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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


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):

\[
\begin{bmatrix}
    d_{1,1} & d_{1,2} & d_{1,j} \\
    d_{2,1} & d_{2,2} & d_{2,j} \\
    d_{i,1} & d_{i,2} & d_{i,j}
\end{bmatrix}
\]

where \( d_{i,j} \) is the position of a director’s seat in the matrix.

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):

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

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 \( t \),

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

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

\( c \) 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.”

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 *successful creation and execution of the differentiation through innovation strategy* and the *cost leadership strategy / the efficiency strategy* by **Apple Inc**; and
2. the fact that the *two different electrons* can occupy the *very same physical space*;

is dubious, because the comparison is made between:

1. the *two unrelated different 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 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.”

Therefore, 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).

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.

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 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) as in Ledenyov D O, Ledenyov V O (2015n):

I. “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*.”

We can also demonstrate the *quantum logic* (the *probability logic*), using the 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 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 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 simplified scheme* in Ledenyov D O, Ledenyov V O (2015n):

1. 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*, and then

2. 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* as explained before.

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* in

The authors’ 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 at the time of the disruptive changes and opportunities by the globalization.

Conclusion

In an information century, the leading states create the quantum devices/technologies development roadmaps, trying to predict/outline/evaluate the future progress in the quantum devices/technologies development 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 economy of the scale and scope. In this connection, the innovative research on the application of the scientific principles in the quantum mechanics science / the quantum econophysics science with the aim 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.

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 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 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 their valuations and outperform the competitors in the economies of the scales and scopes at the time of globalization.

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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 algorithm ECE James Cook University Townsville Australia, Kharkov Ukraine.

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