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# Multivector strategy vs quantum strategy by Apple Inc

Dimitri O. Ledenyov and Viktor O. Ledenyov

*Abstract* – We propose that the quantum strategy can be considered as a most effective winning virtuous organizational strategy, allowing the board of directors to build a prosperous organization with the optimal business model in the economies of the scale and scopes at the time of the great opportunities and unexpected challenges by the globalization. We provide a concise definition on the quantum strategy: The organizational strategy, which can be derived with the use of the quantum strategy search algorithm by the interlocking interconnecting directors in the board of directors in the modern organization at the time of the global integration. We demonstrate that the quantum strategy search algorithm applies the quantum logic (the probabilistic logic) on the top of the inductive, deductive and abductive logics (the value based logics), aiming to create the most effective optimal winning virtuous organizational strategy by the interlocking interconnecting directors in the board of directors in the modern organization in the information century. We highlight the main existing differences between the multivector strategy (the multiple different strategies implementation at the selected time period) and the quantum strategy (the most effective optimal winning virtuous organizational strategy implementation at the selected time period), considering the real-life case study on the strategy formulation and execution by the interlocking interconnecting directors in the board of directors in the Apple Inc. We express a research opinion that the quantum strategy can be clearly defined/distinguished in line with the generally accepted scientific definitions/meanings/principles in the quantum mechanics science. We think that the prosperous organizations will create and implement the quantum strategies to increase their valuations and outperform the competitors in the economies of the scales and scopes at the time of globalization.

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**Keywords** multivector strategy, quantum strategy, winning virtuous strategy, strategy creation and implementation, strategy selection logics, strategy decision making, strategy optimization problem, most effective strategy search, quantum/inductive/deductive/abductive logics, board of directors composition, board of directors chairman, interlocking directors networks, boards of directors seats accumulation number, centrality, Freeman degree, Betweenness, information flows measurements, destructive coordination, information absorption, theory of firm, microeconomics, Schrodinger wave function, quantum mechanics, econophysics, Apple Inc.

## Introduction

The *fundamental theory of strategy* - a golden key to the successful organisation development – undergoes the process of scientific evolution in a century of information, being enriched by the new research ideas, proposals and conceptions, for example: by the *quantum strategy theory*, in the *business administration science* / the *microeconomics science* 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), Holt, Cameron (2010), Ledenyov D O, Ledenyov V O (2015b, n).

Indeed, the *quantum strategy theory* as a research subject of considerable scientific interest attracts an increasing research attention by the academicians and practitioners in the *business administration science* and in the *microeconomics science* around the World in Ledenyov D O, Ledenyov V O (2015n). Thus, let us explain that the *quantum strategy* represents an *organizational strategy*, which can be derived with the use of the *quantum strategy search algorithm* by the *interlocking interconnecting directors* in the *board of directors* in the *modern organization* at the time of the *global integration*. The *quantum strategy search algorithm*

applies the *quantum logic* (the *probabilistic logic*) on the top of the *inductive, deductive and abductive logics* (the *value based logics*), aiming to create the *most effective optimal winning virtuous organizational strategy* by the *interlocking interconnecting directors* in the *board of directors* in the *modern organization* in an *information century* in *Ledenyov D O, Ledenyov V O (2015n)*.

In this research article, we would like to be focused on the *theory of the quantum strategy creation and execution* in *Ledenyov D O, Ledenyov V O (2015n)* by the *interlocking interconnecting directors* in the *boards of directors* in the *modern organizations* in the *modern economies of the scales and scopes* in the *time of constant introduction* of the *market-creating innovations, sustaining innovations and efficiency innovations* on a *global scale* in *Christensen, Raynor, McDonald (December 2015), Christensen, Denning (December 2015), Rodin (2015), Dobbs, Woetzel, Flanders (2015), Barber (2015)*, considering the *Apple Inc real life business case study* as an example. A *real-life business case study* represents one of possible research approaches to understand an essence of the *quantum strategy theory* in the *business administration science / the microeconomics science*. *Heracleous (2013)* conducted an *interesting research* on the *quantum strategy* at *Apple Inc*, in which it was suggested that the *Apple Inc* has already created and executed its *quantum strategy*. In this connection, we would like to highlight the main existing differences between the *multivector strategy* (the *multiple different strategies implementation at the selected time period*) and the *true quantum strategy* (the *most effective optimal winning virtuous organizational strategy implementation at the selected time period*), considering the *highlighted real-life business case study* on the *strategy formulation and execution* by the *interlocking interconnecting directors* in the *board of directors* in the *Apple Inc* in *Heracleous (2013)*.

