Multivector strategy vs quantum strategy by Apple Inc

Ledenyov, Dimitri O. and Ledenyov, Viktor O.

James Cook University, Townsville, Australia

23 December 2015

Online at https://mpra.ub.uni-muenchen.de/68557/
MPRA Paper No. 68557, posted 29 Dec 2015 06:45 UTC
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.

JEL code: C0, G21, G24, G30, G34, L1, L4, M2.

PACS numbers: 89.65.Gh, 89.65.-s, 89.75.Fb.

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):

\[
\text{Board of Directors} = \begin{vmatrix}
  d_{1,1} & d_{1,2} & d_{1,j} \\
  d_{2,1} & d_{2,2} & d_{2,j} \\
  d_{i,1} & d_{i,2} & d_{i,j}
\end{vmatrix},
\]

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):

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

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 \( t \),

\( \text{board}_{t, j} \) 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 Apple 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).


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):

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.”

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.

Acknowledgement

Authors acknowledge the multiple scientific discussions on the econophysics, the quantum mechanics and the quantum physics with Oleg P. Ledenyov in Kharkov, Ukraine in 2015. The first author appreciates many hours of the research polemics on the quantum effects in the superconducting electronics with Janina E. Mazierska at James Cook University in Townsville, Australia in 2000 - 2015. The second author appreciates the useful scientific discussions on the quantum effects in the superconducting quantum interference device (SQUID) with Jesper Mygind at Technical University of Denmark in Lyngby, Denmark and Copenhagen, Denmark in 1995, 1996-1997. The second author would like to make a comment that the Niels Bohr’s visit to Kharkiv, Ukraine in 1933 led to the serious progress in the nuclear physics and the subsequent creation of the econophysics science, and the second author’s visits to Lyngby, Denmark and Copenhagen, Denmark in 1995, 1996-1997 resulted in the new theories formulation in the modern econophysics science. The second author expresses his gratitude for a kind invitation to present a scientific talk on the measurement of the magnetic flux qubit by the SQUID at the scientific seminar, organized by Peter Kes at Leiden University in The Netherlands in 1998. The second author thanks for a wonderful opportunity to conduct an important exchange by the research opinions on the fundamental theory of strategy during our numerous private discussions with Roger L. Martin at University of Toronto and at Empire Club of Canada in Toronto, Canada in 1998 - 1999 and in 2005 - 2006.

*E-mail: dimitri.ledenyov@my.jcu.edu.au,

ledenyov@univer.kharkov.ua.
References:

Economics Science, Finance Science, Economic History Science:


7. Menger C 1871 Principles of Economics (Grundsätze der Volkswirtschaftslehre) Ludwig von Mises Institute Auburn Alabama USA

8. Bagehot W 1873, 1897 Lombard Street: A description of the money market Charles Scribner's Sons New York USA.


10. von Böhm-Bawerk E 1884, 1889, 1921 Capital and interest: History and critique of interest theories, positive theory of capital, further essays on capital and interest Austria; 1890 Macmillan and Co Smart W A (translator) London UK


13. Schumpeter J A 1906 Über die mathematische methode der theoretischen ökonomie ZfVSV Austria.


15. Schumpeter J A 1911; 1939, 1961 Theorie der wirtschaftlichen entwicklung; The theory of economic development: An inquiry into profits, capital, credit, interest and the business cycle Redvers Opie (translator) OUP New York USA.


19. Slutsky E E 1915 Sulla teoria sel bilancio del consumatore *Giornale degli economisti e rivista di statistica* 51 no 1 pp 1 – 26 Italy.


21. von Mises L 1912 The theory of money and credit *Ludwig von Mises Institute* Auburn Alabama USA


27. Ellis H, Metzler L (editors) 1949 Readings in the theory of international trade *Blakiston* Philadelphia USA.

28. Friedman M (editor) 1953 Essays in positive economics *Chicago University Press* Chicago USA.


Juglar Economic Cycle in Macroeconomics:


*Kondratiev Economic Cycle in Macroeconomics:*

53. Tugan-Baranovsky M 1894 Industrial crises in contemporary England: Their causes and influences on the life of the people *St Petersburg/Moscow* Russian Federation.


56. Kondratieff N D 1925 The big cycles of conjuncture *The problems of conjuncture* 1 (1) pp 28 – 79.


60. Kondratieff N D 1984 The Long wave cycle *Richardson & Snyder* New York USA.


64. Kowal L 1973 The market and business cycle theories of M I Tugan-Baranovsky *Revista Internazionale di Scienze Economiche e Commercial* vol 20 part 4 Padova Italy.


