (2000) discovered the association between independent non-executive directors, family control and financial disclosures in Hong Kong. Dyer, Noboeka (2000) discussed the creation and management of a high performance knowledge-sharing network in the case of Toyota. Fiegener, Brown, Dreux, Dennis (2000) documented the cases of the adoption of outside boards by the small private US firms. Fich (2000) answered the question: Do directors who are CEOs of other firms enhance firm performance? Gargiulo, Gulati (January 2000) researched the problem: Where do inter-organizational networks come from? Gulik, Gedajlovic, Maassen, Bosch, Volberda (July 8-11 2000) researched a service role of the boards of directors, based on the research work by Pfeffer (1972). Huat Ong, Hoon Lee (2000) tried to find the possible interconnections between the board functions and the firm performance. Kracaw, Zenner (2000) analyzed a role of bankers in the boardroom. Miwa, Ramseyer (2000) estimated the value of prominent directors, studying the lessons in corporate governance from transition Japan. O'Sullivan (2000a) was focused on the impact of board composition and ownership on the audit quality, bringing the evidences from large UK companies. O`Sullivan (2000b) studied the corporate governance and economic performance in the United States and Germany. O'Sullivan, Diacon (2002) considered the impacts of ownership, governance, and non-audit services on the audit fees, analyzing the evidences from the insurance industry. Rhoades, Rechner, Sundaramurthy (2000) studied the board composition and financial performance, including a meta analysis of the influence of outside directors. Robert, Evans, Honemann, Balch (October 1 2000) developed the Robert's rules of order. Samra-Fredericks (2000a) completed the 'boards-in-action' research with the purpose to capture and analyse the directors and senior managers interactive routines. Samra-Fredericks (2000b) conducted an analysis of the behavioural dynamics of corporate governance in the UK. Scott (2000) focused on the research toward the social network analysis. Ward (2000) created the boardroom insider guidebook, aiming to improve corporate boards. Whittington, Mayer (2000) considered the European corporations'

*strategies and structures. Agnblad, Berglof, Hogfeldt, Svancar (2001) studied the ownership and control in Sweden. Crespi, Garcia-Cestona (2001) investigated the ownership and control of the Spanish listed firms. Dehaene, De Vuyst, Ooghe (2001) evaluated the corporate performance and board structure in Belgian companies. Ferri, Masciandaro, Messori (2001) considered the corporate governance, board turnover and performance of banks in Italy. Ferris, Jagannathan (2001) studied the incidence and determinants of multiple corporate directorships. Ferris, Jagannathan, Pritchard (2003) researched the directors with the multiple board appointments. Golden, Zajac (2001) tried to answer the question: When will boards influence strategy? Heracleous (2001) considered the problem: What is the impact of corporate governance on organizational performance? Heracleous, Murray (2001) created a theoretical framework for the networks, interlocking directors and strategy research. Ingley, Van der Walt (2001) researched a changing role of directors in developing and maintaining corporate capability. Kroszner, Strahan (2001a, b) investigated the board connections, conflicts of interest, and lender liability in the banks. Lin (2001) created the network theory of social capital. Monks, Minow (2001) researched the corporate governance problems. Newman, Strogatz, Watts (2001), Newman (2003) researched the structure and function of complex networks. Newman (2007) developed the mathematics of networks. Okazaki, Yokoyama (October 2001) measured the extent and implications of director interlocking in the pre-war Japanese banking industry. Perry, Shivdasani (2001) answered the question: Do boards affect performance?, providing some evidences from the corporate restructuring. Postma, van Ees (2001) presented the research on the functions of supervisory boards in the Netherlands. Rhoades, Rechner, Sundaramurthy (2001) conducted a meta-analysis of the board leadership structure and financial performance, answering the question: Are two heads better than one? Schilling (July 2001) investigated the corporate governance in Germany, identifying the move to the shareholder value. Snijders (2001) completed the statistical evaluation of social network dynamics. Snijders (2003) created the models for the longitudinal network data. Stiles, Taylor (2001) considered the boards at work: How do directors view their roles and responsibilities? Tomka (2001) researched the interlocking directorates between banks and industrial companies in Hungary at the beginning of the twentieth century. Watts (2001) proposed a dynamic model of network formation. Welch (2001a, b), Welch J, Welch S (2006) described the possible practical approaches to the boardroom problems solutions findings in the firms. Baena Del Alcazar (2002) conducted the research on the nature of power, examining the governing elite and the institutional power in Spain, 1939-1992. Bainbridge (2002) discussed the group decision making in the corporate governance. Becht, Bolton, Roell (October 2002) studied the corporate governance and control.*

*Bianchi, Bianco, Enriques (2002) described the pyramidal groups and the separation between the ownership and the control in Italy. Bianchi, Bianco, Giacomelli, Paccos, Trento (2005) considered the ownership and control of firms in Italy. Bianchi, Bianco (2006) studied the Italian corporate governance in the last 15 years, emphasizing the transition from the pyramids to the coalitions. Carcello, Hermanson, Neal, Riley (2002) described the board's characteristics and evaluated the audit fees. Chau, Gray (2002) discussed the business ownership structure and corporate voluntary disclosure in Hong Kong and Singapore. Everard, Henry (2002) completed a social network analysis of the interlocked directorates in the electronic commerce firms. Faccio, Lang (2002) studied the ultimate ownership of Western European corporations. Hanna, Walsh (2002) researched the small firm networks as a successful approach to innovation. Lindgren (2002) investigated the succession strategies in a large family business group, considering the case of the Swedish Wallenberg family. Morris, Hyun Song Shin (2002) estimated the social value of public information. Perry, Peyer (September 2002, August 12 2005) studied the board seat accumulation by the executives, accenting their conclusions on the shareholder's perspective. Sonnenfeld (2002) researched the problem: What makes the great boards great? Volpin (2002) worked on the problem of the corporate governance with the poor investor protection, taking the evidences from the top executive turnover. Bainbridge (November 2003) described the pre-commitment strategies in corporate law. Borgatti, Foster (2003) discussed the network paradigm in the organizational research. Burgess, Fallon (2003) conducted a longitudinal study of women directors in Australia. Carter, Simkins, Simpson (2003) studied the corporate governance, board diversity, and firm value. Carter, D'Souza, Simkins, Simpson (2010) considered the gender and ethnic diversity of the US boards and board committees and the firm financial performance. Dann, Del Guercio, Partch (2003) documented the governance and boards of directors in the closed-end investment companies. De (2003) researched the incidence, performance effects of interlocking directorates in the emerging market business groups, considering the evidences from India. Fich, White (2003) studied the effects of mutually interlocked boards on the CEO compensation and turnover. Fich, White (2005) explained the problem: Why do CEOs reciprocally sit on each other's boards? Fich, Shivdasani (2006) researched the problem: Are busy boards effective monitors? Gabrielsson (2003) conducted an inquiry into the boards' contribution to the firm performance. Gillette, Noe, Rebello (2003) researched the corporate board composition, protocols, and voting behavior experimental evidence. Gillette, Noe, Rebello (2008) completed an empirical investigation on the board structures around the world. Graziano, Luporini (2003) discussed the board efficiency and the internal corporate control mechanisms. Graziano, Luporini (September 2005) studied*

the ownership concentration, monitoring and optimal board structure. Higgs (2003) reviewed the role and effectiveness of nonexecutive directors. Humphry Hung (July 2003) proposed a dual network model of interlocking directorates. Ibrahim, Howar, Angelis (2003) described the board members in the service industry, making an empirical examination of the relationship between the corporate social responsibility orientation and the directorial type. Kiel, Nicholson (2003) considered the issues of the board composition and the corporate performance, solving the problem: How does the Australian experience complement the contrasting theories of corporate governance. Kiel, Nicholson (2006) collected the information on the multiple directorships, corporate performance in Australian listed companies. Levy, Loebbecke, Powell (2003) characterized the role of information systems SMEs, cooptation and knowledge sharing. Lin, Pope, Young (2003) documented the stock market reactions to the appointment of outside directors. Malcolm (2003) described the boardroom networks among Australian company directors, 1976 and 1996, identifying the impact of investor capitalism. Mínguez, Martín (2003) researched the board of directors as a mechanism of control in the firm. Omar (2003) investigated the boards of directors and financial performance of the Malaysian block-holding companies. Ong, Wan, Ong (October 2003) conducted an exploratory study on the interlocking directorates in the listed firms in Singapore. Ornstein (2003) completed research on the Canadian corporate network in the comparative perspective. Phan, Lee, Lau (2003) characterized the performance impact of interlocking directorates in the case of Singapore. Postma, Van Ees, Sterken (2003) described the board composition and firm performance in the Netherlands. Rodriguez, Cardenas, Oltra (2003) presented a study on the networks of economic power in Europe. Ruhwedel, Epstein (2003) completed a research on an empirical analysis of structures and processes in the boards of directors in the German firms. Schmidt (2003) investigated the corporate governance in Germany from an economic perspective. Singh, Davidson (2003) studied the agency costs, ownership structure and corporate governance mechanisms. Tihanyi, Johnson, Hoskisson, Hitt (2003) researched the institutional ownership differences and the international diversification, focusing on the effects of the boards of directors and identifying the technological opportunity. Tosi, Shen, Gentry (2003) answered the question: Why the outsiders on the boards can't solve the corporate governance problem? Van der Walt, Ingley (2003) described the board dynamics and the influence of professional background, gender and ethnic diversity of directors. Williams (2003) discussed the presence of the women on the corporate boards of directors and their influence on the corporate philanthropy. Xie, Davidson, DaDalt (2003), discussing the earnings management and corporate governance, identified clearly the role of the board and the audit committee. Yeo, Pochet, Alcouffe (2003) described the CEO



*reciprocal interlocks in French corporations. Anderson, Reeb (2004) researched the board composition in S&P 500 firms. Anderson, Mansi, Reeb (2004) studied the board characteristics, accounting report integrity and the cost of debt. Anderson, Sawyer (2014) characterized the board of directors as an agent of change in the turnarounds. Battiston, Catanzaro (2004) considered the statistical properties of both the corporate board and the director networks. Bebchuk, Cohen, Ferrell (2004) clarified the problem: What matters in the corporate governance? Bebchuk, Cohen (2005) calculated the cost of entrenched boards. Bebchuk, Grinstein, Peyer (2006a, b) characterized the lucky CEOs, directors in the firms. Bebchuk, Cremers, Peyer (2007) studied the CEO centrality. Bebchuk, Weisbach (2010) defined the state of corporate governance research. Beekes, Pope, Young (2004) indentified the link between the earnings timeliness, earnings conservatism and board composition, taking the evidences from the UK. Beiner, Drobetz, Schmid, Zimmermann (2004) answered the question: Is the board size independent from the corporate governance mechanism? Böcking, Dutzi, Müßig (2004) discussed the economic function of the board of directors in the firm. Brunninge, Nordqvist (2004) researched the ownership structure, board composition and entrepreneurship on the base of the evidences from the family firms and venture-capital-backed firms. Caldarelli, Catanzaro (2004) studied the corporate boards networks. Corbetta, Salvato (2004) discussed the board of directors composition in the family firms? Drobetz, Schillhofer, Zimmermann (2004) described the corporate governance and the expected stock returns, using the evidences from Germany. Dulewicz, Herbert (2004) researched the problem: Does the composition and practice of the boards and directors bear any relationship to the performance of their companies? Gabrielsson, Huse (2004) spent some time thinking on the context, behavior, and evolution of the boards of directors and the corporate governance. Gul, Leung (2004) researched the board leadership, outside directors' expertise and voluntary corporate disclosures. Hakansson, Lind (2004) focused on the accounting and network coordination in the firms. Heinze (2004) characterized the dynamics in the German system of corporate governance, presenting the empirical findings on the interlocking directorates. Levine (April 2004) focused on the study of the concise discussion of concepts and issues during the corporate governance of banks. Maitlis (2004) discussed the problem: How CEOs influence (and fail to influence) their boards? Nicholson, Kiel (2004) created a framework for the diagnosing of the board effectiveness. OECD (2004) developed the principles of corporate governance. O'Hagan, Green (2004) used a network analysis approach to measure the corporate knowledge transfer via the interlocking directorates. Peasnell, Pope, Young (2004, 2005) studied the board monitoring and earnings management, finding an answer to the question: Do the outside directors influence abnormal*

accruals? Peng (2004) evaluated the *outside directors and firm performance during institutional transitions*. Randøy, Jenssen J I (2004) studied the *board independence and the product market competition in Swedish firms*. Rinaldi (June 25-26 2004) researched the *business elites in Italy: 1913-1972*. Rinaldi, Vasta (2005) researched the *structure of Italian capitalism, 1952-1972, using the interlocking directorates technique*. Rinaldi, Vasta (2008) studied the *Italian corporate network, 1952- 1983, applying the interlocking directorates technique*. Robins, Alexander (2004) considered the *small worlds among the interlocking directors with particular attention to the network structure and distance in bipartite graphs*. Rodriguez, Cardenas, Oltra (2004) researched the *networks of economic power in Europe*. Ryan, Wiggins (2004) studied the *director's compensation, board independence, and barriers to effective monitoring*. Shamsul (2004) researched the *board composition, CEO duality and performance among the Malaysian listed companies*. Stablein, Cleland, Mackie, Reid (2004) investigated the *New Zealand exchange limited boards and directors, concluding that it is a small world after all*. Van Den Berghe, Levrau (2004) evaluated the *boards of directors, answering the question: What constitutes a good corporate board?* Webb (2004) conducted an *examination of the socially responsible firms' board structure*. Uzun, Szewczyk, Varma (2004) researched the *board composition and corporate fraud problems*. Ajinkya, Bhojraj, Sengupta (2005) established an *association between the outside directors, institutional investors and the properties of management earnings forecasts*. Andrés, Azofra, López (2005) wrote on the *corporate boards in some OECD countries, researching such parameters as the size composition, functioning and effectiveness*. Andrés, Valledado (2008) studied the *corporate governance in banking, concentrating on the role of board of directors*. Attig, Morck (2005) documented the *boards, corporate governance in a typical country*. Bohren, Strom (2005) characterized the *value creating board in the firm*. Burris (2005) discussed the *interlocking directorates and political cohesion among the corporate elites*. Carrington, Scott, Wasserman (2005) studied the *models and methods in social network analysis*. Chabi, Maati (2005) researched the *small World of the CAC 40 index*. Charan (2005) researched the *boards that deliver, writing on the advancement of the corporate governance from the compliance to the competitive advantage*. Cheng, Firth (2005) researched the *ownership, corporate governance and top management pay in Hong Kong*. Cools (2005) explained the *real difference in the corporate law between the United States and the continental Europe, showing the real distribution of powers*. Coles, Daniel, Naveen (2005) researched the *boards, answering the question: Does one size fit all?* Corley (2005) examined the *non-executive director's role from a non-agency theory perspective, highlighting the implications arising from the Higgs report*. De Nooy, Mrvar, Batagelj (2005) completed an *exploratory social network*

analysis with the Pajek software program. Deutsch (2005) demonstrated an impact of the board composition on the firms' critical decisions in his meta - analytic review. Erickson, Park, Reising, Shin (2005) investigated the board composition and the firm value under the concentrated ownership, providing the Canadian evidences. Farrell, Hersch (2005) researched the corporate boards, highlighting the effect of gender. Feng, Ghosh, Sirmans (2005) answered the question: How important is the board of directors to REIT performance? Fich, White (2005) considered the problem: Why does CEOs reciprocally seat on each other's board. Francois-Philippe Boisserolles (2005) researched the human resources management problems. Galo (2005) considered the independent board directors, thinking about the problem: How to improve their contribution to the family business. Hanneman, Riddle (2005) made an introduction to the social network methods. Harris, Raviv (2005, 2008) created a theory of board control and size. Hayes, Mehran, Schaefer (2005) researched the board committee structures, ownership, and firm performance. Hendrikse (July 2005) characterized the boards in the agricultural cooperatives, focusing on the competence, authority, and incentives. Hendrikse (2006) discussed the two vignettes, regarding the boards in the cooperatives versus the corporations, studying the cooperative hierarchies. Hogfeldt (2005) described the history and politics of co-ownership in Sweden, researching the history of corporate governance around the world. Kyereboah-Coleman, Biekpe (2005) considered the relationship between the board size, board composition CEO duality and the firm performance, using the experiences from Ghana. Linn, Park (2005) described the outside director compensation policy and the investment opportunity set. Page, Wooders, Kamat (2005) researched the networks and farsighted stability. Peasnell, Pope, Young (2005) researched the board monitoring and earnings management, answering the question: Do outside directors influence abnormal accruals? Pueyo (2005) investigated the inter-firm relationships and the interlocking directorates in Spanish banking in the twentieth century. Pueyo (2006) studied the interlocking directorates in Spanish banking in the twentieth century. Raheja (2005) described the determinants of the board size and the composition in frames of his theory on the corporate boards. Roberts, McNulty, Stiles (2005) decided to make the research beyond the agency conceptions of the work of the nonexecutive director, thinking on the problem of the accountability creation in the boardroom. Saleh, Iskandar, Rahmat (2005) discussed the earnings management and the board characteristics, bringing the evidences from Malaysia. Schnake, Fredenberger, Williams (2005) uncovered the influence of the board characteristics on the frequency of 10-K investigations of firms in the financial services sector. Schnake, Williams (2008) researched the multiple directorships and corporate misconduct, discussing the moderating influences on the board size and outside