It makes sense to say that, presently, the *leading scientists* from a number of *well established/funded research institutions/universities* make everything possible to find an *answer* on the *challenging question: How can the interlocking interconnecting directors create and implement the quantum strategy, which is considered as a most effective winning virtuous organizational strategy, allowing the board of directors to build a prosperous organization with the optimal business model in the economies of the scale and scopes at the time of the great opportunities and unexpected challenges by the globalization?* There is no *simple answer* on this *particular question*. We hope that our research will greatly improve the *quantum strategy theory*, which was proposed for the first time in *Ledenyov D O, Ledenyov V O (2015n)*, and move the *frontiers of the business administration science / the microeconomics science* forward. Therefore, completing a *short insightful introduction*, let us begin a *more detailed insightful*

discussion on the comparative analysis of the multivector strategy vs. the quantum strategy by Apple Inc, presenting our original research thoughts on the subject of scientific interest in this research article.

### Multivector strategy vs quantum strategy by Apple Inc

The *board of directors in the Apple Inc* could be mathematically represented as a two dimensions matrix in Ledenyov D O, Ledenyov V O (2015b, n):

$$\mathbf{Board\ of\ Directors} = \begin{vmatrix} \mathbf{d}_{1,1} & \mathbf{d}_{1,2} & \mathbf{d}_{1,j} \\ \mathbf{d}_{2,1} & \mathbf{d}_{2,2} & \mathbf{d}_{2,j} \\ \mathbf{d}_{i,1} & \mathbf{d}_{i,2} & \mathbf{d}_{i,j} \end{vmatrix},$$

where  $\mathbf{d}_{i,j}$  is the position of a director's seat in the matrix.

The *change of the composition of the board of directors in the Apple Inc* over the time could be mathematically described as an integer in Santella, Drago, Polo (November 11 2007), Ledenyov D O, Ledenyov V O (2015b, n):

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

where

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

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

$\mathbf{en}(t)$  is the number of directors entrants at time  $t_i$ ,

$\mathbf{ex}(t)$  is the number of directors exits at time  $t_i$ ,

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

$c$  is the company,

$i$  is the director.

Let us begin our detailed insightful discussion and conduct a comparative analysis on the multivector strategy vs. the quantum strategy by Apple Inc, using the recently published research article in Heracleous (2013) and the knowledge base in Ledenyov D O, Ledenyov V O (2015b, n). We would like to provide the below citations and to consider the research ideas on the quantum strategy, focusing on the following research topics in Heracleous (2013) and discussing them in details:

1. the *research statements* on the *electron* in the *quantum mechanics* / the *quantum physics*; and
2. the *research statements* on the *quantum strategy* in the *business administration science* / the *microeconomics science*.
3. the *concluding scientific remarks* on the *subject of interest*.

*Heracleous (2013)* writes: “Conversely, conventional wisdom holds that a company competing on innovation, outstanding design, or service excellence will not be able to reach intense levels of efficiency, since these capabilities are costly to develop and maintain. Apple, however, has achieved both — what might be seen as the holy grail of strategy — and it is worth asking how. The answer can help us gain insight into the trickiest of strategies to execute, and one that most companies do not even try to achieve. This strategy, if successfully executed, represents a shift of the iso-value curve to the right in any industry it is employed in, not just movement along the curve where most competitors are positioned. I call this Quantum Strategy, after the idea that at the quantum level of reality, the same electron can be at two places at the same time, and two different electrons can occupy the very same physical space. Both seem to be logical and natural impossibilities, but nevertheless do occur. An understanding of Quantum Strategy offers important lessons for executives. In particular, we can understand the principles are involved in breaking the trade-offs that are conventionally assumed to constrain strategic choices and to lock firms in single generic strategies.”

As we can see, *Heracleous (2013)* made the following *two meaningless mistaken statements*, related to the *quantum physics science*:

1. “the *same electron* can be at *two places* at the *same time*, and
2. *two different electrons* can occupy the *very same physical space*.”