72. Van Duijn J J 1979 The long wave in economic life *De Economist* 125 (4) pp 544 – 576.


74. Van Duijn J J 1983 The long wave in economic life *Allen and Unwin* Boston MA USA.


78. Tinbergen J 1981 Kondratiev cycles and so-called long waves: The early research *Futures* 13 (4) pp 258 – 263.


83. Wallerstein I 1984 Economic cycles and socialist policies *Futures* 16 (6) pp 579 – 585.
84. Zarnowitz V 1985 Recent work on business cycles in historical perspective: Review of
theories and evidence Journal of Economic Literature 23 (2) pp 523 – 580.
85. Summers L H 1986 Some skeptical observations on real business cycle theory Federal
Reserve Bank of Minneapolis Quarterly Review 10 pp 23 – 27.
86. Freeman C 1987 Technical innovation, diffusion, and long cycles of economic development
87. Freeman C, Louçã F 2001 As time goes by: From the industrial revolutions to the
information revolution Oxford University Press Oxford UK.
88. Goldstein J 1988 Long cycles: Prosperity and war in the modern age Yale University Press
New Haven CT USA.
swings Cambridge University Press Cambridge UK.
90. Berry B J L 1991 Long wave rhythms in economic development and political behavior Johns
Hopkins University Press Baltimore MD USA.
91. Metz R 1992 Re-examination of long waves in aggregate production series New Findings in
Long Wave Research Kleinknecht A, Mandel E, Wallerstein I (editors) St. Martin’s New
York USA pp 80 – 119.
92. Metz R 1998 Langfristige wachstumsschwankungen – Trends, zyklen, strukturbrüche oder
zufall Kondratieffs Zyklen der Wirtschaft. An der Schwelle neuer Vollbeschäftigung?
93. Metz R 2006 Empirical evidence and causation of Kondratieff cycles Kondratieff Waves,
Warfare and World Security Devezas T C (editor) IOS Press Amsterdam
The Netherlands pp 91 – 99.
94. Tylecote A 1992 The long wave in the world economy Routledge London UK.
95. Cooley Th (editor) 1995 Frontiers of business cycle research Princeton University Press
USA ISBN 0-691-04323-X.
96. Modelski G, Thompson W R 1996 Leading sectors and world politics: The co-evolution of
global politics and economics University of South Carolina Press Columbia SC USA.
pp 75 – 80.
98. Modelski G 2006 Global political evolution, long cycles, and K-waves Kondratieff Waves,
Warfare and World Security Devezas T C (editor) IOS Press Amsterdam
The Netherlands pp 293 – 302.

100. Perez C 2002 Technological revolutions and financial capital – The dynamics of bubbles and golden ages *Edward Elgar* Cheltenhem UK.


**Kitchin Economic Cycle in Macroeconomics:**


**Kuznets Economic Cycle in Macroeconomics:**

110. Kuznets S 1924 Economic system of Dr. Schumpeter *M. Sc. Thesis under Prof. Wesley Clair Mitchell* Columbia University NY USA.

111. Kuznets S 1930 Secular movements in production and prices *Ph. D. Thesis under Prof. Wesley Clair Mitchell* Columbia University NY USA.
112. Kuznets S 1930 Secular movements in production and prices. Their nature and their bearing upon cyclical fluctuations *Houghton Mifflin* Boston USA.


118. Kuznets S 1968 Toward a theory of economic growth, with reflections on the economic growth of modern nations.

119. Kuznets S 1971 Economic growth of nations: Total output and production structure.


**Accurate Characterization of Properties of Economic Cycles in Macroeconomics:**


139. Hicks J R 1950 A contribution to the theory of the trade cycle *Oxford University Press* Oxford UK.


158. Sussmuth B 2003 Business cycles in the contemporary World Springer Berlin Heidelberg Germany.
159. Hirooka M 2006 Innovation dynamism and economic growth: A nonlinear perspective Edward Elgar Cheltenham UK Northampton MA USA.


164. Jourdon Ph 2008 La monnaie unique Europeenne et son lien au developpement economique et social coordonne: une analyse cliometrique *Thèse Universite Montpellier* France.

165. Taniguchi M, Bando M, Nakayama A 2008 Business cycle and conserved quantity in economics *Journal of the Physical Society of Japan* vol **77** no 11.