directors. Wan, Ong (2005) studied the *board structure, process and performance, providing the evidences from the public-listed companies in Singapore*. Ahmed, Hossain, Adams (2006) considered the *effects of board composition and board size on the informativeness of annual accounting earnings*. Barucci (2006) researched the *problems on the corporate governance in Italy*. Bassen, Kleinschmidt, Zollner (Spring 2006) researched the *corporate governance of German growth companies, conducting an empirical analysis of the corporate governance quality and the structure of supervisory boards of companies listed on TEC-DAX*. Batagelj, Mrvar (2006) created the *Pajek software program for the social networks analysis*. Bertoni, Randone (2006) described the *small-world of Italian finance, considering the ownership interconnections and the board interlocks amongst the Italian listed companies*. Bizjak, Lemmon, Whitby (2006, 2009) researched the *option backdating and board interlocks*. Boone, Field, Karpoff, Raheja (2006) conducted an *empirical analysis on the determinants of corporate board size and independence*. Brick, Palmon, Wald (2006) investigated the *CEO compensation, director compensation and firm performance, finding some evidences of cronyism*. Carbonai, Di Bartolomeo (November 2006, August 2007) studied the *interlocking directorates as a thrust substitute, considering the case of the Italian non-life insurance industry*. Carretta, Farina, Schwizer (2006) evaluated the *board of directors of financial intermediaries, focusing on the competencies, effectiveness and performance*. Farina (2008) considered the *banks' centrality in the corporate interlock networks, taking the evidences in Italy*. Cheng, Courtenay (2006) described the *board composition, regulatory regime and voluntary disclosure*. Chhaochharia, Grinstein (2006a, 2007) considered the *corporate governance and the firm value, stressing on the impact of the 2002 governance rules*. Chhaochharia, Grinstein (2006b) researched the *executive compensation and the board structure*. Chhaochharia, Grinstein (2009) studied the *CEO compensation and the board structure*. Corrado, Zollo (2006) described the *small worlds evolution: Governance reforms, privatizations, and ownership networks in Italy*. Elouaer (2006) documented his *thoughts on the boardroom networks among the French companies in 1996 - 2005*. Fauver, Fuerst (2006) answered the question: *Does good corporate governance include the employee representation?, considering the evidences from the German corporate boards*. Ferrarini (2006) discussed the *one share - one vote problem as a European rule?* Gillan, Hartzell, Starks (2006) described the *tradeoffs in the corporate governance, describing the evidences from the board structures and the charter provisions*. Goyer (2006a) focused his research on the *varieties of institutional investors and the national models of capitalism, describing the transformation of corporate governance in France and Germany*. Goyer (2006b) wrote on the *transformation of corporate governance in France, describing the changing*

France. Guieu, Meschi (2006) researched the boards of directors structures and operational dynamics in France in 2000-2003. Haniffa, Hudaib (2006) the corporate governance structure and performance of Malaysian listed companies. Hsu-Huei Huang, Paochung Hsu, Khan H A, Yun-Lin Yu May (2006) answered the question: Does the appointment of the outside director increase firm value?, taking the evidences from Taiwan. Jackson (2006) considered the economics of social networks in the frames of the econometrics theory. Kakabadse A P, Kakabadse N K, Barrat (2006) conducted the research on the CSR in the boardroom, describing the contribution of non executive director. Kamran, Mahmud, Mike (2006) described the effects of board composition and board size on the informativeness of annual accounting earnings. Kramarz, Thesmar (January 2006) described the social networks in the boardroom. Krivogorsky (2006) discussed the ownership, board structure, and performance in continental Europe. Kyereboah, Biekpe (2006) answered the question: Do boards and CEO's matter for bank performance?, making a comparative analysis of banks in Ghana. Limpaphayom, Connelly (2006) provided the board characteristics and firm performance, using the multiple evidences from the life insurance industry in Thailand. Linck, Netter, Yang (2006) conducted a large sample study on the board changes and determinants of the board structure. Linck, Netter, Yang (2007) discussed the determinants of board structure. MacLean, Harvery, Press (2006) characterized the business elites and corporate governance in France and the UK. Morresi (2006) the directors changes in the boards of directors in the firms, making the research on the business administration in Italy. Murgia (2006) researched the interlocking directors in the IT firms, based on the social network analysis approach. Osterloh, Frey (2006) came to the conclusion that the shareholders should welcome knowledge workers as the directors. Prinz (2006) researched the corporate governance and the uncertain role of interlocking directorates. Pueyo (2006) considered the interlocking directorates in Spanish banking in the twentieth century. Ravasi, Zattoni (2006) explored the political side of the board involvement in the strategy, conducting a study on the mixed-ownership institutions. Ruigrok, Peck, Keller (2006) described the board characteristics and involvement in the strategic decision making, using the evidences from Swiss companies. Saito, Dutra (2006) characterized the boards of directors of publicly-held companies in Brazil, focusing on the profile and implications for minority shareholders. Silva, Majluf, Paredes (2006) researched the family ties, interlocking directorates, performance of business groups in the emerging countries, studying the case of Chile. Soon Moon Kang (May 23 2006) considered the equi-centrality and network centralization, finding the micro-macro linkage. Yano (2006) wrote on the optimal board system: Supervisory board vs. management board. Ahmed, Duellman (2007) described the accounting conservatism and the

*board of directors' characteristics in an empirical research analysis. Ali (2007) investigated the disclosure quality and corporate governance, taking the evidences from the French stock market. Bjuggren, Eklund, Wiberg (2007) researched the ownership structure, control and firm performance, concentrating on the effects of vote differentiated shares. Eklund, Palmberg, Wiberg (2009) described the ownership structure, board composition and investment performance. Boone, Field, Karpoff, Raheja (2007) highlighted the determinants of corporate board size and composition in an empirical research analysis. Bozec, Dia (2007) researched the board structure and the firm technical efficiency, bringing the evidences from the Canadian state owned enterprises. Campbell, Minguez-Vera (2007) studied the gender diversity in the boardroom and the firm financial performance. Carver (November 2007) wrote on the promise of governance theory: Beyond codes and best practices. Choi, Park, Yoo (2007) estimated the value of outside directors, applying the evidences from the corporate governance reform from Korea. Ciocca (2007) made the research on the rich business elite in Italy (1796-2005). Clarke (2007) proposed the three concepts of the independent director. Combs, Ketchen, Perryman, Donahue (2007) described the moderating effect of the CEO power on the board composition, researching the firm performance relationship. Dahya, McConnell (2007) investigated the board composition, corporate performance, and the Cadbury Committee recommendation. Dahya, Dimitrov, McConnell (2008) researched the dominant shareholders, corporate boards, and corporate value in a cross-country analysis. Dahya, Dimitrov, McConnell (2009) considered the problem: Does the board independence matter in the companies with a controlling shareholder? Enriques, Volpin (Winter 2007) studied the corporate governance reforms in the continental Europe. Fernandes (2007, 2008) researched the role of "independent" board members, board compensation and firm performance. Finegold, Benson, Hecht (2007) studied the corporate boards and company performance, making a review of research findings in the light of recent reforms. Garcia Osma, Gill de Albornoz Noguer (2007) described the effect of the board composition and its monitoring committees on earnings management, taking the evidences from Spain. Gerber (2007) researched the interlock benefits and the anticompetitive harm toward an optimal definition of the competitors under the section 8 of the Clayton Act. Gordon (2007) described the rise of independent directors in the United States, 1950-2005. Heimbrandt (2007) investigated the business administration problems. Hsu (2007) considered the boards of directors and the audit committees in the initial public offerings. Huafang, Jianguo (2007) researched the ownership structure, board composition and corporate voluntary disclosure, using the evidences from the listed companies in China. Ibarra (2007) conducted the research on the networking opportunities: What you know or who you know? Kelly, Gennard (2007)*

considered the *business strategic decision making with a particular interest in the role and influence of directors*. Kim, Nofsinger (2007) researched the *corporate governance*. Lara, Osma, Penalva (2007) investigated the *board of directors' characteristics and conditional accounting conservatism, using the Spanish evidence*. Ledenyov V O (2007a) discussed the *problem: Can social networking boost businesses?* Ledenyov V O (2007b) participated in the *discussion on the thinking like a leader*. Lehn, Patro, Zhao (2007) researched the *governance indices and causation: Which causes which?* Lehn, Patro, Zhao (2009) described the *determinants of the size and structure of the US corporate boards, 1935-2000*. Lim, Matolcsy, Chow (2007) considered the *association between the board composition and the different types of voluntary disclosure*. Malloy (2007) researched the *social networks*. Mourkogiannis (2007) formulated the *true purpose of the board*. Murray (2007) described the *new rules of power in the boardroom in the corporate America*. Non, Franses (2007) researched the *possible interconnection between the interlocking boards and the firm performance, taking the evidences from a new panel database*. Patelli, Prencipe (2007) investigated the *relationship between the voluntary disclosure and the independent directors in the presence of a dominant shareholder*. Provan, Fish, Sydow (2007) characterized the *interorganizational networks at the network level in a review on the empirical literature on the whole networks*. Pugliese, Wenstop (2007) described the *board members' contribution to the strategic decision - making in the small firms*. Rommens, Cuyvers, Deloof (November 2007) characterized the *interlocking directorates and the business groups, using the Belgian evidence*. Deloof, Vermoesen (December 2011) estimated the *value of bank relationships, taking the evidences from Belgium at the start of the Great Depression*. Rose (2007) answered the *question: Does female board representation influence firm performance?*, using the *Danish evidence*. Rutherford, Buchholtz (2007) investigated the *relationship between the board characteristics and the board information*. Santella, Drago, Paone (2007) stated on the *issue: Who cares about director independence?* Santella, Drago, Polo (November 11 2007) conducted an *empirical analysis of the Italian listed company boards from 1998 to 2006*. Santella, Drago, Polo, Gagliardi (2009) made a *comparison among the director networks in the main listed companies in France, Germany, Italy, and the United Kingdom*. Schmid, Zimmerman (2007) answered the *question: Should chairman and CEO be separated?*, researching the *leadership structure and firm performance in Switzerland*. Singh V (2007) investigated the *ethnic diversity on the top corporate boards from a resource dependency perspective*. Uzzi, Amaral, Reed-Tsochas (2007) characterized the *small-world networks in the management science research in a comprehensive review*. Visser, Swank (2007) wrote on the *committees of experts in the firms*. Voordeckers, Van Gils, Van Den Heuvel (2007) characterized the *board composition*

in the small and medium-sized family firms. Andres (2008) analyzed the large shareholders and the firm performance in an empirical examination on the founding-family ownership. Bammens, Voordeckers, Van Gils (2008) described the boards of directors in the family firms from a generational perspective. Baranchuck, Dybvig (2008) researched the consensus reaching problem in the diverse corporate boards. Bowen (2008) created an insider's guide for the directors and trustees in the form of the board book. Canarella, Nouray (2008) characterized the executive compensation and the firm performance, covering the problems on the adjustment dynamics, non-linearity and asymmetry. Chan, Li (2008) wrote on the audit committee and firm value, providing the evidences on the outside top executives as the expert independent directors. Coles, Daniel, Naveen (2008a, b) studied the problem of boards, answering the question: Does one size fit all? Farrell, Friesen, Hersch (2008) explained the problem: How do firms adjust director compensation? Fluck, Khanna (2008) created the theory of corporate boards with the endogenous information collection, optimal compensation and strategic voting, answering the problem: When do independent boards dominate rubberstamping ones? Gelter (2008) showed the dark side of shareholder influence toward a holdup theory of stakeholders in the comparative corporate governance. Harford, Li, Zhao (2008) researched the corporate boards and the leverage and debt maturity choices. Ilona (2008) studied the board quality and firm performance. Kaymak, Bektas (2008) described the board characteristics in an emerging market, using the evidences from Turkish banks. Kumar, Sivaramakrishnan (2008) described the effect of board independence on the executive compensation and firm value. Lam, Lee (2008) conducted an analysis on the CEO duality and the firm performance, applying the evidences from Hong Kong. Lapido, Nestor, Risser (2008) characterized the board profile, structure and practice in large European banks. Lefort, Urzua (2008) discussed the board independence, firm performance and ownership concentration, using the evidences from Chile. Masulis, Mobbs (2008) answered the question: Are all the inside directors the same?, deciding on the CEO entrenchment or the board enhancement. Masulis, Mobbs (2010) explained the problem: Are all the inside directors the same? Do they entrench CEOs or facilitate more informed board decisions? Milakovíc, Alfarano, Lux (2008) researched the small core of the German corporate board network. Milakovíc, Raddant, Birg (2009) highlighted the persistence of a network core in the time evolution of interlocking directorates. Alfarano, Milakovíc (2009) described the network structure and N-dependence in the agent-based herding models. Donnelly, Mulcahy (2008) researched the board structure, ownership, and voluntary disclosure in Ireland. Ong, Wan (2008) outlined the three conceptual models of the board role performance. Sarkar, Sarkar, Sen (2008) investigated the board of directors and opportunistic earnings management, considering



the multiple evidences from India. Schmid, Zimmermann (2008) studied the leadership structure and firm performance in Switzerland. Rouby (June 2008) focused his research on the composition of the board of directors. Vermeulen (2008) researched the successful business strategies by the companies. Tutelman (2008) the various influences from the side of the business owners on the boards. Volpe, Woodlock (2008) conducted a survey of board financial literacy. Abidin, Kamal, Jusoff (2009) identified the typical board structure and corporate performance in Malaysia. Adam, Shavit (2009) highlighted the roles and responsibilities of boards of directors revisited in the reconciling conflicting stakeholders interests while maintaining corporate responsibility. Adams, Gupta, Leeth (2009) tried to clarify a question: Are female executives over-represented in precarious leadership positions? Akhtaruddin, Hossain, Hossain, Yao (2009), Akhtaruddin, Haron (2010) studies the corporate governance, board ownership, audit committees' effectiveness and voluntary disclosure in corporate annual reports of Malaysian listed firms. Alvarez, Marin, Fonfria (2009) considered a role of networking in the competitiveness of firms. Andreas, Rapp, Wolff (2009) defined the determinants of director compensation in the two-tier systems, taking the evidences from German. Belkhir (2009) measured the board of directors' size and performance in the banking industry. Cai, Garner, Walkling (2009) researched the directors elections. Cai, Garner, Walkling (2010) performed a survey, examining the shareholder access to the boardroom. Calabro, Di Carlo, Ranalli (2009) spent some time toward the understanding of the conflicts inside the board of directors. Chauhan, Dey (2009) studied the board composition and performance in Indian firms. David, Ginalska, Mach, Rebmann (2009) researched the Swiss business associations activities as an intermediary between the business, politics and administration during the 20<sup>th</sup> century. Delis, Gaganis, Pasiouras (November 2009) investigated the boards of directors in the selected banks. Desender (2009) identified a relationship between the ownership structure and the role of the board. Desender, García-Cestona, Crespi, Aguilera (November 23 2009) studied the board characteristics and the audit fees levels. Dey, Engel, Xiaohui Liu (2009) conducted a polemics about the possible advantages of splitting the CEO and board chair roles. Fahlenbrach (2009) considered the shareholder rights, boards, and CEO compensation. Fennema, Heemskerk (2009) has been interested in the research on the network dynamics of the Dutch business elite. Francis, Hasan, Koetter, Wu (2009) studied the problem: Do corporate board impact financial contracting? Ghita, Cuyvers, Deloof (2009) researched the business elites, political connections, and economic entrenchment, considering the numerous evidences from Belgium in time period: 1858–1909. Ghita, Cuyvers, Deloof (2010) documented the rise and decline of the Belgian business network in the twentieth century. Gomez (2009) studied some aspects of the business