Going from the *quantum physics science* in *Planck (1900a, b, c, d, 1901, 1903, 1906, 1914, 1915, 1943)*, *Einstein (1905, 1917, 1924, 1935)*, *Einstein, Podolsky, Rosen (1935)*, *Bohr (1922, 1924, 1933)*, *de Broglie L (1924, 1925, 1926, 1927, 1928)*, *Compton (1926)*, *Compton A, Allison S K (1935)*, *Schrödinger (1926, 1935)*, *Schiff (1949)*, *Akhiezer, Berestetsky (1953, 1964, 1980)*, *Berestetsky, Lifshits, Pitaevsky (1980)*, *von Neumann (1955)*, *Dirac (1958)*, *Merzbacher (1961)*, *Feynman, Leighton, Sands (1965)*, *Heisenberg (1967)*, *Petersen (1968)*, *DeWitt (1970)*, *Atkins (1974, 1977, 1978)*, *Landau, Lifshits (1977)*, *Bransden, Joachain (1983)*, *Resnick, Eisberg (1985)*, *Galindo, Pascual (1990, 1991)*, *Shankar (1994)*, *Ballentine (1998)*, *Bransden, Joachain (2000)*, *Liboff (2002)*, *Abers, Pearson (2004)*, *Blokhintsev (2004)*, *Griffiths (2004)*, *Vakarchuk (2004)*, *McMahon (2006)*, *Halliday (2007)*, *Hand, Finch (2008)*, *Teschl (2009)*, *Zettili (2009)*, *Laloe (2012)*, *Papirov (2013)*, *Rylov (2015)*, we can explain that there may be the *initial*

*observation stage*, the *transition stage* and the *final observation stage* in the *quantum mechanics science / the quantum physics science*, hence:

1. In the *transition stage*, the *single electron* can be in a *superposition state*, in which the *single electron* cannot be characterized by the *certain physical parameters* in the *time – space domain*. However, the *electron* can be accurately characterized by the *momentum*, *spin* and *other parameters* in the *final measurement state* only;

2. In the *final observation stage*, the *two different electrons* can occupy the *very same physical space*, if they have the *different spins* only.

Speaking about the *strategies* by *Apple Inc* in *Heracleous (2013)*, it is difficult to understand: How can the *innovation strategy* by *Apple Inc* and the *efficiency strategy* by *Apple Inc* in the *strategies superposition state* in *Heracleous (2013)* relate to the *superposition state* by the *single electron* in the *quantum mechanics/the quantum physics* in *Blokhintsev (2004)*? We can hypothetically suppose that the *innovation strategy* and the *degradation strategy* can exist in the *strategies superposition state* in the *quantum econophysics science*. Also, we can hypothetically suppose that the *efficient strategy* and the *inefficient strategy* can exist in the *strategies superposition state* in the *quantum econophysics science*. However, it makes no sense to state that the *two absolutely unrelated strategies* (the *innovation strategy* by *Apple Inc* and the *efficiency strategy* by *Apple Inc*) in *Heracleous (2013)* can create a *superposition state* in the *quantum econophysics science*.

*Heracleous (2013)* states: “Apple has achieved its outstanding performance through effectively implementing an unconventional strategy: differentiation through innovation (along various dimensions that include serial, strategic and incremental innovation) with simultaneous intense levels of efficiency, leading to the lowest costs in its peer group. Conventional wisdom holds that such strategies would be impossible to achieve in a long-term, sustainable timeframe, because they entail mutually contradictory investments and organizational processes. ... Apple has accomplished the Quantum Strategy within the same organizational setup, skillfully integrating elements of strategy that most other companies would consider distinct; and achieved long term competitive success in the process. ... Quantum strategy has enabled Apple to achieve super-normal profits in hyper-competitive industries with thin margins.”

In our opinion, the fact that the *Apples Inc* successfully created and executed the *differentiation through innovation strategy* on *one side*, and the *cost leadership strategy / the efficiency strategy* on *other side* at the *same time* in *Heracleous (2013)* does not mean the *Apples Inc* successfully created and executed the *quantum strategy*. The conclusion on the *quantum*

strategy by Apples Inc in *Heracleous (2013)*, which is derived, going from the *comparative analogy* between:

1. the fact on the *successful creation and execution* of both the *differentiation through innovation strategy* and the *cost leadership strategy / the efficiency strategy* by Apple Inc at the same time; and

2. the fact on that the *two different electrons* can occupy the *very same physical space* at the same time;

is *dubious* and *mistaken* from the *scientific point of view*, because the above mentioned comparison is made between:

1. the *two unrelated different business strategies* on *one side*; and
2. the *two similar quantum objects with distinctive parameters (the two electrons with the different spins)* on *other side*.