173. Uechi L, Akutsu T 2012 Conservation laws and symmetries in competitive systems
   \textit{Progress of Theoretical Physics Supplement} no 194 pp 210 – 222.

174. Central Banking Newsdesk 2013 Swiss board member supports counter-cyclical capital
   buffer
   http://www.centralbanking.com/central-banking/speech/2203857/swiss-board-member-
supportscountercyclical-capital-buffer.

175. Union Bank of Switzerland 2013 UBS outlook Switzerland
   http://www.ubs.com/global/en/wealth_management/wealth_management_research/ubs_outlo-
   ok_ch.html.

176. Da Costa 2015 Weak first-quarter growth due to seasonal issues after all, SF Fed says
   \textit{The Wall Street Journal} New York USA.

177. Federal Reserve Bank of St Louis 2015 US Federal Reserve Economic Data (FRED)
   Federal Reserve Bank of St Louis
   http://research.stlouisfed.org/fred

178. Desai M, King St, Goodhart Ch 2015 Hubris: why economists failed to predict the crisis
   and how to avoid the next one \textit{Public Lecture on 27.05.2015} London School of Economics
   and Political Science London UK
   http://media.rawvoice.com/lse_publiclecturesandevents/richmedia.lse.ac.uk/publiclecturesan-
devnts/20150527_1830_hubris.mp4.

179. Desai M 2015 Do we need a new macroeconomics? \textit{Public Lecture on 09.07.2015}
   London School of Economics and Political Science London UK (the presentation was made
   after the publication of an initial version of our research article at the MPRA and SSRN)
   http://media.rawvoice.com/lse_publiclecturesandevents/richmedia.lse.ac.uk/publiclecturesan-
devnts/20150709_1830_needNewMacroeconomics.mp3.

180. Wall Street Journal 2015a Economic forecasting survey US GDP (quarterly) for 5 years
   (28.06.2015) Wall Street Journal New York USA
   http://projects.wsj.com/econforecast/#ind=gdp&r=20

181. Wall Street Journal 2015b Economic forecasting survey US GDP (quarterly) for 7 years
   (28.06.2015) Wall Street Journal New York USA
   http://projects.wsj.com/econforecast/#ind=gdp&r=28

182. Wikipedia (English) 2015c Business cycle \textit{Wikipedia} California USA

\textit{Firm Theory Science, Business Administration Science:}
183. Babbage Ch 1832 On the economy of machinery and manufacturers Charles Knight 13 Pall Mall East London UK.


189. Ohlin B 1933 Interregional and international trade Harvard University Press Cambridge Massachusetts USA.


206. Fogel R 1964 Railroads and American economic growth: Essays in econometric history *Johns Hopkins Press* Baltimore USA.


208. Stigler G 1968 The organization of industry *Richard Irwin Inc* Homewood USA.


238. Perrow C 1986 Complex organizations Random House New York USA.

Board of Directors Science, Interlocking Directors Networks Science, Firms Networks Science, Social Networks Science:
250. Brandeis L D 1933 Other people’s money-and how the bankers use it Jacket Library
Washington National Home Library Foundation USA.
pp 95 – 116.
252. Selznick P 1949 TVA and the grass roots University of California Press Los Angeles
California, Harper & Row New York USA.
Mathematics 8 pp 399 – 404.
255. Hopkins T K 1964 The exercise of influence in small groups Bedminster Press Totawa
New Jersey USA.
257. Travers A H 1968 Interlock in corporate management and the antitrust laws Texas Law
Review 45 p 819.
258. Vance S C 1968 The corporate director. A critical evaluation Dow-Jones Irvine
Homewood Illinois USA.
pp 314 – 323.
260. Harary F 1969 Graph theory Addison-Wesley Reading MA USA.
261. Bunting D, Barbour J Autumn 1971 Interlocking directorates in large American
262. Bunting D 1976 Corporate interlocking, part III - Interlocks and return on investment
Directors & Boards 1 pp 4 – 11.
263. Mace M L 1971 Directors: Myths and reality Harvard University Press Cambridge
Massachusetts USA.
264. Pfeffer J 1972 Size and composition of corporate boards of directors: The organization
and its environment Administrative Science Quarterly 17 pp 218 – 228.
265. Pfeffer J 1973 Size, composition, and function of hospital boards of directors: A study of
266. Pfeffer J, Salancik G R 1978 The external control of organizations: A resource-
dependency perspective Harper & Row New York USA.
268. Pfeffer J 1983 Organizational demography in Research in organizational behavior
283. Tukey J W 1977 Exploratory data analysis Addison-Wesley USA.
285. Freeman L 1979b Visualizing social networks School of Social Sciences University of California Irvine California USA.