administration. Gomez, Moore (2009) redefined the boundaries of the consulting and corporate governance, considering the board members and management consultants' interaction. Gstraunthaler, Lukacs, Steller (2009) studied the board of directors and its role in the corporate governance system. Gulamhussen, Guerreiro (2009) determined the influence of the foreign equity and board membership on the corporate strategy and internal cost management in Portuguese banks. Gulamhussen, Fonte Santa (2009) analyzed the work by the women in the bank boardrooms and their influence on the performance and risk-taking. Hasnah (2009) determined the multiple impacts of the corporate governance and board performance on the performance of public listed companies in Malaysia. Heidrick & Struggles (2009, 2011) studied the challenging board performance in the turbulent time. Karoui (2009) conducted the board of directors functional performance analysis. Karpov (2009, 2012) proposed the theorem about the impossibility of proportional representation and developed a model of corporate board of directors elections. Minichilli, Zattoni, Zona (2009) conducted an empirical examination of board task performance aiming to making the boards effective. Mnif (2009) researched the board of directors and the pricing of initial public offerings in France, trying to get an answer on the following question: Does the existence of a properly structured board matter? Pathan (2009) considered the research problems such as the strong boards, CEO power and bank risk-taking. Pathan, Skully (2010) studied the endogenously structured boards of directors in the banks. Rosch (2009) investigated the vertical and conglomerate merger and interlocking directorate law enforcement in the United States. Sarkar J, Sarkar S (2009) researched the multiple board appointments and firm performance in emerging economies, using the evidences from India. Schiehl, Bellavance (2009) considered the boards of directors, CEO ownership, and the use of non-financial performance measures in the CEO bonus plan. Schonlau, Singh P V (2009) worked on the board networks and merger performance investigation. Schwizer, Farina, Stefanelli (November 2009) determined the dimension, structure and skill mix in European boards. Stefanelli, Matteo (March 2011) completed an empirical analysis on the board monitoring role and the loan portfolio quality measurement in the banks. Setia-Atmaja, Tanewski, Skully (2009) tried to understand a role of dividends, debt and board structure in the governance of family controlled firms. Stevenson, Radin (2009) studied the social capital and the social influence on the board of directors. Strom (2009) attempted to learn more on the modern firm performance, corporate governance and investment. Alam, Chen, Ciccotello, Ryan (2010) uncovered the information acquisition and monitoring problems by the directors in the board of directors, depending on the directors' locations. Al-Shammari, Al-Sultan (2010) investigated the corporate governance and voluntary disclosure in Kuwait. Baccini, Barabesi (2010) researched

the *interlocking between economic journals*. Baccini, Marroni (September 2013) studied the *interlocking directorates regulation*. Badia-Miro, Blasco, Lozano, Soler (2010) tried to understand the *centrality and investment strategies at the beginning of industrialization in mid-nineteen-century*. Balta, Woods, Dickson (2010) considered an *influence of the boards of directors' characteristics on the strategic decision-making, taking the evidences from the Greek companies*. Campbell, Minguez-Vera (2010) analyzed the *female board appointments and the firm valuation from the short and long-term perspectives*. Chau, Gray (2010) researched the *family ownership, board independence and voluntary disclosure, finding the evidences from Hong Kong*. Chemmanur, Fedaseyeu (2010) proposed the *theory of corporate boards*. Cheung, Jiang, Tan (2010) studied the *Chinese listed companies*. Chiang, He (2010) researched the *board supervision capability and the information transparency problems*. Colpan, Hikino, Lincoln (2010) compiled the *information on the business groups*. Dimitropoulos, Asteriou (2010) discussed the *effect of board composition on the informativeness and quality of annual earnings, using the data from Greece*. Duchin, Matsusaka, Ozbas (2010) examined the *criteria of directors' effectiveness*. The former CEO directors have been characterized in Fahlenbrach, Minton, Pan (August 2010). Faleye, Hoitash R, Hoitash U (2010) computed the *costs of intense board monitoring*. Gompers, Ishii, Metrick (2010) analyzed the *dual-class firms in the United States*. Levy, Pliskin, Ravid (2010) studied the *decision making processes via a knowledge management lens*. Malenko (February 2011) researched the *communication and the decision-making problems in the corporate boards*. Mayers, Smith (2010) considered the *directors' compensation and the board structure*. Palmberg (April 2010) studied the *corporate governance in the Swedish banking sector*. The *board interlocks problem* has been researched in Stuart, Yim (2010). Sulong, Mat Nor (2010) considered the *corporate governance mechanisms and firm valuation in Malaysian listed firms*. Trabelsi (November 2010) researched the *governance and performance of Tunisian banks*. Tran Ngoc Huy Dinh (December 24 2010) compiled a set of the *limited Asian Pacific corporate governance standards after financial crisis, corporate scandals and manipulation*. Zhang (2010) performed a study on the *board capital and absorptive capacity*. Allegrini (2011) performed a study on the *corporate boards, audit committees and voluntary disclosure in Italy*. Balduzzi, Graziano, Luporini (January 2011) considered the voting issues in the corporate boards with the heterogeneous preferences. Bammens, Voodeckers, Van Gils (2011) conducted a research on the *boards of directors in the family businesses*. Belot, Ginglinger, Slovin, Sushka (2011) the *unitary and dual boards in France*. Bourjade, Germain (2011) investigated the *possible collusions in the board of directors*. Cabrera Suarez, Deniz Deniz, Martin Santana (September-December 2011) considered the *board of directors and social*

responsibility potential of non-listed Spanish family firms. Cowen (2011) researched the board's decisions to dismiss the reputationally compromised directors. Dey, Engel, Xiaohui Liu (2011) distinguished the CEO and board chair roles. Dobbin, Jung (2011) considered the corporate board gender diversity and stock performance. Donzé (2011) studied the interlocking directors in the Swiss watch industry, using a business history of the Swatch Group (1983-2010). Faleye, Hoitash, Hoitash (2011) calculated the costs of the intense board monitoring Journal. Gabrielsen, Hjelmeng, Sorgard (2011) researched the interlocking directorships. Ghaya (October 2011) investigated the board of directors' involvement in strategic decision making process. Lara, Osma, Penalva (2011) studied the board of directors' characteristics and conditional accounting conservatism in Spain. Lorca, Sanchez-Ballesta, Garcia-Meca (2011) expressed their thoughts on the board effectiveness and cost of debt. Rousseau, Stroup (2011) researched the directors' histories and the patterns of acquisitions. Stefanescu (2011) studied the corporate governance "actors" influence on the banks' value. Yunos, Smith, Ismail, Ahmad (2011) researched the boards of directors and accounting conservatism. Belot, Ginglinger, Slovin, Sushka (2012) considered the corporate governance problems with a particular interest in the choice between the unitary boards and the dual boards of directors. Bianco, Ciavarella, Signoretti (April – June 2012) described the involvement by the women on the boards in Italy. Bouaziz, Triki (2012) characterized an impact by the board of directors on the financial performance of Tunisian companies. Chu J S G (2012) investigated the corporate interlock networks. Fields, Fraser, Subrahmanyam (2012) elaborated on the board quality problems. Ghezzi (2012) researched the directors in Italia. Gonzalez Diaz (2012) studied the interlocking directorships in the European Union. The board of directors characteristics influences on the firm's performance have been researched in Horváth, Spirollari (2012). Palmberg (2012) unveiled the performance effect of corporate board of directors. Pawlak (2012) presented the interlocking-directorates monitoring system description. The decline of the American corporate network 1960-2010 has been described in Schifeling, Mizruchi (August 27 - 28 2012). Rubio-Mondejar, Garrues-Irurzun (2012) worked on the corporate structure and interlocking directorates in Spanish firms, 1917-1970. Uddin (2012) studied the inter-firm cooperation and information sharing through the interlocking directorates. The compensation structure of directors in the boards of directors has been described in Merino, Manzaneque, Priego (2013). Prete, Stefani (June 2013) researched a role by the women on the Italian bank boards. The possible influences by the board of directors on the corporate governance disclosure have been discussed in Stefanescu (March 2013). The boards of directors composition and financing choices have been uncovered in Alves, Couto, Francisco (2014). Whitehead (December 22, 23

2014) discussed the *boards of directors overlap in publicly traded and non-traded firms in the USA*. Ferreira (January 15 2015) presented some facts on the *corporate boards*. Blood, Wisniewska (January 22 2015) characterized the *tribes of Davos*, using the *social networks approach*. Ledenyov D O, Ledenyov V O (January 22 2015) researched the *winning virtuous strategy creation by the interlocking interconnecting directors in the boards of directors in the firms in the information century*.

Let us move forward with the *author's original proposals consideration* on the *information theory of the firm*, making the *innovative modeling of the firm, director, board of directors*, and researching the *business strategy creation problem* in details.

### **Modeling of firm as operating system to control, manage and process information resources in information theory of firm**

Let us begin the research by formulating the *purpose of the firm* as in Ledenyov D O, Ledenyov VO (2013b): “Mano (1970) defines the *purpose of the firm* as: “Therefore, the activity of the firm should be thought of as the process of producing the organizational utilities by combining the various cooperative activities and converting them into inducements and deriving the next contributions from the member mentioned above. In this case all the members want to sustain such cooperative activities to get more satisfaction (or inducements) and less sacrifice (or their cooperative activities). *The actual purpose of leading principle of the firm can be abstractly said to be the maintenance and development of the firm itself. In other words, it can be said to be the maintenance of the balance of the organizational utilities and their increase.* Unless the differential between the produced organizational utilities and the inducement derived from its utilities is equilibrium or positive, the firm will become bankrupt at some future time.”

Kantarelis (2007) presents an interesting summary of his research findings on the *purpose of the firm*:

1. “The firm identifies a consumer need and develops/invents a recipe on how to satisfy that need;
2. The firm makes the right decisions with respect to making or buying inputs so that it delivers its recipe at the lowest possible cost;
3. The firm provides the best incentives to its stakeholders;
4. The firm constantly and deliberately evolves through the relentless pursuit of competitive, organization and strategic advantage.””

Let us describe the **organizational structure of the firm** as in Ledenyov D O, Ledenyov VO (2013b): “Barnard (1938, 1948, 1949, 1958) introduced the two types of organizations such as the *lateral organization* and *scalar (or hierarchical) organization*. According to Mano (1970): “**The firm** consists of not only stockholders, employees, and managers, but also creditors, government authorities, consumers and material suppliers:

1. *Stockholders* contribute a cooperative action to supply long-term capital in order to pursue the dividends, stock dividends, and the rise of stock value.
2. *Creditors* contribute a cooperative action to supply short-term capital mainly to earn interest.
3. *Consumers* contribute a cooperative action to supply cash in order to purchase goods or services.
4. *Government* authorities contribute a cooperative action to supply many conveniences in order to receive various taxes or donations, and material suppliers contribute a cooperative action to supply materials and facilities to get returns.
5. *Employees* and managers contribute the cooperative actions which combine the actions contributed by other members to produce organizational utilities in Barnard (1938) as large as possible and divide the utilities into various inducements or incentives as mentioned above in order to get contributions from members. They contribute such actions in order to get wages, utilizing right of employee benefit plans, social positions, honors and authority.”

Let us comment that the **evolution of the firm** includes the *three clearly identified stages* in Chandler (1962, 1977, 1993, 1994, 1998, 2001, 2005), Chandler, Daems (1980), Ledenyov D O, Ledenyov VO (2013b):

- 1) *Barriers to entry creation,*
- 2) *Strategic boundaries definition,*
- 3) *Limits to growth evaluation.*

The **existing modern theories of the firm** have been created by many prominent thinkers and described in Ledenyov D O, Ledenyov VO (2013b):

1. “The **neo-classical theory of the firm** describes the various market structures, regulation issues, strategic pricing, barriers to entry, economies of scale and scope and even optimum portfolio selection of risky assets, and establishes the principle of profit maximisation, according to which profit is maximised, when marginal revenue is equal to marginal cost in the conditions of complete information. The theory does not allow for firm evolution in Kantarelis (2007).

2. The ***transaction cost theory of the firm*** states that the people begin to organise their production in the firms, when the transaction cost of coordinating production through the market exchange in the conditions of the imperfect information, is greater than within the firm in *Coase (1937)*. It does not take into consideration agency costs or firm evolution, neither does it explain how vertical integration should take place in the face of investments in human assets, with unobservable value, that cannot be transferred in *Kantarelis (2007)*.
3. The ***managerial theory of the firm*** suggests that the managers would seek to maximise their own utility and consider the implications of this for firm behaviour in contrast to the profit-maximising case in *Baumol (1959, 1962)*, *Marris (1964)* and *Williamson (1966)*.
4. The ***principal-agent theory of the firm*** extends the ***neo-classical theory of the firm*** and ***managerial theory of the firm*** by adding agents to the firm, and it considers the friction due to asymmetric information between owners of firms and their stakeholders or managers and employees; the friction between agent and principal requires precise measurement of agent performance and the engineering of incentive mechanisms. The weaknesses of the theory are many: it is difficult to engineer incentive mechanisms, it relies on complicated incomplete contracts (borderline unenforceable), it ignores transaction costs (both external and internal), and it does not allow for firm evolution in *Spence and Zeckhauser (1971)*, *Ross (1973)*, *Kantarelis (2007)*.
5. The ***behavioural theory of the firm*** assumes that the groups of people participate in setting goals and making decisions on the production; inventory; market share; sales and profits in the firm, potentially creating conflicts. The theory proposes that the real firms aim to satisfy rather than maximize their results in agreement with the bounded rationality concept in *Cyert, March (1963)*.
6. The ***evolutionary theory of the firm*** states that the firm possesses unique resources: financial, physical, human and organizational. It sees the firm as a reactor to change and a creator of change for competitive advantage. The firm, as a creator of change, may cause creative destruction, which in turn may give birth to new industries and enable sectors of, or entire, economies to grow. The theory does not take to the account that the creative innovation process cannot be easily programmed within a firm or a nation in *Kantarelis (2007)*.”

Let us highlight the most significant research works on the *theory of the firm*: Berle, Means (1932) discussed the *modern corporation and private property problems*. Coase (1937) described the *nature of the firm*. Barnard (1948) made the *theoretical description of the organization*. Penrose (1959) created the *theory of the growth of the firm*. Lee, Jung Hwan (1975) wrote an essay on the *theory of the firm*. Jensen, Meckling (1976) formulated the *theory of the firm*. Fama (April 1980) explained the *agency problems* and developed the *theory of the firm*. Kantarelis (2007) analyzed the *theories of the firm*.

In addition, the *theory of the firm* and the *related scientific topics* have been comprehensively researched (in a *chronological order*) in Babbage (1832), Ueda (1904, 1937), Marshall (1923), Berle, Means (1932a, b), Ohlin (1933), Coase (1937), Barnard (1938, 1948, 1949, 1958), Solow (August 1957), Modigliani, Miller (June 1958), Baumol (1959, 1962), Penrose (1959), Chandler (1962, 1977, 1993, 1994, 1998, 2001, 2005), Chandler, Daems (1980), Marris (May 1963), Telser (1963), Williamson (1964, 1975, 1988), Cyert, March (1963, 1992), Fogel (1964), Manne (1965), Stigler (1968), Mano (1968-1969, 1970-1971, 1972-1973, 1975-1976, 1978, 1980-1981, 1987, 1994, 1995), Black, Scholes (1973), Black, Cox (1976), Merton (1973, 1974), Lee (1975), Jensen, Meckling (1976), Jensen, Ruback (1983), Jensen (1986, September-October 1989, 1993, 2007), Jensen, Murphy (1990), Fama (1980), Fama, Jensen (1983, 1985), Demsetz (1983, 1997), Wernerfelt (1984, 1995), Lode Li (1986), Perrow (1986), Hart, Moore (1990), Hart (2011), Sterman (2000), Williamson (2002), Kantarelis (2007), Spulber (2009), Ledenyov D O, Ledenyov V O(2013b).

Going to the description of *our new research proposals*, the *authors* think that the *firm* receives/transmits the *constant information data streams*, processes the *big information files* and mainly deals with the *various kinds of information* in the *information century*, hence it makes sense to describe the *firm* in the frames of the *information theory*, which is formulated by the *authors* for the first time.

***The Ledenyov information theory of the firm proposes that the firm controls and manages the information resources, hence it is possible to theoretically model the firm as the operating system (OS), which controls, manages and processes the firm's information resources.***

The *authors* think that a certain analogy can be drawn between the *firm's operating system* in the *information theory of the firm* and the *operating system in a microprocessor (quantum processor) in a computing device in the computer science*.