In other words, the *following scientific question* may arise: What are the *main criteria* for the *quantum strategy definition/characterization* in the *econophysics science* in *Heracleous (2013)*? As we explained early: “In the *final observation stage*, the *two different electrons* can occupy the *very same physical space*, if they have the *different spins* only.”

*Heracleous (2013)* expresses the following research opinion: “Porter’s classic strategies have shaped strategic thinking for decades, and Porter’s ideas have consistently been recognized as among the most influential in business. Most companies have employed the differentiation, cost leadership or niche strategies as a first approximation to their strategic thinking. The belief has been, as Porter had argued, that it is impossible to achieve the sustained, true combination of cost leadership and differentiation because of the inherent conflict that occur if a firm tried to do so. At the time Porter developed and popularized these ideas (later 1970s/early 1980s), this proposition was both reasonable and valid. Since then, however, things have changed. ... Apple is a master of Quantum Strategy, which is both unconventional as well as extremely difficult to implement. The company has accomplished serial innovation and outstanding design in terms of its offerings and its business model as well as simultaneous cost leadership, having become more efficient than the traditional cost leader, Dell.”

Analyzing the above research outcomes in *Heracleous (2013)*, we think that the *Porter’s research ideas* in *Porter (1980, 1998; 1985)*, *Miller, Friesen (1986a, b)*, *Miller (1988)* mostly relate to the *case* of the *small and medium size firms (the startups)* with the *limited available resources*. The *creation and implementation* of the *multivector strategy (the multiple strategies)* by the *startups* at the *same time* cannot be achieved successfully in view of the *existing obvious limitations* as far as the *financial/human/technological resources* is concerned. In the case of



*Apple Inc*, we have a different story, because the *Apple Inc* is *one of the biggest multinational corporations* with the approximate *firm's market valuation* of *US\$700bn* as of *December, 2014* in *Ive, Foulkes (March 6, 2015)*.

Therefore, thinking about the *expressed misleading research opinion* on the *Apple Inc* in *Heracleous (2013)*, we would like to say that the *modern firm* such as *Apple Inc* can *efficiently create and implement the multivector strategy* (the *multiple corporate strategies*) at the *same time*, including:

1. the *R&D strategy*;
2. the *manufacturing strategy*;
3. the *efficiency/cost leadership strategy*;
4. the *logistics strategy*;
5. the *sales strategy*;
6. the *marketing strategy*;
7. the *financial strategy*;
8. the *public relationships strategy*.

An important fact is that the ***formulation and implementation of the winning virtuous R&D strategy would lead to the superior product/service design by the modern firm, which could create a huge competitive advantage for the particular firm in relation to other firms in the corresponding goods/services market at the time of globalization.*** The existing differences in the *R&D strategies* between the *competing firms* define the *winners* and the *losers* in most of the cases. Here, let us explain that the *implementations of all the strategies*, including the *R&D strategy*, the *manufacturing strategy*, the *logistics strategy*, the *sales strategy*, the *marketing strategy*, the *financial strategy* and the *public relationships strategy* are normally well optimized among *all other key competitors* so that the *mentioned strategies implementation efficiency levels* among all the *competing firms* in the *corresponding markets* are pretty much similar.

In other words, ***the interlinking interlocking directors in the board of directors in the prosperous organizations such as the Apple Inc create and implement the unique R&D strategies, which result in the design of the new products/services/ecosystems for the potential customers in the corresponding markets.*** Let us note that the *Apple's winning virtuous R&D strategy* has been *successfully created and implemented* together with the *manufacturing strategy*, *logistics strategy*, *sales strategy*, *marketing strategy*, *financial strategy*, *public relationships strategy*, *etc* at the *same time*. We have to emphasize that the *other less successful competing firms* have been unable to *create and implement* their *winning virtuous R&D*

*strategies*, however they had all the *necessary capabilities* to realize/implement *all other strategies* at the *same time* quite efficiently.

Let us sum up all the *research statements* by saying that ***the unique winning virtuous R&D strategy creation and implementation by the Apple Inc is a key differentiating factor, which allows the modern firm like the Apple Inc to win the competition with other firms at the selected industries at the same time.***

The *creation and implementation* of the *multiple strategies* by the *modern firm* at the *same time period* can be regarded as a *certain type* of the *multivector strategy creation and execution*, but not the *quantum strategy creation and execution*. The *modern firm* wins a *fierce competition* with *other competing firms* due to its *unique winning virtuous R&D strategy creation and implementation mainly*, assuming that *the other competing firms* can *efficiently implement the multiple business strategies* in the *selected time frame*.