300. Mizruchi M S 1992 The structure of corporate political action *Harvard University Press* Cambridge USA.


306. Barnes J A 1983 Graph theory in network analysis *Social Networks* vol **5** pp 235 – 244.


313. American Bar Association 2011 Interlocking directorates *Handbook on Section 8 of the Clayton Act* Washington USA.


317. Useem M 1984 The inner circle *Oxford University Press* New York USA.


361. Demb A, Neubauer F F 1992 The corporate board: Confronting the paradoxes Oxford University Press NY USA.


391. Krackhardt D 1994 Graph theoretical dimensions of informal organizations in Computational organization theory Carley K M, Prietula M J (editors) *Lawrence Erlbaum Ass Hillsdale USA.*


421. Park S, Rozeff M 1996 The role of outside shareholders, outside boards, and management entrenchment in CEO selection Working Paper SUNY Buffalo NY USA.


427. Bianco M, Pagnoni E 1997 I Legami creati tra le societa' quotate dagli interlocking
directorates: Il caso delle banche Quaderni di Moneta e Credito Banca Nazionale del Lavoro
Italy.
430. Hallock K 1997 Reciprocally interlocking boards of directors and executive
New York University NY USA.
432. Loderer C, Martin K 1997 Executive stock ownership and performance: Tracking faint
433. Loderer C, Peyer U September 5 2001, 2002 Board overlap, seat accumulation, and share
prices Social Science Research Network USA SSRN-id273465.pdf, European Financial
Management 8 pp 165 – 192.
434. Podolny J M, Baron J N 1997 Resources and relationships: Social networks and mobility
in stakeholder research Proceedings of the 9th Annual Meeting of the International
Association for Business and Society.
437. Elms H, Berman S L, Rowley T J 2000 Network influences on CEO compensation
Proceedings for the 11th Annual International Association for Business & Society Vermont
USA.
analysis of structural and relational embeddedness in the steel and semiconductor industries
439. Rowley T J June 3, 2005a Invited talk on Canadian directors networks Rotman School of
Management Alumni Meeting 2005 Fairmont Royal York Hotel Toronto Canada.
440. Rowley T J June 3, 2005b Private communications on the directors networks in the board
of directors of the North American corporations Rotman School of Management Alumni
Meeting 2005 Fairmont Royal York Hotel Toronto Canada.


444. Miller G T March 26 1997 Interlocking directorates and the antitrust laws *Colorado Lawyer* 53.


448. Collin S-O 1998 Why are these islands of conscious power found in the ocean of ownership? Institutional, governance hypotheses explaining the existence of business groups in Sweden *Journal of Management Studies* 35 pp 719 – 746.


461. Hopt K J 1998 The German two-tier board: Experience, theories, reforms in Comparative corporate governance: The state of the art and emerging research Hopt K J (editor) *Clarendon* USA


481. Borgatti S P 2002 Basic social network concepts AoM PDW Denver CO USA.


488. Davies A 1999 A strategic approach to corporate governance *Gower* Cambridge UK.


494. Maman D 2001 The organizational connection: Social capital, the career expansion of directors of business groups in Israel *Social Science Research* 30 pp 578 – 605.


503. Fich E 2000 Do directors who are CEOs of other firms enhance firm performance? UNC Working Paper University of North Carolina NC USA.


507. Miwa Y, Ramseyer M 2000 The value of prominent directors: Lessons in corporate governance from transition Japan University of Tokyo, Harvard University Japan, USA.


511. Ferri G, Masciandaro D, Messori M 2001 Corporate governance, board turnover and performance: The case of local banks in Italy Paolo Baffi Centre Working Paper no 01-150 Italy.


525. Tomka B 2001 Interlocking directorates between banks and industrial companies in Hungary at the beginning of the twentieth century *Business History* 43 (1) pp 25 – 42.
532. Carver J 2002 Corporate boards that create value: Governing company performance from the boardroom *Jossey-Bass USA*. 


568. Stablein R, Cleland P, Mackie B, Reid D 2004 New Zealand exchange limited (nzx) boards and directors: It is a small world after all Working Paper.
572. Charan R 2005 Boards that deliver: Advancing corporate governance from compliance to competitive advantage Jossey-Bass USA.
574. Hanneman R A, Riddle M 2005 Introduction to social network methods University of California Riverside California USA http://faculty.ucr.edu/~hanneman/.