In accordance with the *Ledenyov information theory of the firm*, the firm's *deterministic operating system controls and manages the firm's information resources with the application of a computing kernel*, which has a number of functions

- 1) *Making the computational operations with the information data streams,*
- 2) *Activation and deactivation of the business tasks in the time domain,*
- 3) *Setting the business task priorities in the time domain,*
- 4) *Making the sequential preemptive or time-sliced scheduling of business task execution in the time domain,*
- 5) *Supporting the communications between the business tasks over the time period,*
- 6) *Managing the allocation of and access to the memory by the business tasks at certain time moments.*
- 7) *Tracking the business tasks in the time domain,*
- 8) *Supporting the multitasking execution in the time domain.*

We developed the *MicroITF* operating system with the following purpose to *control, manage and process the firm's operations by the means of the information resources processing*. Going from a conducted comparative analysis of the *source codes* of the different operating systems, the *authors* came to a conclusion that the *MicroITF* operating system is based on the *new innovative computing technologies*, which are much more advanced than the known technologies, used in the *near real time VxWorks* operating system by WindRiver; *Windows* operating system by Microsoft; *MacOS* and *iOS* operating system by Apple, *Android* operating system by Google and *Linux / Unix* open source operating systems.

The *authors* would like to explain that the *MicroITF* operating system can be emulated at the *computing devices* with the *Linux, Unix, Windows, MacOS, iOS, Android, Amoeba* operating systems with the purposes:

- 1) to *control the firm operation by the means of the information resources processing;*
- 2) to *accurately characterize the director's performance by means of a) the filtering of the generated/transmitted/received information by the director into the separate virtual channels, depending on the information content, and b) the measurement of the levels of signals in every virtual channel with the generated/transmitted/received information by the director, in the overlapping interconnecting interlocking directors networks in the boards of directors in the firms during the Quality of Service (QoS) measurements process, and*
- 3) to *create the winning virtuous business strategies by the interlocking interconnecting directors in the boards of directors in the firms, using the patented recursive artificial intelligence algorithm.*

## **Representation of director as processing element in analogy with digital signal processor in information theory of firm, and modeling of board of directors as electronically-scanned electronically-steered phased array radar in information theory of firm**

It is a well known fact that the *information* can be transmitted in the *analogue and digital formats* over the *wireless, wireline and optical communication channels* in agreement with the research findings in the *information theory* and the *information communication theory* in Shannon (1948), Yaglom A M, Yaglom I M (1983), Ledenyov D O, Ledenyov V O (2015d).

The authors would like to formulate the *Ledenyov theory of the board of directors* as well as the *interlocking interconnecting directors' networks in the boards of directors in the firms*, going from the *information theory* and *information communication theory perspectives* in Shannon (1948), Yaglom A M, Yaglom I M (1983), Ledenyov D O, Ledenyov V O (2015d).

The authors make a logical assumption that the *director works with the information in the board of directors in the firm*, performing various kinds of manipulations with the *information* to form his *opinions* and make his decisions on the *business related issues* in the *firm*. Therefore, let us focus our attention on a possible representation of the *director* in terms of the *information communication theory*. The authors come up with a *research idea* that the *director* works to make the *decisions* on the a *number of different business related tasks in the firm* by doing the following things:

1. The *information sensing/detection*, we can conditionally imagine that the *director* is a *sensing and detecting device* with the *embedded optical, sound, chemical sensors and detectors*, which can gather the *information data streams* in the *information fields*.

2. The *information filtering*, it would be interesting to say that every *director* has the *accumulated knowledge base, subject oriented skills developed during his education at university, professional experiences obtained in the process of work*, can allow the *director* to *tune into the selected information data streams at certain frequencies* and to *filter out the undesired information streams*, working at the *board of directors* in the *firm*. The *filtered information* by every *director* is different, but some correlations may occur. Moreover, the *filtered information* can be distorted during the *information filtering process*, because of various factors such as the *existing imperfections in the director's professional education, professional experiences, and problems with the data communication channels*.

3. The *information processing*, we would like to make a *theoretical proposition* that the *director can be represented as an information processing element* with the *Harvard*

*director's mindset architecture* or the *von Neumann director's mindset architecture* or some other possible director's mindset architectures in agreement with the digital signal processing and business administration sciences. Let us suppose that the classical von Neumann director's mindset architecture has a single memory to store the data and program instructions; and the Harvard director's mindset architecture has the two separate memories to keep the data and program instructions, achieving a high degree of concurrency in Hwang, Briggs (1984), Anceau (1986), Fountain (1987), Chen (editor) (1988), Van de Goor (1989), Prisch (1998), Wanhammar (1999). Thus, we firmly believe that the director's mindset architecture may have the multiple distinctive impacts on the information processing volume, quality and time, resulting in an appearance of the different professional director's characteristics. In other words, the nature of the director's mindset architecture can partly explain an observation of variations in the functional performance of the board of directors, resulting in the different paths of enterprises evolution.

4. The **information resonant absorption**, the authors want to note that the director's resonant absorptive capacity in respect to the information, that is an ability to obtain and memorize the knowledge and information from the external environment, is defined by the director's professional education, professional experiences, etc. The absorption phenomena with an emphasis on the knowledge creation and accumulation in the organization in the economics has been researched in Cohen, Levinthal (1989, 1990), Nonaka (1994), Kumar, Nti (1998), Lane, Lubatkin (1998), Farina (2008). The director's resonant absorptive capacity in respect to the information is to some degree analogous to the resonant absorption phenomena in the condensed matter and soft condensed matter in the physics and chemistry, which has been researched by the authors early:

a) The **absorption of the different radioactive chemical elements and their isotopes in the soft condensed matter (the coal granules of different geometric shapes, the coal dust particles of micro- and nano- sizes) at the sound frequencies** have been researched in the nuclear physics in Neklyudov, Dovbnya, Dikiy, Ledenyov O P, Lyashko (2014), Ledenyov O P, Neklyudov (2013), Neklyudov, Dovbnya, Dikiy, Ledenyov O P, Lyashko (2013), Neklyudov, Ledenyov O P, Fedorova, Poltinin (2013a, b), Neklyudov, Fedorova, Poltinin, Ledenyov O P (2013), Ledenyov O P, Neklyudov, Poltinin, Fedorova (2012a, b), Neklyudov, Ledenyov O P, Fedorova, Poltinin (2012), etc.

b) The **absorption of the electromagnetic signals in the condensed matter (the high pure metals and superconductors) at the ultrasonic frequencies** has been investigated in the solid state physics at the in Ledenyov O P (2012a, b, c), Ledenyov V O, Ledenyov D O, Ledenyov O P,

Tikhonovsky (2012), Ledenyov O P, Fursa V P (2012), Shepelev, Ledenyov O P, Filimonov (2012a, b, c, d, e), etc.

c) The ***absorption of the electromagnetic signals in the sub-surface layers in the condensed matter (the high temperature superconducting ceramics and dielectrics) at the ultra high frequencies*** has been studied in the *solid state physics* in Ledenyov D O, Mazierska, Allen, Jacob (2012), Leong, Mazierska, Jacob, Ledenyov D O, Batt (2012), Mazierska, Ledenyov D O, Jacob, Krupka (2012), Jacob, Mazierska, Ledenyov D O, Krupka (2012), Mazierska, Krupka, Jacob, Ledenyov D O (2012), Jacob, Mazierska, Leong, Ledenyov D O, Krupka (2012), Jacob, Mazierska, Krupka, Ledenyov D O, Takeuchi (2012), Mazierska, Jacob, Ledenyov D O, Krupka (2012), Ledenyov D O (2013), Ledenyov D O, Ledenyov V O (2014), Mazierska, Leong, Ledenyov, Rains, Zuchowski, Krupka (2014), etc.

5. the ***information analysis***, the authors would like to explain that an **application of various types of logics, including the inductive, deductive and abductive logics in the creative imperative integrative intelligent conceptual co-lateral adaptive logarithmic thinking process in Martin (1998-1999, 2005-2006) in the frames of the econophysical econometrical analysis in Schumpeter (1906, 1933), Bowley (1924), Box, Jenkins (1970), Grangel, Newbold (1977), Van Horne (1984), Taylor S (1986), Tong (1986, 1990), Judge, Hill, Griffiths, Lee, Lutkepol (1988), Hardle (1990), Grangel, Teräsvirta (1993), Pesaran, Potter (1993), Banerjee, Dolado, Galbraith, Hendry (1993), Hamilton (1994), Karatzas, Shreve (1995), Campbell, Lo, MacKinlay (1997), Rogers, Talay (1997), Hayashi (2000), Durbin, Koopman (2000, 2002, 2012), Ilinski (2001), Greene (2003), Koop (2003), Davidson, MacKinnon (2004), Campbell, Lo, MacKinlay (1996), Vialar, Goergen (2009) is quite essential.**

6. the ***decision making***, let us highlight the fact that the **decision making must be conducted with the consideration of the obtained analytic results in the certain time period, using the reasoning techniques with an application of the theoretical and practical knowledge base, which is accumulated by the director.**

Therefore, it is logical to assume that in view of the fact that the ***director makes the information sensing, filtering, processing, resonant absorption, analysis, decision making, strategy creation, hence the director can be empirically represented as a processing element with the Harvard or von Neumann director's mindset architectures in line with the digital signal processing science*** as in Ledenyov D O, Ledenyov V O (January 22 2015).

The authors proposed a concise definition of the ***board of directors*** in Ledenyov D O, Ledenyov V O (January 22 2015): ***“a group of elected appointed directors (institutional***

*agents), who control all the business activities by the management team (corporate agents) toward the firm's business development, constitute a board of directors."*

We have already emphasized that the *standard board of directors* in the firm can be represented as a matrix in Ledenyov D O, Ledenyov V O (January 22 2015).

$$\text{Board of Directors} = \begin{bmatrix} d_{1,1} & d_{1,2} & d_{1,j} \\ d_{2,1} & d_{2,2} & d_{2,j} \\ d_{i,1} & d_{i,2} & d_{i,j} \end{bmatrix},$$

where  $d_{i,j}$  is the position of a director's seat in the matrix, which describes the *standard board of directors* in the firm.

We also highlighted a fact that the *board of directors composition dynamics* over the time can be described by the generalized formula as in Santella, Drago, Polo (November 11 2007), Ledenyov D O, Ledenyov V O (January 22 2015)

$$\text{board}_{c,t} = \text{board}_{c,t-1} + \int_t^{t+1} (en - ex) dt,$$

where

$$en(t) = \frac{d}{dt} en \cdot t = en,$$

$$ex(t) = \frac{d}{dt} ex \cdot t = ex,$$

$en(t)$  is the number of directors entrants at time  $t_i$ ,

$ex(t)$  is the number of directors exits at time  $t_i$ ,

$\text{board}_{c,t}$  is the board of directors size at time  $t_i$ ,

$c$  is the company,

$i$  is the director.

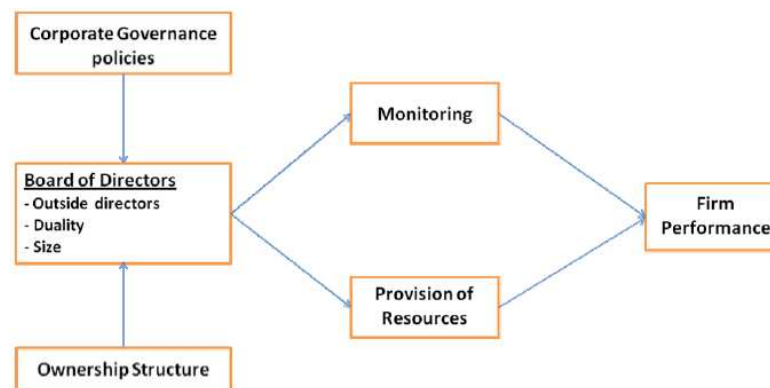
Heimbrandt (2007) writes: "As the modern firm has continued to grow and its owner base has widened, the owners' opportunities to exert influence has diminished. While the board of directors is a strategic resource available to management it is also the owners' primary tool for exercising control. To a large extent research on the role of the board of directors has focused on the relationship between various characteristics of the board and the firm's financial result. Research literature within the field of corporate governance has established three primary roles for the board of directors: setting strategy, controlling management and being a resource available to management. The vast majority of research within the field is primarily based on investor owned firms."

Going to the topics of the *information analysis and subsequent decision making* by the director in the board of directors in the firm, let us focus on a possible representation of the *board of directors* in terms of the *information communication theory*. In the predefined set of coordinates, the *board of directors* with a certain number of elected appointed directors can be theoretically represented as

1. An *electronically scanned electronically steered phased array radar* with a certain number of active elements (*directors*), which can sense the information and tune into the selected *information carrier frequencies bands* in the *information fields*;
2. A *filters bank* with a certain number of *information filters*, which tunes into the certain *data streams frequencies* and reject the *unnecessary information streams* in the *adjacent channels* over all the *frequencies range*;
3. An *array of digital signal processors* with the *Harvard / von Neumann architectures*, which process the *digitized data streams*, using the *predefined information processing algorithms*, which can be implemented in the *hardware* or the *software*;
4. A *memory chipset* with the *ultra fast short and long term memories*, which store the *absorbed information* and provides a fast access to the *absorbed information*.

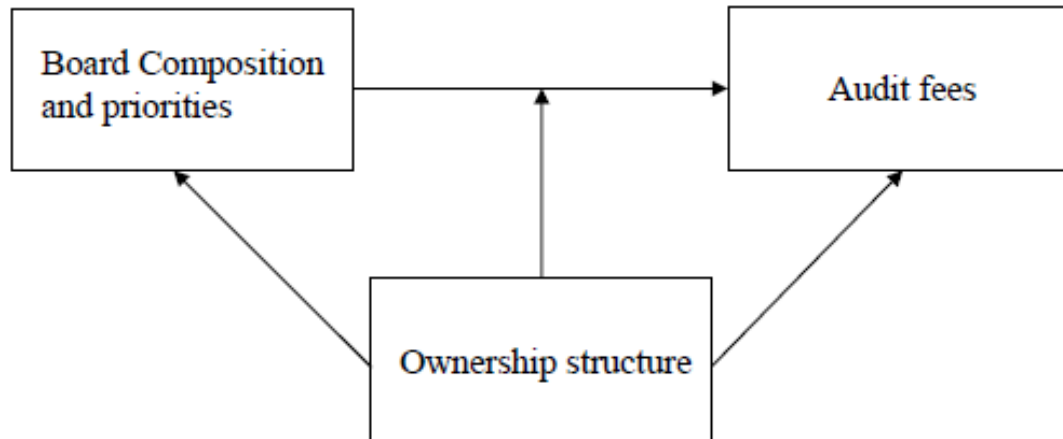
In other words, we think that the *board of directors in the corporate governance system* can be theoretically represented as the *electronically-scanned electronically-steered phased array radar* with a certain number of the *electronic elements/devices (directors, who can be modeled as electronic devices with the active antenna elements, filters banks, digital signal processors, memory chipsets in agreement with the microwave and digital signal processing sciences)*.

Let us take a general look on the *board of directors position and characteristics within the firm*. Fig. 1 shows the *relationship between ownership structure, composition of the board and firm performance* in Desender (2009).



**Fig. 1.** Relationship between ownership structure, composition of the board and firm performance (after Desender (2009)).

Fig. 2 demonstrates a relationship between the ownership structure, board composition and external audit services in Desender, García-Cestona, Crespi, Aguilera (November 23, 2009).



**Fig. 2.** The relationship between ownership structure, board composition and external audit services (after Desender, García-Cestona, Crespi, Aguilera (November 23, 2009)).