Let us compare the *authors' research statements* in this *article* with the *research findings* in *Heracleous (2013)*:

1. We propose that the *unique winning virtuous R&D strategy* (the *differentiation through innovation strategy*) by *Apples Inc*, *comparing to other R&D strategies* by the *competing companies*, mainly creates the *Apples Inc competitive advantage* in the *digital creative economies of the scales and scopes* at the *selected time periods*.

2. From other side, *Heracleous (2013)* thinks that the *successful creation and execution* of both the *R&D strategy* (the *differentiation through innovation strategy*) and the *cost leadership strategy / the efficiency strategy* within the *firm* such as *Apple Inc* results in the *Apples Inc competitive advantage appearance*. *Heracleous (2013)* misses the fact that it is necessary to compare the *R&D strategies* between the *various corporations*, because, in most cases, the *corporations* can create and implement *all the business strategies* quite efficiently.

Once again, we must understand the following fact that the *successful R&D strategy creation and implementation* is able to result in the *competitive advantage origination* mostly, because *all the modern global corporations* in the *high tech industries* are very *efficient in the implementation of their business strategies* (see the *above list of strategies*). Let us support our *research statements* by the citation on the *unique winning virtuous R&D strategy* by *Apple Inc* in *Ive, Foulkes (March 6, 2015)*: “[Apple’s] Hardware and software seem designed together in such a way that one cannot quite tell where the machine ends and the operating system begins. As a commercial strategy [the *R&D strategy*] it is undeniable brilliant, quickly enveloping users in a world they do not want to leave. But it is the clairvoyant ingenuity of it all that makes me marvel.”

Making the *innovative research on the multivector strategy vs. the quantum strategy at Apple Inc, we would like to provide a research comment that it is necessary to remember that the scientific term “quantum” in the quantum mechanics science / the quantum physics science has both its clear scientific definition and its certain scientific meaning; hence, we think that it would be beneficial for Heracleous (2013) to clearly understand the scientific terminology in the quantum mechanics science / the quantum physics science, avoiding the use of the word: “quantum” in the inappropriate cases in the published research article in Heracleous (2013).*

Using the knowledge on the *fundamental strategy theory in the business administration science / the microeconomics science 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), Shiryayev (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), Holt, Cameron (2010), Ledenyov D O, Ledenyov V O (2015b, n), we would like to point out to the fact that the creation and implementation of the two different corporate strategies at Apple Inc at the same time in Heracleous (2013) has to be scientifically qualified as the creation and implementation of the multiple different corporate strategies at Apple Inc at the same time, in other words, we have*

*the case of the creation and implementation of the multivector strategy by the Apple Inc at the selected time period.* The *multivector strategy* is well studied in the frames of the *fundamental strategy theory* in the *business administration science / the microeconomics science*.

### **Quantum strategy creation and implementation by Apple Inc**

The *quantum strategy* as a *new research topic* in the *business administration science / the microeconomics science* has been introduced for the *first time* in *Ledenyov D O, Ledenyov V O (2015n)*.

In our opinion, the *quantum strategy* in the *business administration science / the microeconomics science* must be accurately characterized by the *quantum mechanics/quantum physics sciences principles*. We think that the term: “*quantum*” has its *carefully defined scientific meaning* in the *natural sciences* such as the *quantum mechanics/quantum physics sciences* in *Planck (1900a, b, c, d, 1901, 1903, 1906, 1914, 1915, 1943), Einstein (1905, 1917, 1924, 1935), Einstein, Podolsky, Rosen (1935), Bohr (1922, 1924, 1933), de Broglie L (1924, 1925, 1926, 1927, 1928), Compton (1926), Compton A, Allison S K (1935), Schrödinger (1926, 1935), Schiff (1949), Akhiezer, Berestetsky (1953, 1964, 1980), Berestetsky, Lifshits, Pitaevsky (1980), von Neumann (1955), Dirac (1958), Merzbacher (1961), Feynman, Leighton, Sands (1965), Heisenberg (1967), Petersen (1968), DeWitt (1970), Atkins (1974, 1977, 1978), Landau, Lifshits (1977), Bransden, Joachain (1983), Resnick, Eisberg (1985), Galindo, Pascual (1990, 1991), Shankar (1994), Ballentine (1998), Bransden, Joachain (2000), Liboff (2002), Abers, Pearson (2004), Blokhintsev (2004), Griffiths (2004), Vakarchuk (2004), McMahan (2006), Halliday (2007), Hand, Finch (2008), Teschl (2009), Zettili (2009), Laloe (2012), Papirov (2013), Rylov (2015)*, hence it cannot be used as a *meaningless label* in *Heracleous (2013)* in application to the *scientific theories* in the *social sciences* such as the *business administration science / the microeconomics science*.