580. Aguilera R V 2006 National state differences and patterns of directorship interlocks: A comparative study of Italy and Spain MIT USA


582. Batagelj V, Mrvar A 2006 Pajek University of Ljubljana.


http://mpra.ub.uni-muenchen.de/4420/ .

587. Carretta A, Farina V, Schwizer P 2006 Evaluating the board of directors of financial intermediaries: Competencies, effectiveness and performance University of Rome “Tor Vergata” Italy MPRA Paper no 8299 Munich University Germany pp 1 – 28
http://mpra.ub.uni-muenchen.de/8299/ .

588. Farina V 2008 Banks' centrality in corporate interlock networks: Evidences in Italy Sefemeq Department University of Rome “Tor Vergata” Italy MPRA Paper no 11698 Munich University Germany pp 1 – 31
http://mpra.ub.uni-muenchen.de/11698/ .

590. Chhaochharia V, Grinstein Y 2006b Executive compensation and board structure Working Paper Cornell University USA.


613. Ibarra H 2007 What you know or who you know? *INSEAD Knowledge-casts* INSEAD France.


616. Malloy Chr 2007 Social networks *Public Lecture* London School of Economics and Political Science London UK.

617. Murray A S 2007 Revolt in the boardroom: The new rules of power in corporate America *Collins* USA.


624. Santella P, Drago C, Polo A, Gagliardi E 2009 A comparison among the director networks in the main listed companies in France, Germany, Italy, and the United Kingdom *MPRA Paper no 16397* Munich University Germany pp 1 – 19 http://mpra.ub.uni-muenchen.de/16397/.


630. Vermeulen Fr 2008 How companies can get lucky and succeed Public Lecture London School of Economics and Political Science London UK.


632. Tutelman H 2008 The balance point: New ways business owners can use boards Famille Press USA.


649. Schifeling T, Mizruchi M S August 27 - 28 2012 The decline of the American corporate network 1960-2010 *Corporate Networks in the 20th century Conference* University of Lausanne USA.


651. Anderson R, Sawyer H 2014 The board of directors as an agent of change in turnarounds *Transaction Advisors* ISSN 2329-9134 https://www.transactionadvisors.com/insights/board-directors-agent-change-turnarounds ,
Whitehead Ch K December 22, 23 2014 Private communications on the boards of directors overlap in publicly traded and non-traded firms in the USA V N Karazin Kharkiv National University Kharkiv Ukraine.


Wikipedia January 15 2015 Board of directors USA


Strategic Science, Strategic Governance Science, Management Science:


664. Andrews K R 1971a The concept of corporate strategy Richard D Irwin Homewood USA.


models and economics Taylor T H (editor) North-Holland Publishing Company Amsterdam The Netherlands.


678. Porter M E 1983 Analyzing competitors: Predicting competitor behavior and formulating offensive and defensive strategy in Policy, strategy, and implementation Leontiades M (editor) Random House USA.


695. Porter M E 2001b The technological dimension of competitive strategy in Research on technological innovation, management and policy vol 7 Burgelman R A, Chesbrough H (editors) JAI Press Greenwich CT USA.


705. Yelle L E 1979 The learning curve: Historical review and comprehensive survey Decision Sciences 10 (2) pp 302 – 328.


730. McKiernan P 1997 Strategy past, strategy futures Long range planning vol 30 no 5 p 792.


735. Moldoveanu M, Martin R L 2001 Agency theory and the design of efficient governance mechanisms Joint Committee on Corporate Governance Meeting Rotman School of Management University of Toronto Ontario Canada pp 1 – 57.


737. Martin R L 2007 Becoming an integrative thinker Rotman Magazine Rotman School of Management University of Toronto Ontario Canada pp 4 – 9.
738. Martin R L 2007 Designing the thinker Rotman Magazine Rotman School of Management University of Toronto Ontario Canada pp 4 – 8.
749. Drejer A 2002 Strategic management and core competencies 1st edition Quorum Books Westport Connecticut USA.
www.blueoceanstrategy.com ,
https://smart.ly/blue-ocean-strategy/.

www.thinkers50.org .

756. Roney C 2004 Strategic management methodology 1st edition Praeger Westport
Connecticut USA.

Thomson Higher Education Mason OH USA.

USA.