Tab. 1 presents the independent variables description in Ștefănescu (March 2013).

| Dependent variables |         | Variables description  | Predicted sign |
|---------------------|---------|--|----------------|
| Board independence  | B_Indep | number of non-executive directors / total number of members              | +              |
| Board size          | B_Size  | total number of members on the board                                     | -              |
| Board education     | B_Edu   | number of members with high level of education / total number of members | +              |
| Board experience    | B_Exp   | number of members with cross-directorship / total number of members      | +              |
| Board gender        | B_Gen   | male members / total number of members                                   | +              |
| Board meetings      | B_Met   | number of board meetings / year  | +              |

**Tab. 1** Independent variable description (Ștefănescu (March 2013)).

There is a big number of variables to characterize the *board of directors* (see below).  
Tab. 2 shows the corporate governance variables definitions in *Horváth, Spirollari (2012)*.

|                                    |   |
|------------------------------------|---|
| <b>Board of Directors Size</b>     | The total number of members in the Board of Directors (inclusive independent directors) attending the annual meetings held during each fiscal year.   |
| <b>Board of Directors Meetings</b> | The number of regular meetings held by the Board of Directors during each fiscal year. The meetings refer only to those held in person, excluding the telephonic meetings.  |
| <b>Insider Ownership</b>           | The percentage of common stock, relative to the common stock outstanding, beneficially owned by all directors and executive officers as a group.  |
| <b>Average Age</b>                 | The average age of board of director's members.   |
| <b>Women in the Board</b>          | The proportion of women in the Board of Directors, alternatively the number of women and the dummy variable for the presence of women in the Board.   |
| <b>Insider Directors</b>           | Insiders are the directors that participate in the day to day running of the company. They work full-time in the company and are responsible for the achievement of operational and strategic objectives. For example, the CEO represents an inside director.   |
| <b>Independent Directors</b>       | Independent directors represent the category of directors that are not employed in the company and do not have any material relationship with it. These directors are in the role of monitors of the Boards. They are also called outsiders or external directors. Board independence is measured by the proportion of independent directors to the Board size. |

**Tab. 2.** *The definitions of corporate governance variables (after Horváth, Spirollari (2012)).*

Tab. 3 depicts the firm performance variables definitions in *Al-Matari Y A, Al-Swidi, Fadzil, Al-Matari E M (2012)*.

| <b>Name of Variable</b>      | <b>Acronym</b> | <b>Measurement</b>   |
|------------------------------|----------------|--|
| <b>Dependent Variables</b>   |                |  |
| Tobin's Q                    | TQ             | The market value of equity plus total debt divided by the book value of total assets of the company. |
| <b>Independent Variables</b> |                |  |
| Board composition            | BODCOM         | The proportion of non-executive directors to total number of directors on the board.                 |
| CEO duality                  | DUAL           | Dummy variable, taking a value of 1 for firms with the CEO as Chair, and 0 otherwise.                |
| Board size                   | BSIZE          | Total number of directors on the board.  |
| Audit committee independence | ACIND          | The proportion of independent directors on the audit committee.                                      |
| Audit committee activity     | ACMEET         | The number of audit committee meetings held in a year 2010.  |
| Audit committee size         | ACSIZE         | Total number of directors on the audit committee.  |
| <b>Control Variables</b>     |                |  |
| Firm Size                    | FSIZE          | The book value of the total assets of the company.   |
| Leverage / Debt proportion   | DEBT           | The percentage of total liabilities to total assets.   |

**Tab. 3.** *Firm performance variables definitions  
(after Al-Matari Y A, Al-Swidi, Fadzil, Al-Matari E M (2012)).*



Tab. 4 shows the main interpretations (definitions) of *board involvement* in the *strategic process* in Ghaya (October 2011).

| Author                                     | Definition   |
|--|--|
| <i>Andrews (1980)</i>                      | Andrews (1980) argues that board of directors is in a great position to contribute on the strategic planning and formulation. He associates an effective ' <i>board strategic contribution</i> ' to <i>Board involvement in the critical strategic issues as generating alternatives and search for new opportunities [...], also, in supporting management imagination, overseeing innovative processes and reviewing CEO propositions</i> ".   |
| <i>Rindova (1999)</i>                      | Rindova (1999), board involvement in strategy is associated to <i>directors' participation in the thinking through of strategy making: environmental scanning and interpretation and strategic formulation</i> .   |
| <i>McNulty and Pettigrew (1999)</i>        | McNulty and Pettigrew (1999) have proposed a detailed set of strategic activities that board of directors can insure during the strategic decision making process. They identify choice, change and control as key aspects of corporate strategy and illustrate three level of board involvement in strategy: 'taking decision', 'shaping decisions' and 'shaping the content, context and conduct of strategy'.   |
| <i>Forbes and Milliken (1999)</i>          | Forbes and Milliken (1999) defined ' <i>board task performance</i> ' as <i>the board's ability to perform its control and service tasks effectively [...]</i> control tasks include decisions regarding hiring and compensation management. The service tasks include providing experts during major events and generating and analysis strategic alternatives during board meeting. (p. 492)  |
| <i>Judge and Zeithaml (1992)</i>           | Judge and Zeithaml (1992) propose: " <i>the overall level of participation of board members in making non-routine, organization-wide resource allocation decisions that affect the long-term performance of an organization</i> " (P. 771).  |
| <i>Demb and Neubauer (1992)</i>            | Demb and Neubauer (1992) consider establishing the strategic direction of the corporation as the most important task of board of directors (P.50). In consequence, a meaningful board involvement, for them, is characterized by the manner in which directors help to define company strategy (p.55) [...] it depends on the strategy process (p. 73).  |
| <i>Stiles and Taylor (2001)</i>            | Stiles and Taylor (2001) associate board involvement in strategic decision making in large organizations to " <i>setting the context of strategy</i> " through several activities: <i>reviewing the corporate definition, actively assessing and reviewing strategic proposals and often changing proposals through comment and advice [...] encouraging management with good track records in their strategic aims and through the selection of directors</i> ". (P. 31)  |
| <i>Huse (2007)</i>                         | Huse (2007) argued that board strategic involvement is widely related to the content of strategy. He define strategy as " <i>the development, maintenance and monitoring of the firms' core competencies with the purpose of achieving long-term results and survival. Strategic decision-making involves resolving uncertainty, complexity and conflict</i> " (P.239). So, board strategic involvement covers " <i>corporate mission development, strategy conception and formulation, and strategy implementation [...]</i> the board can be involved to various degrees in each of these areas." (p. 240) |
| <i>Karoui (2009)</i>                       | For Karoui (2009), board involvement represents <i>the effective measurement of the intensity with which board undertakes its strategic activities</i> (P.152). It is related to different forms of board activation. The author defines board activation as " <i>the decision to make a portfolio of activities. This decision can be individual or collective, deliberated or emergent, voluntary or forced. Board activation leads to the expression of a set of expectations and generates either strong or weak level of commitment on boards 'activities.'</i> " (p. 153)                              |
| <i>Minichilli, Zattoni and Zona (2009)</i> | Minichilli, Zattoni and Zona (2009) defined board task performance as " <i>the ability of the board to perform six tasks related both to service (advice, networking and strategic participation) and control (behavioral, output and strategic control)</i> (p. 56)." This empirical definition was inspired from the theoretical framework of Huse (2005) about board involvement and the model of Zona and Zattoni (2006) of board task effectiveness.  |
| <i>Zhang (2010)</i>                        | Zhang (2010) have studied empirically the impact of possessing and using diverse information of board members on the quality of board task performance. They define board task performance as " <i>a source of competitiveness, which can protect the firm's long-term health against managerial short-term plans.</i> " It covers set of activities such as, <i>the development of the firm's mission and vision, the formulation of business concepts, the evaluation and control of strategic proposals and the implementation of approved strategies.</i> (p. 474)                                       |

**Tab. 4.** Main interpretations (definitions) of board involvement in strategic process  
(after Ghaya (October 2011)).



Tab. 5 describes a set of *board activities* in the steps of the *strategic decision making process* in *Ghaya (October 2011)*).

| Steps of the strategic process                                   | Board activities<br>(Board involvement in...)  | Board roles        | Main references                                  |
|--|--|--------------------|--|
| Major objectives and analysis of the company and its environment | 1.Setting (initiating and discussing) major objectives of the company policy   | Strategy + service | Rindova (1999), McNulty and Pettigrew (1999)     |
|  | 2. Keep watch on competitive, economic, financial and legal corporate environment  | Strategy + service | Huse (2007)                                      |
|  | 3.Analyzing corporate environment  | Strategy + service | McNulty and Pettigrew (1999)                     |
|  | 4.Analyzing and evaluating the corporate resources (strength / weakness)   | Strategy + service | McNulty and Pettigrew (1999)                     |
|  | 5.Identification of opportunities and problems that the company could avail (depending on its human and financial resources)                                 | Strategy + service | Huse (2007), Rindova (1999)                      |
| Identification and selection of strategic options                | 6.Identification of options (solutions) for retained opportunities and problems  | Strategy           | Lorsch and MacIver (1989)                        |
|  | 7.Analysis of the competitive position of the company vis-à-vis the retained problem/opportunity   | Strategy           | McNulty and Pettigrew, 1999                      |
|  | 8. Evaluation of management's proposals and/or propositions of alternative options (advantages and disadvantages, etc.)                                      | Strategy           | McNulty and Pettigrew, 1999                      |
|  | 9.Evaluation of the financial impact of alternative and retained options   | Strategy           | Zahra and Pearce (1989)                          |
|  | 10.Consolidating the options (discussion and making final choice)  | Strategy           | McNulty and Pettigrew (1999)                     |
| Strategic implementation   | 11.Review and approve corporate plan of implementation and actions (main steps and setting objectives and indicators to monitor the implementation progress) | Strategy + control | Lorch and MacIver (1989)                         |
|  | 12.Tracking of the decision implementation   | Strategy + control | Huse (2007)                                      |
|  | 13.Intermediation with important external actors to facilitate the implementation  | Service            | Pfeffer (1972,1973)                              |
|  | 14.Council and advice management in the implementation step  | Service + control  | Lorsch and MacIver (1989),                       |
|  | 15.Identification of solutions for the emergent problems of management   | Service            | Pettigrew (1992)                                 |
|  | 16.Facilitate (intermediation in) acquiring resources (financial, cognitive or technological resources)  | Service            | Pfeffer and Salancik (1978)                      |
| Control and evaluation   | 17.Monitoring the achievement of strategic goals   | Strategy + control | Huse (2007), Rindova (1999)                      |
|  | 18. Financial monitoring (control by results, accounts, budget, etc.)  | Control            | Zahra and Pearce (1989)                          |
|  | 19.Monitoring the performance of the company via financial and strategic measures  | Control            | Fama and Jensen (1983)                           |
|  | 20.Evaluation of management performance  | Control            | Fama and Jensen (1983) Lorsch and MacIver (1989) |
|  | 21.The process of appointment or revocation of the CEO and controlling compensation  | Control            | Lorch and MacIver (1989)                         |

**Tab. 5.** Set of board activities in the steps of the strategic decision making process (after Ghaya (October 2011)).

Tab. 6 provides information on the *synthesis of board of directors' contributions* in the *corporate governance theories* in Ghaya (October 2011)).

| CONTRACTUAL THEORIES   |  | STRATEGIC AND COGNITIVE THEORIES  |  |
|--|--|---|--|
| <b>MAIN IDEAS:</b> - the firm is a nexus of contracts based on an agency relationship between top managers and shareholders/stakeholders.<br>-Board of directors has a little contribution in the firm life, monitoring role without participation in initiating strategy. |  | <b>MAIN IDEAS:</b> - the firm is a directory of key skills. Knowledge has a capital role in the creating value.<br>-Board has an important role in establishing the corporate strategy. |  |
| Theory / Discipline  | Board contribution   | Theory / Discipline   | Board contribution   |
| <b>T: Legalistic approach</b><br><br><b>D: Corporate Law</b> (Chaganti et al., 1985, etc.)   | Nominating CEO and monitoring his performance; evaluating company performance and representing shareholders' interest  | <b>T: Resource dependence theory (&amp; social networks theory)</b><br><br><b>D: Organizational theory &amp; Sociology</b> (Pfeffer, 1972, 1973; Pfeffer and Salansik, 1978)            | Board reduces environmental uncertainty and participates to insure critical resources, legitimacy and reputation of the company.   |
| <b>T: Agency theory (and transaction-cost theory)</b><br><br><b>D: Economics &amp; Finance</b><br><br>(Fama and Jensen, 1983, etc.)  | Board ensures intermediation between managers and owners. It contributes on strategic control and monitoring managers' effectiveness.  | <b>T: Stewardship theory</b><br><b>D: Theories of organizations</b> (Donaldson and Davis, 1991; Davis and al., 1997)  | Managers are not only opportunistic agents. They are also good stewards of company assets.<br>Board should assure the stewardship of firm assets<br>It participates in the discussion of strategic options.                  |
| <b>T: Stakeholder theory</b><br><b>D: theory of organizations</b> (Charreaux and Debrieres, 1998, etc.)  | Board provides the link between managers and other stakeholders (managers, employees, etc.), and insure arbitration of value creation.   | <b>T: Class Hegemony</b><br><br><b>D: Sociology</b> (Mills, 1965, in Zahra et Pearce, 1989)   | Board represents capitalist elites over social and economic institutions. This theory has not explained board process but only his composition.  |
| <b>T: Managerial hegemony</b><br><br><b>D: theories of organizations</b> (Mace, 1971; Lorsch and McIver, 1989)   | Board members don't participate to establish the corporate strategy because of their low availability and low commitment. The real running of the organization is assumed by corporate management. | <b>T: Cognitive perspective (and strategic choice)</b><br><br><b>D: cognitive psychology</b> (Child, 1972; Rindova, 1999, etc.)   | Board of directors is a capital actor in the strategy setting.<br>It participate actively in all steps of the strategic decision making process. The knowledge and experience of directors are crucial for board efficiency. |

**Tab. 6.** *Synthesis of board of directors' contributions in the corporate governance theories (after Ghaya (October 2011)).*

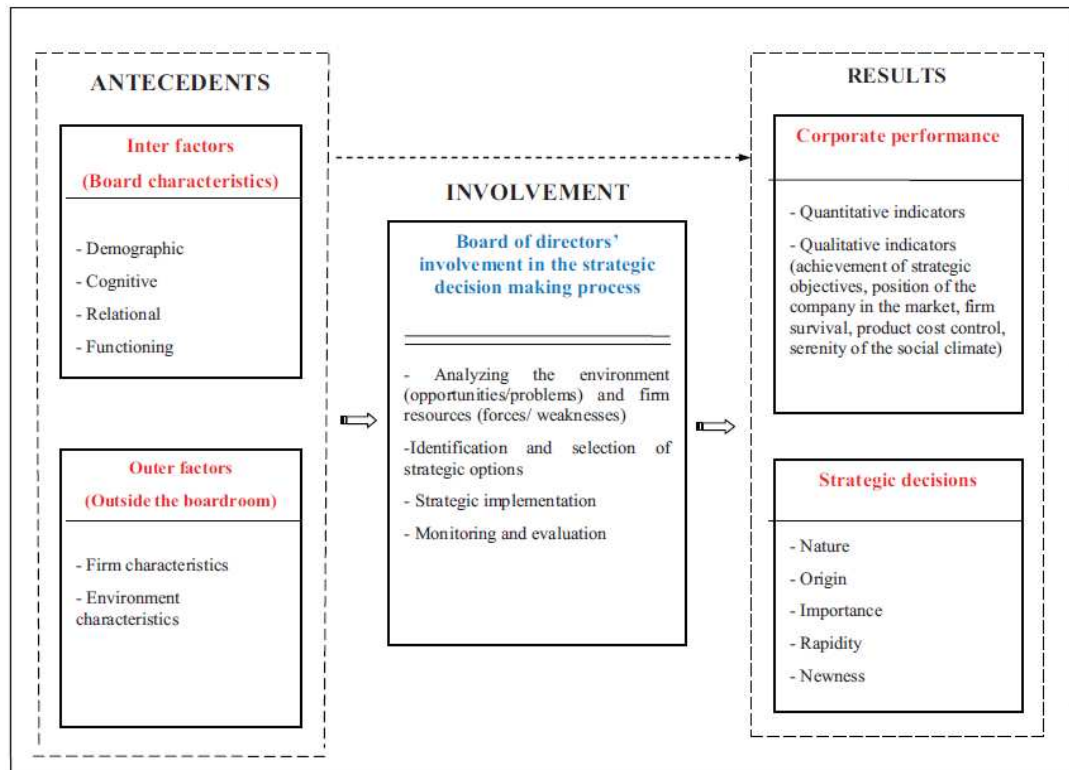


*Tab. 7. Shows the characteristics of the board of directors in Ghaya (October 2011).*

| Board characteristics              | Details   | Main references   |
|------------------------------------|---|---|
| <b>Demographic characteristics</b> | Size, independence, duality of functions, presence of women, foreign directors, age, directors representing employees, demographic diversity  | Jensen and Milliken (1976), Andrews (1981), Fama and Jensen (1983), Pfeffer (1983), Nguyen et Faff (2006), Lefort et Urzua (2008), etc.                     |
| <b>Cognitive characteristics</b>   | Educational background (specialty and level), functional background, cognitive diversity, specific knowledge on company and its environment, specific expertise (strategy, finance, law, etc.)                | Huse (2007), Pugliese (2007) Forbe and Milliken (1999), McNulty and Pettigrew (1999), Rindova (1999), Charreaux (2000), Lazonick et O'Sullivan (1998), etc. |
| <b>Relational characteristics</b>  | Having developed networks (with external actors), being directors in other companies, organizational reputation, negotiation competences with management and external actors                                  | Huse (2007), Charreaux (2003), McNulty and Pettigrew (1999), Rouby (2008), etc.   |
| <b>Functioning characteristics</b> | Meeting preparation, number and length of formal meetings, assiduity, informal meetings, training and procedure of directors' evaluation, consulting extern consultants, committees (meetings, members, etc.) | Lorsch and MacIver (1989), Huse (2007), Godard (2006), Gomez and Moore (2009), etc.   |

*Tab. 7. Characteristics of the board of directors (after Ghaya (October 2011)).*

*Fig. 3 proposes an operational model of board involvement in strategic decision making process in Ghaya (Octobre 2011).*



*Fig. 3. Operational model of board involvement in strategic decision making process (after Ghaya (October 2011)).*

Let us now discuss the *board of director's performance evaluation problem* in details. Evaluating the *board of directors competences, professional capabilities and work performance*, Carretta, Farina, Schwizer (2006) suggest: "The degree of effectiveness of a board should be appreciated taking into account the *business structure, ownership and institutional model of the firm*, on the one hand, and the *characteristics of its board, in terms of its composition, structure and skills*, on the other hand."