Speaking about the *quantum mechanics / the quantum physics* in *Ledenyov D O, Ledenyov V O (2015n)*, it is necessary to explain a few *interesting scientific facts* that the *Copenhagen interpretation* of the *quantum mechanics science* considers a *quantum phenomenon* as a process, which takes place from the *initial condition* through the *transitory state* to the *final condition*. The evolving understanding of the *quantum mechanics* led to the new theoretical discoveries, particularly, to the introduction of the *Schrödinger wave function*, which can accurately probabilistically characterize the *quantum system*, using the *probability distributions* in *Schrödinger (1926)*. One of the interesting facts is that the *probabilities distribution* depends

on the system's quantum state at the instant moment of the measurement in the quantum mechanics in Planck (1900a, b, c, d, 1901, 1903, 1906, 1914, 1915, 1943), Einstein (1905, 1917, 1924, 1935), Einstein, Podolsky, Rosen (1935), Bohr (1922, 1924, 1933), de Broglie L (1924, 1925, 1926, 1927, 1928), Compton (1926), Compton A, Allison S K (1935), Schrödinger (1926), Schiff (1949), Akhiezer, Berestetsky (1953, 1964, 1980), Berestetsky, Lifshits, Pitaevsky (1980), von Neumann (1955), Dirac (1958), Merzbacher (1961), Feynman, Leighton, Sands (1965), Heisenberg (1967), Petersen (1968), DeWitt (1970), Atkins (1974, 1977, 1978), Landau, Lifshits (1977), Bransden, Joachain (1983), Resnick, Eisberg (1985), Galindo, Pascual (1990, 1991), Shankar (1994), Ballentine (1998), Bransden, Joachain (2000), Liboff (2002), Abers, Pearson (2004), Blokhintsev (2004), Griffiths (2004), Vakarchuk (2004), McMahon (2006), Halliday (2007), Hand, Finch (2008), Teschl (2009), Zettili (2009), Laloe (2012), Papirov (2013), Rylov (2015).

In this connection, researching a scientific problem on the quantum strategy creation and implementation, the new **Quantum Strategy Creation Algorithm** in Ledenyov D O, Ledenyov V O (2015n) has been proposed to complement the **Modern Strategy Creation Algorithm** in Ledenyov D O, Ledenyov V O (2015b): “**The Quantum Strategy Creation Algorithm: 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 application of the quantum logic above 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 the 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).*

Let us take a minute and refresh the *scientific meanings* of the *inductive, deductive, abductive logics* in Wikipedia (2015) and the newly introduced *quantum logic (the probability logic)* in Ledenyov D O, Ledenyov V O (2015n):

1. **Inductive logic** – the logic of what is operative — reasons from the specific to the general. Induction allows inferring **a** entails **b** from multiple instantiations of **a** and **b** at the same time.
2. **Deductive logic** – the logic of what must be — reasons from the general to the specific. Deduction allows deriving **b** as a consequence of **a**. In other words, deduction is the process of deriving the consequences of what is assumed.
3. **Abductive logic** – the logic of what could possibly be true – reasons through successive approximation. Abduction allows inferring **a** as an explanation of **b**, because of this, abduction allows the precondition **a** to be inferred from the consequence **b**.
4. **Quantum logic (Probability logic)** – the logic of what may occur – reasons through computing of events probabilities distributions. Quantum logic allows **a** and **b** to be realized, depending on **a** and **b** events probabilities distributions equal to square of Schrödinger's wave function.

We would like to illustrate the distinctions between the *quantum logic (the probability logic)* and the *inductive, deductive and abductive logics (the value based logic, the binary logic)*, making a citation with the detailed explanation in Ledenyov D O, Ledenyov V O (2015n):

1. “We can illustrate the *probability logic*, by using the *quantum mechanics* and by saying that the *probability* that the *Schrödinger cat* may be *alive* or *dead* (the *two possible choices*) in the *superposition state* in the *observable closed box* is 50% until the *moment of the measurement* in *Schrödinger (1935)*. In other words, the *interlocking interconnecting director* in the *board of directors* in the *organization* must consider the *probabilities distribution* of the *various events*, related to *the particular business matter / situation*, before the moment of the creation of the *quantum business strategy*.