Fig. 4 shows the *perspectives and tools for the evaluation of the board of directors* in Carretta, Farina, Schwizer (2006).

|            |                      |  |  |
|------------|----------------------|--|--|
| Evaluation | Individual directors | Observation of specific individual requirements                          | Questionnaires (self-evaluation, peer evaluation)<br>One-to-one interviews |
|            | Whole board          | Observation of specific institutional and organizational characteristics | Group self-evaluation  |
|            |                      | Quantitative   | Qualitative  |
|            |                      | Method   |  |

**Fig. 4.** Perspectives and tools for evaluating board of directors (after Carretta, Farina, Schwizer (2006)).

Fig. 5 provides some information on the *procedure for calculating the performance of board of directors* in Carretta, Farina, Schwizer (2006).

$$\begin{array}{c}
 \text{BOARD EVALUATION} \\
 = \\
 \text{ASSESSMENT OF THE INSTITUTIONAL CHARACTERISTICS} \\
 + \\
 \text{ASSESSMENT OF THE ORGANIZATIONAL CHARACTERISTICS} \\
 + \\
 \text{ASSESSMENT OF THE DIRECTORS' PROFESSIONAL SKILLS}
 \end{array}$$

**Fig. 5.** Procedure for calculating the performance of board of directors (after Carretta, Farina, Schwizer (2006)).

Fig. 6 compiles a checklist for surveying the institutional and organizational characteristics in *Carretta, Farina, Schwizer (2006)*.

| CHARACTERISTICS   | YES                      | NO                       |
|---|--------------------------|--------------------------|
| <i>Institutional</i>  |                          |                          |
| Is the size of the board adequate <i>vis-à-vis</i> the activities to be carried out?  | <input type="checkbox"/> | <input type="checkbox"/> |
| Are the roles of chairman of the board and chief executive separate?  | <input type="checkbox"/> | <input type="checkbox"/> |
| Is the degree of representativeness of the shareholders adequate?   | <input type="checkbox"/> | <input type="checkbox"/> |
| Is the number of independent directors higher than or equal to that of the executive directors?   | <input type="checkbox"/> | <input type="checkbox"/> |
| Do some directors also hold directorships in other companies?   | <input type="checkbox"/> | <input type="checkbox"/> |
| Are there any female directors?   | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Organizational</i>   |                          |                          |
| Have board committees been created?   | <input type="checkbox"/> | <input type="checkbox"/> |
| Are the tasks and powers apportioned and delegated (between the BoD, Executive Committee, senior management)?                                     | <input type="checkbox"/> | <input type="checkbox"/> |
| Are meetings held frequently (at least 7 times a year)?   | <input type="checkbox"/> | <input type="checkbox"/> |
| Are the board meetings attended by other stakeholders (managers, etc.)?   | <input type="checkbox"/> | <input type="checkbox"/> |
| Is there a policy for communicating price-sensitive information to the outside?   | <input type="checkbox"/> | <input type="checkbox"/> |
| Are remunerations commensurate to the commitment required from the directors' (attendance time, special tasks, required output and contribution)? | <input type="checkbox"/> | <input type="checkbox"/> |

**Fig. 6.** Checklist for surveying the institutional and organizational characteristics  
(after *Carretta, Farina, Schwizer (2006)*).

Fig. 7 depicts a procedure for the measurements of the board professional skills in *Carretta, Farina, Schwizer (2006)*.

|  |
|--|
| <p>PROFESSIONAL SKILLS OF THE BOARD (<i>max 40 grades</i>)</p> <p>=</p> <p>AVERAGE PROFESSIONAL SKILLS OF THE INDIVIDUAL DIRECTORS</p> |
|--|

**Fig. 7.** Procedure for measuring the professional skills of the board  
(after *Carretta, Farina, Schwizer (2006)*).

Let us explain that the following original research proposals on an *accurate characterization of the overlapping interconnecting interlocking directors' networks in the boards of directors in the firms* have been formulated in the corporate governance research in Ledenyov D O, Ledenyov V O (2015a), namely the authors suggested that:

- 1) *Transmitted/Received information data-stream measurements,*
- 2) *Transmitted/Received information bit error rate measurements,*

have to be used to accurately characterize the interlocking interlinking interconnecting directors networks in addition to the well known parameters such as:

- a) *Director's boards seats accumulation number,*
- b) *Overlapping interconnecting interlocking directors networks configuration*
- c) *Centrality,*
- d) *Freeman degree,*
- e) *Betweenness.*

In other words, the authors suggested that: “the *information, which is generated, transmitted and received by the director in the overlapping interconnecting interlocking directors networks in the boards of directors in the firms can accurately characterize the overlapping interconnecting interlocking directors networks performance, and tell the true story about the director's competence and effectiveness, impacting the involved firms' valuations,*” in Ledenyov D O, Ledenyov V O (2015a). It was also explained that: “The *director can have a big director's boards seats accumulation number, an advanced overlapping interconnecting interlocking director's professional networks configuration, a high degree of centrality, however, at the same time, the director can generate, transmit, receive the low information data streams (the information data flows) in the advanced overlapping interconnecting interlocking director's professional networks, behaving as a passive observer and making the little or no useful contributions to the boards of directors work in the considered firms,*” in Ledenyov D O, Ledenyov V O (2015a). The authors came to a logical conclusion that: “*the information, which is generated, transmitted and received by the director in the overlapping interconnecting interlocking directors networks in the boards of directors in the firms is the only important parameter, which can accurately characterize the director's competence, efficiency and effectiveness during his/her work assignments in the boards of directors in the firms. In any firm, the work performance, shown by every director, will ultimately impact the work performance, demonstrated by the board of directors, which will certainly be reflected in the firm's valuation in Carretta, Farina, Schwizer (2006), Black, Kim (2011),*” in Ledenyov D O, Ledenyov V O (2015a). The attention was drawn to the fact that: “We

*do believe that the generated, transmitted, and received information data streams in the interlocking interlinking interconnecting directors' networks have a highly asymmetric nature, because of some reasons. In our opinion, every director has the different education, professional experience, accumulated knowledge base and can allocate the different amounts of time to work at the boards of directors in the firms, hence the director will generate, transmit, receive the various information data streams (the information data flows), resulting in the asymmetric information data streams appearance in the interlocking interlinking interconnecting directors' networks in the boards of directors in the firms", in Ledenyov D O, Ledenyov V O (2015a). It makes sense to note that the above propositions in Ledenyov D O, Ledenyov V O (2015a) have been made, considering the present research achievements in the wireline information communication networks (ADSL), wireless information communication networks (GSM, WCDMA, UMTS), the optical information communication networks (SONET, ATM, all optical CDMA), which can be accurately characterized by both*

- 1) the transmitted/received data stream measurements, and*
- 2) the existing bit error rate measurements (BER), using the eye diagram and the special measurement equipment, in accordance with the US Federal Communication Commission (FCC) technical requirements.*

Let us add that a *research assumption* that the ***positive and negative feedback loops can quite possibly lead to the destructive coordination among the directors by eliminating the randomness element and by introducing the greater uniformity in the pursuing business strategies*** has been proposed in Ledenyov D O, Ledenyov V O (2015a). It was stated that: “***We would like to emphasis that the conducted empirical research reveals another interesting fact that the positive and negative feedback loops, which can be created by the interlocking directors networks in the boards of directors in the firms, can quite possibly lead to the destructive coordination among the directors in the boards of directors in the firms by eliminating the randomness element and introducing the greater uniformity in the pursuing business strategies (the destructive coordination term is well described in Whitehead (2011, 2014)),***” in Ledenyov D O, Ledenyov V O (2015a). We would like to clarify that the *total risk calculation*, using the similar *risk management techniques* in the financial institutions, can result in an increase of *systemic risk* and a possible systemic collapse of financial institutions due to the *destructive coordination* presence.

Let us highlight the fact that the ***problem of stability in the overlapping interconnecting interlocking directors networks in the boards of directors in the firms*** has been considered from the econophysics point of view in Ledenyov D O, Ledenyov V O (2015a). The authors wrote:



*“We think that the stability of interlocking interconnecting directors’ network depends on the nature of stochastic dynamic processes in the interlocking interconnecting directors’ network, hence it can be impacted by the election / appointment / introduction of a new directors into the overlapping interconnecting interlocking directors networks in the boards of directors in the firms in the time domain in Anishenko, Vadivasova, Astakhov (1999), Kuznetsov (2001). The stability is an important parameter in all types of modern networks in the economics, finances, electronics, energy sector, and information communication industry in Page, Wooders, Kamat (2005). For example, it is a well known fact that a fast random addition of the energy consumers to the energy distribution networks may result in a shift of the energy distribution networks out of a stable state, because of the origination of the stochastic dynamic resonance. The same processes can have place in the case of the electronic circuits with the interconnected networks of electronic components, hence the stability of electronic circuits is considered as an important parameter. The stability of wireless, wireline and optical communications networks with the millions of active users is assumed to be quite important parameter as well,” in Ledenyov D O, Ledenyov V O (2015a).*

The special **MicroID** software program to compute the real-world director’s election / appointment numbers in the boards of directors in the firms, was developed in Ledenyov D O, Ledenyov V O (2015a): “Using the knowledge base in the probability theory in De Laplace (1812), Bunyakovsky (1846), Chebyshev (1846, 1867, 1891), Markov (1890, 1899, 1900, 1906, 1907, 1908, 1910, 1911, 1912, 1913), Kolmogorov (1938, 1985, 1986), Wiener (1949), Brush (1968, 1977), Shiryaev (1974, 1988, 1995), Pugachev (1979), the authors derived the appropriate universal formula to compute the probability number of the additional directorship mandates issues, depending on a set of already existing directorship mandates in the case of the interconnecting interlocking directors’ networks in the boards of directors in the firms,  $P(b + 1|b)$ , in Milakovíc, Raddant, Birg (2009), Alfarano, Milakovíc (2009); and developed the **MicroID software program**, which makes the actual probabilistic prediction toward the director’s election / appointment in the boards of directors in the firms, taking to the consideration both the director’s technical characteristics and the interconnecting interlocking director’s network parameters. We tested the MicroID software program, improved the computing recursive algorithm, and evaluated the accuracy of developed prediction models, comparing the obtained computing results with the real-world director’s election / appointment numbers in the boards of directors in the firms in the considered cases of research interest.”

In this research paper, let us focus our research attention on our most interesting research proposal to introduce the **Quality of Service (QoS) measurements to accurately**

*characterize the director's performance in the overlapping interconnecting interlocking directors networks in the boards of directors in the firms* in Ledenyov D O, Ledenyov V O (2015a). The authors made the following research proposal: “*We propose to introduce the Quality of Service measurements scale for the directors' competence and effectiveness measurements during their work performance evaluation in the boards of directors in the firms, going from the accurate characterization of the generated, transmitted and received information streams by the director in the boards of directors in the firms over a certain period of time,*” in Ledenyov D O, Ledenyov V O (2015a).

Therefore, in the *present research article*, we would like to take a few steps forward and describe the *innovative advanced technology to accurately characterize the director's performance in the overlapping interconnecting interlocking directors networks in the boards of directors in the firms during the Quality of Service (QoS) measurements process*, which has been developed by the authors during the research in the *last fifteen years*. We make the *Ledenyov Quality of Service evaluation method proposition to filter the generated/transmitted/received information by the director into the separate virtual information channels, depending on the information content, and to measure the level of signal in every virtual channel with the purpose to accurately characterize the director's performance in the overlapping interconnecting interlocking directors networks in the boards of directors in the firms during the Quality of Service (QoS) measurements process*. For example, using the *MicroITF software program*, we can investigate a *certain number of directors in the boards of directors in the firms at the same time* and analyse the following *director's virtual information communication channels, which are generated/transmitted/received by the directors in the boards of directors in the firms, in our measurements*:

- 1) The *strategic generated/transmitted/received information virtual channel*,
- 2) The *tactical generated/transmitted/received information virtual channel*,
- 3) The *numerical generated/transmitted/received information virtual channel*,
- 4) The *text generated/transmitted/received information virtual channel*,
- 5) The *audio generated/transmitted/received information virtual channel*,
- 6) The *video generated/transmitted/received information virtual channel*,
- 7) The *graphic generated/transmitted/received information virtual channel*,
- 8) The *decisions density generated/transmitted/received information virtual channel*.

The above *Ledenyov Quality of Service evaluation method* is based on the *innovative advanced technology* developed for the *spread spectrum wireless communication networks*, the *spread spectrum optical communication networks* and *computer networks*, where the *different virtual information communication channels* can be practically created with the application of

- 1) the *various signal spreading codes* (WCDMA wireless/optical communication networks), and/or
- 2) the *different signal coding schemes in the multilayered protocols stacks* (the computer networks)

over the same physical channel with the certain frequencies bandwidth, in the time domain. The levels of signals in the different virtual channels can be measured precisely, providing the necessary data on the director's Quality of Service in the boards of directors in the firms in an analogy with the QoS measurements in the spread spectrum wireless communication networks and the spread spectrum optical communication networks.

In this research publication, we would like to discuss shortly the important obtained research results by saying that the special software program **MicroITF** has been created by the authors to accurately characterize the director's performance by means of

1) the filtering of the generated/transmitted/received information by the director into the separate virtual channels, depending on the information content, and

2) the measurement of the levels of signals in every virtual channel with the generated/transmitted/received information by the director, in the overlapping interconnecting interlocking directors networks in the boards of directors in the firms during the Quality of Service (QoS) measurements process.

Presently, we can only report the preliminary research results by saying that **MicroITF** software program has been developed, tested and applied successfully to make the QoS measurements as far as the selected directors in the firms, corporations in Europe, North America, Asia and Australia is concerned.

The directors' characteristics, boards of directors' characteristics, interlocking interconnecting directors networks in the boards of directors in the firms and the related scientific topics have been extensively researched (in a chronological order) in Brandeis (1915, 1933), Berle (1932), Berle, Means (1932), Dodd (1932), Luce, Perry (1949), Selznick (1949, 1957), Ford, Fulkerson (1956), Mills (1956), Hopkins (1964), Vance (1964, 1968, 1983), Williamson (1964, 1975, 1984, 1985, 1988, 1996, 2002, 2007), Koontz (1967), Milgram (1967), Travers (1968), Dooley (1969), Harary (1969), Miliband (1969), Zald (1969), Domhoff (1970), Bunting, Barbour (Autumn 1971), Bunting (1976), Mace (1971, 1972, 1986), Child (1972),

*Levine (1972), Pfeffer (1972, 1973, 1981, 1983, 1987, 1991), Pfeffer, Salancik (1978, 2003), Bacon (1973, 1993), Blumberg (1973), Bron, Kerbosch (1973), Granovetter (1973), Mintzberg (1973), Ross (1973), Allen (1974), Doreian (1974), Zeitlin (1974), Mariolis (1975), Buchmann (1976), Burt (1976, 1983), Cuyvers, Meeusen (1976, 1985), Wilson (1976), Hughes, John, Mackenzie (1977), Tukey (1977), Freeman (1979a, b), Karjala (1979), Koenig, Gogel, Sonquist (1979), Mokken (1979), Andrews (Nov-Dec 1980, May-June 1981a, Nov-Dec 1981b), Burt (1980, 1997), Pennings (1980), Provan (1980), Radcliff (1980), Boje, Whetten (1981), Linderberger, Ross (1981), Mintz, Schwartz (1981, 1985), Bearden, Mintz (1985), Mizruchi, Bunting (1981), Mizruchi (1982, 1983, 1992, 1996), Stearns, Mizruchi (1986), Mizruchi, Schwartz (editors) (1987), Mizruchi, Stearns (1988, 1994), Byrd, Mizruchi (2005), Schoorman, Bazerman, Atkin (1981), Hirsch (1982), Mariolis, Jones (1982), Andrews (1983), Barnes (1983), Bazerman, Schoorman (1983), Burt (1983, 2000), Dodd, Warner (1983), Donaldson G, Lorsch (1983), Fama, Jensen (1983b), McAvoy, Conter, Dona, Peck (1983), Palmer (1983), Roy (1983), Tashakori, Boulton (1983), Vance (1983), American Bar Association (1984, 2011), Caswell (1984), Hambrick, Mason (1984), Lease, McConnell, Mikkelsen (1984), Ornstein (1984), Scott, Griff (1984), Tricker (1984, 1994a, b, 2000, 2009), Useem (1984), Ziegler (1984), Baysinger, Butler (1985), Baysinger, Hoskisson (1990), Baysinger, Kosnik, Turk (1991), Chaganti, Mahajan, Sharma (1985), Charreaux, Pitol-Belin (Novembre 1985, 1989, 1990, October 1991, October 1993), Charreaux, Couret, Joffre, Koenig, De Montmorillon (1987), Charreaux, Debrieres (1998), Charreaux (2000, 2002a, b), Cochran, Wood, Jones (1985), Demsetz, Lehn (1985), Demsetz, Villalonga (2001), Galaskiewicz, Wasserman, Rauschenbach, Bielefeld, Mullaney (1985), Meeusen, Cuyvers (1985), Stockman, Wasseur (1985), Stockman, Ziegler, Scott (editors) (1985), Stockman, van der Knoop, Wasseur (1990), Waldo (1985), Anderson, Anthony (1986), Mace (1986), Shleifer, Vishny (1986, 1997), Tirole (1986, 1997, 2001, 2006), Grossman, Hart (1986), Glatthard (1987), Kosnik (1987), Richardson (1987), Hermalin, Weisbach (1988, 1991, 1998, 2001, 2003), Weisbach (1988), Hermalin, Benjamin (2005), Kesner (1988), Mathile (1988), Hill C W L, Snell (1988), Zahra, Pearce (1988, 1989), Zahra (1990), Pearce, Zahra (1991, 1992), Zajac (1988, 1996), Connors (1989), Fosberg (1989), Lorsch, MacIver (1989), Lundstrom, Ottoson (1989), Nelson (1989), Rechner, Dalton (1989, 1991), Schellenger, Wood, Tashakori (1989), Singh H, Harianto (1989), Carver (1990, 2002), Donaldson (1990), Donaldson, Davis G F (1991), Gilson (1990), Glaus (1990), Kaplan, Reishus (1990), Kaplan, Minton (1994), Powell (1990), Rosenstein, Wyatt (1990, 1994, 1997), Barnhart, Rosenstein (1998), Burris (1991), Davis G F (1991), Davis G F, Greve (1997), Davis G F, Yoo, Baker (2002, 2003), Davis G F, Yoo, Vast (2003), Goodstein, Boeker (1991), Israel (1991, 1992), Byrd,*

*Hickman (1992), Daily, Dalton (1992, 1993, 1994a, b, 1997, 2005), Daily (1995), Johnson, Daily, Ellstrand (1996), Daily, Johnson (1997), Dalton, Daily, Ellstrand, Johnson (1998, 1999), Daily, Dalton, Cannella (2003), Dalton, Daily, Certo, Roengpitya (2003), Demb, Neubauer (1992a, b), Finkelstein (1992), Finkelstein, D'Aveni (1994), Finkelstein, Mooney (2003), Fligstein, Brantley (1992), Fligstein (1995), Gerlach (1992), Judge, Zeithaml (1992), Lee, Rosenstein, Rangan, Davidson (1992), Davidson, Pilger, Szakmary (1998), Lincoln, Gerlach, Takahashi (1992), Lipton, Lorsch (1992), Mallette, Fowler (1992), Milgrom, Roberts (1992), Ottoson (1992), Pettigrew (1992), Pettigrew, McNulty (1995), McNulty, Pettigrew (1999), Pye, Camm (2003), Pye, Pettigrew (2005), Smith, Watts (1992), Watts (2001), Wang, Dewhirst (1992), Alexander, Fennel, Halpern (1993), Coulson-Thomas (1993), Haunschild (1993), Haunschild, Beckman (1998), Jensen (1993), Johnson R, Hoskisson, Hitt (1993), Johnson R, Greening (1999), Kester (1993), Mangel, Singh H (1993), Millstein (1993), Shivdasani (1993), Shivdasani, Yermack (1999), Barnhart, Marr, Rosenstein (1994), Barnhart, Rosenstein (1998), Beatty, Zajac (1994), Boyd (1994, 1996), Brickley, Coles, Terry (1994), Brickley, Coles, Jarrell (1997), Brickley, Coles, Linck (1999), Gales, Kesner (1994), Goodstein, Gautam, Boeker (1994), Huse (1994, 2005), Huse, Minichilli, Shoning (2005), Huse (2007), Pugliese, Bezemer, Zattoni, Huse, Van Den Bosch, Volberda (2009), Van Ees, Gabrielsson, Huse (2009), Krackhardt (1994), Li (1994), Scott, Kleidon (1994), Wasserman, Faust (1994), Wassermann, Faust, Iacobucci (1994), Wasserman, Galaskiewicz (1994), Bathala, Rao (1995), Benassi (1995), Blair (1995, 1999), Blair, Stout (1999, 2001, 2006), Boyd (1995), Hallock (January 1995), Hart (1995), Hill S (1995), Kini, Kracaw, Mian (1995), Klein (1995, 1998, 2002), Lorsch (January - February 1995), Moerland (1995, 1997, 1999), Monks, Minow (1995), O'Neal, Thomas (1995), Pfannschmidt (1995), Wunderer (1995), Agrawal, Knoeber (1996, 2001), Agrawal, Chen (2010), Bainbridge (1996, 2003a, b), Beasley (1996), Beasley, Salterio (2001), Bhagat, Black (May 10-11 1996, 1998, 1999, 2000, 2001, 2002), Bhagat, Black, Blair (2004), Bhagat, Bolton (2008), Black, Jang, Kim (2003, 2006a, b), Black, Khanna (2007), Black, Kim (2008, 2011), Black, Kim, Jang, Park (2011), Bianco, Gola, Signorini (1996), Bianco, Pagnoni (March 1997), Booth, Deli (1996, 1999), Borokhovich, Parrino, Trapani (1996), De Cecco, Ferri (1996), Doz (1996), Johnson J, Daily, Ellstrand (1996), La Porta, Lopez-de-Silanes, Shleifer, Vishny (1996, 1998), La Porta, Lopez-de-Silanes, Shleifer, Vishny (1997), La Porta, Lopez-de-Silanes, Shleifer (1998), Mueller (1996), O'Neal, Thomas (1996), Park, Rozeff (1996), Romano (1996), Sundaramurthy (1996), Sundaramurthy, Mahoney, Mahoney (1997), Windolf, Beyer (1996), Windolf (2002, 2009), Yermack (1996), Shivdasani, Yermack (1999), West (1996), Angbazo, Narayanan (1997), Bacon, Cornett, Davidson (1997), Brickley, Coles, Jarrell (1997), Cotter, Shivdasani, Zenner*

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**Winning virtuous strategy creation by interlocking interconnecting  
interlinking directors in board of directors in firm in accordance with  
information theory of firm**

*Exploring the research problem on the winning virtuous strategy creation by the interlocking interconnecting interlinking directors in the board of directors in the firm in the frames of the information theory of firm, the authors prefer to use the research approach by the Ledenyov's school of scientific thinking, which complements the empirical philosophical intuitive logical opinions on the strategy creation issues, which have been nurtured and expressed by the Porter's strategy institute, with the most innovative econophysical econometrical information-technology-driven thoughts on the origins of winning successful*

*strategies, proposed by the Ledenyov's school of scientific thinking. One of the interesting problems to understand is: How can the board of directors create the winning successful business strategies for the company (organization) in the information theory of the firm? Answering the above question, let the authors formulate the **Ledenyov theory on the winning virtuous business strategies creation by the directors in the boards of directors in the firms at the resonant absorption of discrete information in the diffusion - type financial economic systems with the induced nonlinearities.***

*The **Ledenyov theory** postulates that the director with the highest information absorption capacity, who experience the phenomenon of resonant - type absorption of information, is able to create the winning virtuous strategies through the decision making process on the available business choices in the diffusion - type financial economic system with the induced nonlinearities, applying the econophysical econometrical analysis techniques in Schumpeter (1906, 1933), Bowley (1924), Box, Jenkins (1970), Grangel, Newbold (1977), Van Horne (1984), Taylor S (1986), Tong (1986, 1990), Judge, Hill, Griffiths, Lee, Lutkepol (1988), Hardle (1990), Grangel, Teräsvirta (1993), Pesaran, Potter (1993), Banerjee, Dolado, Galbraith, Hendry (1993), Hamilton (1994), Karatzas, Shreve (1995), Campbell, Lo, MacKinlay (1997), Rogers, Talay (1997), Hayashi (2000), Durbin, Koopman (2000, 2002, 2012), Ilinski (2001), Greene (2003), Koop (2003), Davidson, MacKinnon (2004), Campbell, Lo, MacKinlay (1996), Vialar, Goergen (2009) and using the creative imperative integrative intelligent conceptual co-lateral adaptive logarithmic thinking process with the use of the inductive, deductive and abductive logics in Martin (1998-1999, 2005-2006) in the frames of the strategic choice structuring process, that is the winning through the distinctive choices process in Porter (1979, 1980, 1982a, b, 1983, 1985, 1987a, b, 1991, 1994a, b, 1996a, b, 1997, 2001a, b, 2008, 2013), Porter, Harrigan (1981), Porter, Salter (1982), Montgomery, Porter (1991), Porter, Rivkin (2000), Porter, Sakakibara (2004), Anand, Bradley, Ghemawat, Khanna, Montgomery, Porter, Rivkin, Rukstad, Wells, Yoffie (2005), Porter, Kramer (2006), Hill, Jones (1998, 2004), Martin (1998-1999b, 2004, 2005-2006a, b, 2009), Moldoveanu, Martin (2001), Lafley, Martin (2013), Grant (2001), Choo, Bontis (2002), Drejer (2002), Sadler (2003), Roney (2004), Ireland, Hoskisson, Hitt (2006), Besanko, Shanley, Dranove (2007), Hitt, Ireland, Hoskisson (2007), Gavetti, Rivkin (2007), Teece, Winter (2007), aiming both to get an increased business valuation (a return premium) and to make a positive social impact in the local community and society in the frames of the socially responsible investment (SRI) process that integrates social, environmental, and ethical considerations into investment decision making in the real sector of economy in Waddock,*

*Graves, (1994), Arora, Gangopadhyay (1995), Sparkes (1998, 2004, 2008), Johnson, Greening (1999), Lydenburg (2002), Cox, Brammer, Millington (2004), Kotler, Lee (2005), Louche, Lydenberg (2006), McWilliams, Siegel, Wright (2006), Scholtens (2006), Cespa, Cestone (2007), Cumming, Johan (2007), Williams (2007), Hull, Rothenberg (2008), Reinhardt, Stavins, Vietor (2008), Renneboog, Horst, Zhang (2008), Arjalies (2010), Crifo, Mottis (2010), Morrell, Clark (2010), Baron, Harjoto, Jo (2011), Crifo, Forget (February, 2012).*

Making the *concluding comments on the strategy creation issue*, the authors think that the different levels of the information sensing, information filtering, information processing, information absorption, information analysis and decision making with the obtained information by the director may have the certain positive or negative impacts on the director's winning virtuous strategy creation ability in the overlapping interconnecting interlocking directors networks in the boards of directors in the firms.

Of course, the *most complicated task for every wise director* is to adjust to the optimal levels of the information sensing, information filtering, information processing, information absorption, information analysis, decision making, which can allow the winning virtuous strategy creation in the overlapping interconnecting interlocking directors networks in the boards of directors in the firms. ***We would like to mention that the excessive or insufficient levels of the information sensing, information filtering, information processing, information absorption, information analysis by the director may result in the bifurcations and chaos appearances in the frames of a decision making process on the winning virtuous strategy creation in the case of presence of the considered overlapping interconnecting interlocking directors networks in the boards of directors in the firms.***

The *strategy creation by the board of directors in the firm* and the related scientific topics have been researched (in a *chronological order*) in Chandler (1962, 1998; 1977, 1993; 1994; 2001; 2005), Chandler , Daems (1980), Andrews (1971a, b, 1980, 1981a, b, 1984), Rumelt (1974, 1982), Porter (1979, 1980, 1982a, b, 1983, 1985, 1987a, b, 1991, 1994a, b, 1996a, b, 1997, 2001a, b, 2008, December 2013), Porter, Harrigan (1981), Porter, Salter (1982), Montgomery, Porter (1991), Porter, Rivkin (2000), Porter, Sakakibara (2004), Anand, Bradley, Ghemawat, Khanna, Montgomery, Porter, Rivkin, Rukstad, Wells, Yoffie (2005), Porter, Kramer (2006), Porter, Heppelmann (November 2014), Schendel, Hofer (1979), Yelle (1979), Dess, Davis (1984), Schwenk (1984), Pitol-Belin (1984), Hambrick (1985), Palepu (1985), Barney (1986, 1991), Huff, Reger (1987), Hill, Snell (1988), Hill, Jones (1998, 2004), Baysinger, Hoskisson (1989), Rue, Holland (1989), Fombrum, Shanley (1990), Pearson (1990), Ansoff (1991), Goold (1991), Goold, Luchs (1993), Goold et al (1994), Goold, Campbell (September,

October 1998), Alexander, Goold, Collis, Campbell, Lieberthal, Montgomery, Palepu, Prahalad, Stalk, Khanna, Hart, Shulman, Evans (1992, 1995, 1996, 1997, 1998, 1999), Yip (1992, 1998, 2000, 2007), Campbell et al (1995), Johnson, Scholes (1997), Johnson, Scholes, Whittington (1998), Johnson, Scholes, Whittington (2002, 2003), McKiernan (1997), Child, Faulkner (1998), Martin (1998-1999, 2004, 2005-2006, 2007a,b, 2008, 2009), Moldoveanu, Martin (2001), Lafley, Martin (2013), Shiryaev (1999), Laffont, Tirole (1999), Grant (2001), Welch (2001a, b), Choo, Bontis (2002), Drejer (2002), Sadler (2003), Gavetti, Levinthal (2004), Gavetti, Rivkin (2007), Roney (2004), Thietart, Xuereb (2005), Godard (2006), Ireland, Hoskisson, Hitt (2006), Hitt, Ireland, Hoskisson (2007), Lorino, Tarondeau (2006), Besanko, Shanley, Dranove (2007), Sull (2007a, b, c, d, 2008), Teece, Winter (2007), Samuels (2008), Chamberlain (2010).

## Conclusion

The article formulates ***the information theory of firm***, introduces the concept of firm as an operating system, which controls the firm's operation by the means of the information resources processing, in an analogy with the operating system at a microprocessor in the computing devices, represents the director as an information processing element, describes the board of directors as the electronically-scanned electronically-steered phased array radar, considers the scientific problem of strategy creation by the interlocking interconnecting overlapping directors in the boards of directors in the firms in the economic system with the induced nonlinearities.

We highlight a fact that the director makes the information sensing, filtering, processing, resonant absorption, analysis, decision making, strategy creation, hence it can be empirically represented as a processing element in a digital signal processor with the Harvard or von Neumann director's mindset architectures in line with the digital signal processing science.

We think that the board of directors in corporate governance system can be theoretically represented as the electronically-scanned electronically-steered phased array radar with a certain number of electronic devices (directors, who can be modeled as electronic devices with the active antenna elements, filters banks, digital signal processors, memory chipsets in agreement with the microwave and digital signal processing sciences).

Using all the proposed theoretical assumptions, we propose the ***Ledenyov theory on the winning virtuous strategies creation by the interlocking interconnecting directors in the boards of directors in the modern firms*** in a harmony with the management science.

We developed the ***MicroITF*** operation system and software programs:

1) the operation system to *control the firm operation by means of the information resources near-real-time processing in the modern firms in the case of the diffusion - type financial economic system with the induced nonlinearities*. The operating system is based on the accumulated knowledge of source code architecture for the near real time VxWorks operating system by WindRiver.