2. We can describe the *value based logic* by referring to the *inductive, deductive and abductive logics* and by showing that it operates with / converges to the *values: Yes and/or No*, hence it has some similarity with the *binary logic: 1 and/or 0*. It means that, the *interlocking interconnecting director* in the *board of directors* in the *organization* must *inductively / deductively / abductively* come to the conclusion: *Yes and/or No*, related to *the particular business matter / situation*, before the moment of the creation of the *usual business strategy*.”

Going from the *suggested scientific ideas framework*, we can also demonstrate an essence of the *quantum logic* (the *probability logic*), using a practical example of the ***quantum random number generator on the magnetic flux qubits*** chipset in *Ledenyov V O, Ledenyov O P, Ledenyov D O (2002)* in analogy with the *Schrödinger wave function / Schrödinger cat representation* in *Schrödinger (1935)*. For example, the *special entanglement* of the *qubits*, with the *probability* of 50% that *any particular qubit* exists in a *superposition state* of being *0* and being *1*, can be achieved in the *quantum random number generator on the magnetic flux qubits* chipset in *Ledenyov V O, Ledenyov O P, Ledenyov D O (2002)*.

In the *business administration science / the microeconomics science*, we would like to make a *few empirical research comments*, explaining that the *practical creation and implementation* of the ***Quantum Strategy Creation Algorithm*** can be realized by the *interlocking interconnecting directors* in the *board of directors* in the *modern organization* at the *time of the global integration/disintegration* in agreement with the use of the *following greatly simplified strategic actions scheme* in *Ledenyov D O, Ledenyov V O (2015n)*:

1. the *interlocking interconnecting director* absorbs the *information of interest* on the *particular business events/processes/ecosystems*,

2. the *interlocking interconnecting director* applies the *creative imperative integrative intelligent conceptual co-lateral adaptive logarithmic thinking process* to analyze the *particular business events/processes/ecosystems*,

3. the *interlocking interconnecting director* uses the *inductive, deductive and abductive logics* (the *value based logic*, the *binary logic*) to come to a certain *logical conclusion*

on the *desirable corporate strategy of the choice during the strategic choice structuring process* in *Ledenyov D O, Ledenyov V O (2015b)*,

4. the *interlocking interconnecting director* applies the *quantum logic* (the *probability logic*) to evaluate the *corporate strategy of the choice*, with the *ultimate purpose* to create the *quantum strategy* or to disregard the *corporate strategy of the choice during the strategic choice structuring process*, and then

5. the *interlocking interconnecting directors* in the *board of directors* implement the *quantum strategy* in the *digital creative economies of the scales and scopes* at the *selected time period*.

Going from the *true meaning of the quantum strategy* in *Ledenyov D O, Ledenyov V O (2015n)*, we can assume that the *Apple Inc* had been able to create and implement its *quantum strategy*, primarily based on the *quantum leap* in the *innovative design* and *advanced technology* applications, to outperform the *competitors* in the *global markets* of the *wireless computing devices*, the *laptop computers*, the *electronic timepieces* and the *operating systems* at the *certain time periods*, however we propose to clearly distinguish the *multivector strategy* by *Apply Inc* (the mistakenly treated/labeled as the *quantum strategy* in *Heracleous (2013)*) from the true *quantum strategy* by *Apply Inc* in *Ledenyov D O, Ledenyov V O (2015n)*.

Looking forward, in our opinion, the *main question* to understand is: Will the *interlinking interlocking directors* in the *board of directors* in the *Apple Inc* be able to sustain a fierce competition from the competitors and continue to maintain its competitive advantage in the *time of globalization*?

Answering the *challenging question*, we think that the *interlinking interlocking directors* in the *board of directors* in the *Apple Inc* must continue to create and implement its *constantly updated/improved quantum strategy*, aiming to design the new *wireless computing devices*, *laptop computers*, *electronic timepieces*, *operating systems* and having an ultimate goal to satisfy the *customers' experiences* and to increase the *Apple Inc market valuation* on its way to the *prosperity* in the *digital creative economies of the scales and scopes* in the *selected time period*.

Finalizing *all our research statements*, let us say that the *authors' general strategic vision* is that the *interlinking interlocking directors* in the *boards of directors* in the *complex organizations* will greatly benefit by creating and by implementing the *quantum strategies*, pursuing the *ultimate goal* to build the *prosperous organizations* in the *digital creative economies of the scales and scopes* at the *time* of the *disruptive changes and opportunities* by the *globalization*.