2) the software program to *accurately characterize the director's performance by means of a) the filtering of the generated/transmitted/received information by the director into the separate virtual channels, depending on the information content, and b) the measurement of the levels of signals in every virtual channel with the generated/transmitted/received information by the director, in the overlapping interconnecting interlocking directors networks in the boards of directors in the firms during the Quality of Service (QoS) measurements process*; and

3) the software program to *create the winning virtuous business strategies by the interlocking interconnecting directors in the boards of directors in the modern firms in the case of the diffusion - type financial economic system with the induced nonlinearities, using the patented recursive artificial intelligence*.

The *MicroITF* operating system and software programs can be emulated/installed at the computing devices with the Linux, Unix, Windows, MacOS, iOS, Android, Amoeba operating systems.

The authors think that the *information theory of firm* will improve our understanding on the modern information society economics functioning.

## Acknowledgement

The directors in the boards of directors in the firms face a number of business challenges as a result of *appearing disruptions* in the economics in an *information age*. In this *introductory condensed research article*, the authors use an original research approach in an attempt to create the *information theory of the firm* and to find a *possible solution* for the *strategy creation problem*, which has to be solved by the directors in the boards of directors during the *strategic governance* of the firms.

The international students prepared the *brief abstracts of our invited lectures* at the leading universities around the World over the last two decade, and then the authors combined our *lecture notes* with the *brief abstracts of our invited lectures*, aiming to write a *research article*. We also decided to include *some our thoughts*, expressed during the *Q&A sessions* after

the presented lectures and kindly recorded by our students. In addition, the *authors* included the *most interesting comments, professional advises, private opinions* on the *research subject* by the *directors of firms*, recorded during a few thousands of *business meetings* in *Europe, North America and Asia*. In our opinion, the *presented research findings* may be in the scope of interest by the *MBA students, professors in the business administration, management, finances, economics sciences, directors in the boards of directors, chairmen of the boards of directors, subject experts, and business leaders*, who would like to stay up to the date on the recent developments in the *business administration science*.

The *first author's* knowledge on the *origins of the nonlinearities* in the *complex systems* in the *electrical, electronic, computer and financial engineering* has been obtained during the intensive innovative scientific collaboration with *Prof. Janina E. Mazierska, Personal Chair, Electrical and Computer Engineering Department, James Cook University, Townsville, Australia* and *former Dean, Electrical and Computer Engineering Department, James Cook University, Townsville, Australia, and former IEEE Director Region 10 in Australia, and IEEE Fellow*. The first author would like to acknowledge *Prof. Janina E. Mazierska* by expressing his sincere gratitude for the kind scientific advices on how to develop the *logical mathematical analysis skills, the scientific problems analytic solving ability and the abstract scientific thinking* to tackle the complex scientific problems on *the nonlinearities in the microwave superconductivity* as well as on *the nonlinearities in the economics*, applying the interdisciplinary scientific knowledge together with the advanced computer modeling techniques in the course of the cutting-edge highly innovative research projects at *James Cook University in Townsville in Queensland in Australia in 2000 – 2015* after the graduation from *V. N. Karazyn Kharkov National University in Kharkov in Ukraine in 1994 – 1999*.

There would be appropriate to say that, in an *information age*, the *first author's* special efforts have been primarily directed towards the *scientific information gathering, systematization and detailed analysis* in the frames of this research project on the *business strategy creation* by the *directors in the boards of directors in the firms*; hence, the *first author* would like to thank the professional staff at the *central library at James Cook University in Townsville, Queensland, Australia* for providing the *first author* with all the necessary technical support in relation to the literature search on the subjects of his *multidisciplinary research interest* in the *electronic research databases* at *Australian universities*, replying to the numerous chaotic research requests timely, and making everything possible to assist with the completion of the highly innovative advanced research on the *business strategy creation* by the *directors in the boards of directors* in

the *firms*, which has been conducted at the *James Cook University in Townsville, Queensland in Australia in 2000 – 2015*.

The *first author* would like to comment that the *informative scientific discussions* on the *business strategy creation* by the *directors* in the *boards of directors* in the *firms*, which have been conducted by the *first author* with the *M.Sc. students, Ph.D. candidates, professors, visiting scientists and other faculty members* during the *numerous scientific seminars and brain storm research meetings* at *James Cook University in Townsville in Queensland in Australia*, are generously appreciated, because these *valuable scientific opinions exchanges* encouraged the *first author* to generate the new original scientific ideas and make the *creative imperative integrative intelligent conceptual co-lateral adaptive logarithmic thinking* with the application of the *inductive, deductive and abductive logics analysis* as far as the *business strategy creation* by the *directors in the boards of directors in the firms*, is concerned.

A certain part of an *introductory condensed research article* has been written during the *first author's* *yachting* with the *Australian friends* in *Melbourne, Victoria, Australia* and in *Brisbane, Queensland, Australia*, when a number of the *creative research ideas and important research findings* on the *business strategy creation* by the *directors in the boards of directors in the firms*, came to his mind. Most of the ideas have been discussed with the *Australian friends*, when on the *yachts*. Sometimes, the thoughtful discussions have been further conducted during the “*numerous meetings without the ties*” with the great *Australian philosophers, professors, scientists, businessmen, lawyers, governmental officials and political leaders* in the relaxing trusted mutual-respect atmosphere, characterized by the *pluralism of research opinions* on the topics of interest, during the *Yarra valley, Mornington-Peninsula, and Hunter valley limo wine tours* ([www.yarravalleylimowinetours.com.au](http://www.yarravalleylimowinetours.com.au), [www.huntermvalleylimotours.com.au](http://www.huntermvalleylimotours.com.au)). All these exchanges by the scientific opinions fascinated the *first author's mind*, stimulated the *abstract thinking on the presented assumptions*, and inspired to *work consistently* to complete the writing of this *highly innovative condensed research article* on the *business strategy creation* by the *directors in the boards of directors in the firms*, at *James Cook University in Townsville, Brisbane, and Gold Coast in Queensland in Australia as well as in Melbourne and Sydney in Australia in 2015*.

The *first author* would like to thank cordially all the *European universities rectors, universities deans, distinguished professors, world renowned financiers, reputable economists and well respected businessmen* for *many tens of highly creative and productive business meetings* during the *first author's global intellectual journey* over the *European capitals*, including: *Warsaw, Poland; Berlin, Germany; Amsterdam, The Netherlands; Brussels, Belgium;*



*Luxemburg, Luxemburg; Paris, France; Barcelona, Madrid, Spain; and Coimbra, Lisbon, Porto, Portugal in October, 2014. It was nice to meet and discuss all the problems of mutual research interest with the old European Friends, coming from Brisbane, Australia.*

It is not possible to underestimate an influence by the *classic music* on the development of *strategic thinking skills*, hence a visit by the *first author* to the *City of Vienna* in *Austria* in *Europe* during the *Christmas and New Year festivities* in *December 2014- January 2015* had a quite positive overall impact on the completion of *research article writing*.

The *intensive research work* on the *information theory of the firm* in combination with the *sport training exercises* has been conducted by the *first author* during his visits to the *skiing tourism destinations* in *Bukovel* and in *Dragobrat* in *Western Ukraine* in *March 2015*. The fresh air, pine trees wood, delicious meals and high level service at *Radisson hotel* contributed to the research article writing completion and software development. In addition, during the *first author's visit* to *Ukraine* in *March 2015*, it was nice to see the beautiful architecture of old buildings at *University of Czernowitz*, where *Prof. Joseph Alois Schumpeter* had been worked on the *theory of economic development* in *1909 – 1911*.

After the graduation from *V. N. Karazyn Kharkov National University* in *Kharkov* in *Ukraine* in *1988-1993*, the *second author* worked on the *research programs* in a number of universities and institutions around the *World*. Considering this *research paper*, the *second author* would like to kindly acknowledge the numerous private communications with the participants of the *V. Ya. Bunyakovsky international conference* with the special focus on the *V. Ya. Bunyakovsky's research contributions* to the *mathematical theory of probability* and its modern applications in the *econophysics* and *econometrics*, which had place during a tour to the *Town of Bar, Vinnytsya Region, State of Ukraine* in the time of the conference, organized by the *Institute of Mathematics of National Academy of Sciences of Ukraine (NASU), Kyiv, Ukraine* on *August 20 – 21, 2004*. Absorbing the *brilliant research ideas* during a fruitful exchange by the *scientific opinions* among the conference attendees, the *second author* came up with a remarkable conclusion that the foundations of the *mathematical theory of probability* by *V. Ya. Bunyakovsky* enable us to perform a more accurate scientific analysis and characterization of the complex research problems on the *business strategy creation by the directors in the boards of directors in the firms*. The *first author* has been worked on the *research article*, discussing the *points of mutual research interest* with the *second author*, during his regular visits to the *Town of Bar, Vinnytsya Region, State of Ukraine* over the recent years.

It is a real tremendous pleasure to comment that some fundamental issues on the *business strategy creation by the directors in the boards of directors in the firms* have been researched by

the *second author* during his *intensive research assignments* at the *Rotman School of Management, University of Toronto, Canada* in 1998 – 1999 and 2005 – 2006. The *second author* met with many hundreds of *North American Corporations Presidents, Board of Directors Chairmen, Chief Executive Officers (CEOs), Chief Information Officers (CIOs), Chief Operating Officers (COOs)* and visited the *Research Triangle Park high-tech cluster near Durham in North Caroline* in the *USA* as well as the *Kanata high-tech cluster near Ottawa in Ontario*; the *Calgary high-tech cluster in Calgary in Alberta*; the *Richmond high-tech cluster near Vancouver in British Columbia*, the *Montreal high-tech cluster in Montreal in Quebec* in the *North America* in 1998 – 2006, making his *innovative research on the business strategy creation by the directors in the boards of directors in the firms*. The obtained information has been researched and analyzed by the *second author* at the *Rotman School of Management, University of Toronto, Canada*, which was a *global hub of innovative scientific thinking in the economics and finances* mainly due to the *high level organizational and personal efforts by Prof. Roger L. Martin, former Dean, Rotman School of Management, University of Toronto, Canada*, who strongly supported and facilitated the *initiation of innovative research and the creation of intensive business education courses in Canada* on that time. It is important to underline the fact that the *Prof. Roger L. Martin, former Dean, Rotman School of Management, University of Toronto, Canada* took a right decision to support our *innovative research* by all the available resources at *Rotman School of Management, University of Toronto, Canada*, including the *library, computer laboratory and professional management consulting*. Indeed, the *Rotman School of Management, University of Toronto, Canada* was a *global financial and economic center of gravity* on that time, where the *highly innovative research work* has been conducted by the *second author* from the early morning hours until the deep night, being occasionally interrupted by the *thoughtful long hours scientific discussions* on a variety of *research problems in the finances* with *Profs. John C. Hull and Roger L. Martin, Rotman School of Management, University of Toronto, Canada* in 1998 – 1999 and in 2005 - 2006. It makes sense to note that, in some cases, the *intensive research discussions and numerous consultations* have been continued during our *frequent meetings at the Economic Club of Toronto, Empire Club of Canada and Canadian Club in Toronto, Canada* outside the *U of T* in 2005 – 2006. Using every free minute in our busy research schedules, we discussed all the *scientific problems of mutual research interest*, aiming to find the *possible solutions for the challenging research problems* in the economics, finances, econophysics and econometrics in the *time of globalization*.

Moreover, the *second author* would like to thank *Prof. Roger L. Martin, former Dean at the Rotman School of Management* for a kind invitation to attend a day-long seminar, which has

been organized by the *Rotman School of Management, University of Toronto, Toronto, Canada* at the *Canadian room* at the *Fairmont Royal York Hotel* in *Toronto, Canada* on *June 3, 2005*. The *second author* has been particularly interested in an announced presentation of research on the *complex interlocking directors networks in the boards of directors* within the *Canadian corporations* by *Tim Rowley, Professor, Rotman School of Management, Toronto, Canada; visiting Professor, INSEAD, France*.

The *second author* would like to thank *Prof. Roger L. Martin, former Dean at the Rotman School of Management* for a *cordial personal invitation* to attend a day-long seminar: “*Creativity: 21<sup>st</sup> Century Capital*,” which has been organized by the *Rotman School of Management, Toronto, Canada* at the *Fairmont Royal York Hotel* on *June 2, 2006*. It was a nice opportunity to discuss an *increasing role of creativity in the business opportunities widening in the XXI century* with *Mr. Thomas Stewart, former Editor-in-Chief, Harvard Business Review, Boston, USA; Prof. Jonathan Feinstein, Yale University, USA; and Prof. Richard Florida, Rotman School of Management, Canada*. It is necessary to especially highlight a long polemics on the numerous examples of *creativity in the field of econophysics*, which has been conducted with *Prof. Jonathan Feinstein, Yale University, USA*. It makes sense to mention an interesting thoughtful conversation on the *strategic governance in North America*, which has been conducted with *Prof. Roger L. Martin* and cheered by a *friendly toast with the two glasses of young white wine* from the *Niagara Fall region in Ontario, Canada*.

It is wonderful to see that *Prof. Michael E. Porter, Founding Director, Strategy Institute, Harvard Business School, Harvard University* finds the enough time to write the numerous research articles and books despite of his heavy administrative work load at the *Strategy Institute, Harvard Business School, Harvard University*. As always, we are very grateful to *Prof. Michael E. Porter, Bishop William Lawrence University Professor and former Dean of Harvard Business School, Harvard University*, who is considered by the *authors* as a *father of the modern business strategy*, for his *valuable personal efforts and time* to write a number of *interesting informative research articles and books* as well as to create the *lecture notes*, providing us with his professional expertise, exceptional quality professional advices and wise opinions in the *field of competitive strategy in the 21<sup>st</sup> century*. In fact, *Prof. Michael E. Porter* is regarded by the *authors* as a “*guiding star*” in the *science of strategy*.

Of course, the *important groundbreaking research results* on the *creative disruption and evolutionary economics*, obtained by *Prof. Joseph Alois Schumpeter* at the *University of Vienna in Austria* in *1905 – 1908*, *University of Czernowitz in Ukraine* in *1909 – 1911*, *University of Graz in Austria* in *1912 – 1914*, *University of Bonn in Germany* in *1925 – 1932*, *Harvard*

*University in the USA in 1932 – 1950, had a considerable enigmatic influence on the presented research opinions by the authors. The first author's visit to University of Czernowitz in Ukraine in March 2015 is just a clear confirmation of the above statements. As we all know, the ideas on the creative destruction have been further researched by Prof. Clayton M. Christensen, Kim B. Clark University Professor of Business Administration, Harvard Business School, Harvard University and other notable scientists, hence we studied and absorbed the modern research approaches and findings on the creative destruction by Clayton M. Christensen as well. Let us say that Prof. Clayton M. Christensen presents the Scandinavian approach to the understanding of the research problem on the creative disruption and evolutionary economics.*

*The authors would like to highlight a fact that Prof. Michael C. Jensen's research papers made a considerable influence on the formation of the author's research approaches and opinions on the theory of firm. Therefore, it is nice to see that Prof. Michael C. Jensen's, Chairman, Social Sciences Research Networks, NY, USA continues his active research work and plays an important role in the global economics research by chairing the Social Sciences Research Networks, which is a truly global organization in our time.*

*Developing the understanding on a number of complex research problems in the theory of the firm, the organizational forms, the agency problems, the investment decisions, the authors tried to read and understand the brilliant research ideas by Prof. Eugene Fama, Chicago University, USA. Presently, the authors would like to say that it is possible to understand the most innovative ideas on the theory of firm by Prof. Eugene Fama, because of his simple language and clear logics used to describe complex research problems in the research papers.*

*Recently, the second author had a wonderful opportunity to discuss some research problems on the interconnecting interlocking directors networks in the boards of directors in the publicly traded and non-traded firms in New York in the USA with Charles K. Whitehead, Professor of Business Law, Cornell University Law School, New York, USA at V. N. Karazin Kharkiv National University in Kharkiv, Ukraine in December, 2014. Therefore, the second author expresses his personal thanks to Charles K. Whitehead for the six informative invited lectures on the M&A corporate deals, dynamics of the boards of directors, and legal aspects of corporate governance in New York in the USA.*

*It is not conceivable to write this research article without the multiple useful research inputs from and encouragements by our Friends. Indeed, playing the tennis at the tennis courts or the golf at the golf play grounds with our research collaborators, business partners, friends in various developing and developed countries around the World frequently, we have already conducted many thousands of thoughtful discussions on various research topics, hence we would*

like to thank all our *global Friends* for their *brilliant ideas, interesting opinions, wise suggestions* and *shared experiences* on the *subject of our research interest* in the *economics* and *finances*.

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