## Conclusion

In an *information century*, the *leading scientifically/technologically advanced states* create the *quantum devices/technologies development roadmaps*, trying to predict/outline/evaluate the *future progress* in the *quantum devices/technologies* in the *economies of the scales and scopes* for the *years to come*. The *progress* in the *quantum devices/technologies development* depends on the state of matters in the *natural sciences* (the *physics, chemistry, mathematics sciences*) as well as the *hi-tech industries* (the *electronics, computer, materials processing industries*) in the *economies of the scales and scopes* presently. The examples of the *quantum devices/technologies* in the *natural sciences/the hi-tech industries* are the designs of the *thermonuclear and nuclear reactors*, the *high power gas lasers*, the *low power semiconductor heterostructures lasers*, the *quantum random number generators on the magnetic flux qubits chipsets*, the *quantum random number generators on the laser noise*, the *superconducting quantum interference devices*, the *photonic processors*, the *quantum processors*, the *single electron transistors*, the *semiconductor heterostructures transistors*, the *quantum cryptography optical devices/networks*, etc in Ledenyov D O, Ledenyov V O (2015a).

In an *age of the quantum disruption*, the *most progressive scientifically/technologically advanced states* continue to invest heavily in the *innovative research programs* on the *quantum technologies/principles application* in the *social sciences* with the aim to improve/optimize the *existing scientific theories / the management practices* in the *economics/finance/business administration/state governance*. The examples of the *quantum principles application* in the *social sciences* are the creations of the *quantum macroeconomics theory*, the *quantum microeconomics theory*, the *quantum theory of firm*, the *foreign currencies exchange indices quantum forecast theories with the use of the wave function*, the *quantum money*, the *quantum strategies*, etc in Ledenyov D O, Ledenyov V O (2015h, i, j, k, l m, n).

In this connection, the *innovative research* on the application of the *scientific principles* in the *quantum mechanics science / the quantum econophysics science* with the purpose to understand and to accurately characterize the *business strategies* by the *interlocking interconnecting directors* in the *board of directors* in the *modern firms* looks very attractive from the *scientific point of view* in Ledenyov D O, Ledenyov V O (2015b, n).

In this *research article*, we proposed that the *quantum strategy* can be considered as a *most effective winning virtuous organizational strategy*, allowing the *board of directors* to build a *prosperous organization* with the *optimal business model* in the *economies of the scale and scopes* at the *time of the great opportunities and unexpected challenges* by the *globalization*.

We provided a *concise definition* on the *quantum strategy*: *The organizational strategy, which can be derived with the use of the quantum strategy search algorithm by the interlocking interconnecting directors in the board of directors in the modern organization at the time of the increasing global integration.*

We demonstrated that the *quantum strategy search algorithm* applies the *quantum logic* (the *probabilistic logic*) on the top of the *inductive, deductive and abductive logics* (the *value based logics*), aiming to create the *most effective optimal winning virtuous organizational strategy* by the *interlocking interconnecting directors in the board of directors in the modern organization* in the information century. We compared the *quantum strategy search algorithm* with the *modern strategy search algorithm*, showing the *characteristic distinctions* in the used logics.

We highlighted the *main existing differences* between the *multivector strategy* (the *multiple different strategies implementation at the selected time period*) and the *quantum strategy* (the *most effective optimal winning virtuous organizational strategy implementation at the selected time period*), considering the *real-life case study* on the *strategy formulation and execution* by the *interlocking interconnecting directors in the board of directors in the Apple Inc.*

We expressed a *research opinion* that the *quantum strategy* in the *business administration science / the microeconomics science* can be clearly defined /distinguished in line with the *generally accepted scientific definitions/meanings/principles* in the *quantum mechanics science*.

We think that the *interlinking interlocking directors in the boards of directors in the prosperous organizations* will continue to create and implement the *quantum strategies* to *increase the firms' market valuations and outperform the competitors* in the *digital creative economies of the scales and scopes* at the *time of globalization*.

Going from *our present research stand point*, we believe that the better understanding on the *quantum mechanics / quantum physics / quantum chemistry* by the *scientists* will continue to progress rapidly, creating a *necessary knowledge base* for the *groundbreaking inventions* towards the *new quantum device technologies* in the *natural sciences* as well as the *new quantum theories / the quantum methods / the quantum principles* in the *social sciences*.

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