759. Hitt M, Ireland R, Hoskisson R 2007 Management of strategy 1st edition Thomson/South-
Western Australia.

760. Kirkbride P S 2007 Developing a leadership and talent architecture MBS Leader-casts
Melbourne Business School Melbourne Australia.

761. Murphy T, Galunic Ch 2007 Leading in the age of talent wars INSEAD Leader-casts
INSEAD France.

India.

763. Sull D 2007a Simple rules: Strategy as simple rules Part II Public Lecture London School
of Economics and Political Science London UK.

764. Sull D 2007b Closing the gap between strategy and execution: Strategy and its
discontents Public Lecture London School of Economics and Political Science London UK.

765. Sull D 2007c Closing the gap between strategy and execution: Making hard choices
Public Lecture London School of Economics and Political Science London UK.

766. Sull D 2007d Closing the gap between strategy and execution: The strategy loop in action
Public Lecture London School of Economics and Political Science London UK.

767. Sull D 2008 An iterative approach to the strategy Public Lecture London School of
Economics and Political Science London UK.

768. Teece D J, Winter S 2007 Dynamic capabilities: Understanding strategic change in
organizations Blackwell Oxford UK.

769. Samuels R 2008 Japan's grand strategy Public Lecture on 13.10.2008 London School of
Economics and Political Science London UK

63
http://www.lse.ac.uk/collections/LSEPublicLecturesAndEvents/events/2008/20080819t1316z001.htm
http://richmedia.lse.ac.uk/publicLecturesAndEvents/20081013_1830_japansGrandStrategy.mp3

770. Chamberlain G P 2010 Understanding strategy Create Space Charleston South Carolina USA.


772. Heracleous 2013 Quantum strategy by Apple Inc Organizational Dynamics 42 pp 92 – 99
www.elsevier.com/locate/orgdyn .

http://mpra.ub.uni-muenchen.de/61681/ ,

http://mpra.ub.uni-muenchen.de/68404/ ,

**Disruptive Innovation in Technology, Economics and Finances:**

775. Schumpeter J A 1911; 1939, 1961 Theorie der wirtschaftlichen entwicklung; The theory of economic development: An inquiry into profits, capital, credit, interest and the business cycle Redvers Opie (translator) OUP New York USA.


794. Christensen C M 1999a Innovation and the general manager Irwin McGraw-Hill Homewood IL USA.

795. Christensen C M 1999b Impact of disruptive technologies in telecommunications in Bringing PC economies to the telecommunications industry PulsePoint Communications.


800. Christensen C M, Craig Th, Hart S March April 2001 The great disruption Foreign Affairs 80 no 2.


808. Christensen C M June 2002 The rules of innovation Technology Review.


812. Shah Ch D, Brennan T A, Christensen C M April 2003 Interventional radiology: Disrupting invasive medicine.

813. Christensen C M March April 2003 Beyond the innovator's dilemma Strategy & Innovation 1 no 1.


841. Farina V 2008 Network embeddedness, specialization choices and performance in investment banking industry *University of Rome Tor Vergata* Italy *MPRA Paper no 11701* Munich University Munich Germany pp 1 – 26 http://mpra.ub.uni-muenchen.de/11701/.

**Selected Research Papers in Macroeconomics, Microeconomics & Nanoeconomics Sciences:**


860. Ledenyov D O, Ledenyov V O 2014f *MicroLBO* software program with the embedded optimized near-real-time artificial intelligence algorithm to create winning virtuous strategies toward leveraged buyout transactions implementation and to compute direct/reverse leverage buyout transaction default probability number for selected public/private companies during private equity investment in conditions of resonant absorption of discrete information in diffusion - type financial system with induced nonlinearities *ECE James Cook University* Townsville Australia, Kharkov Ukraine.


865. Ledenyov D O, Ledenyov V O 2015e On the spectrum of oscillations in economics
MPRA Paper no 64368 Munich University Munich Germany, SSRN Paper no SSRN-id2606209 Social Sciences Research Network New York USA pp 1 – 48


http://mpra.ub.uni-muenchen.de/67162/,
http://mpra.ub.uni-muenchen.de/67470/,

http://mpra.ub.uni-muenchen.de/67982/,

http://mpra.ub.uni-muenchen.de/68404/,

875. Ledenyov D O, Ledenyov V O 2015o *MicroID* software program with the embedded optimized near-real-time artificial intelligence algorithm to create the winning virtuous business strategies and to predict 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 in conditions of the resonant absorption of discrete information in diffusion-type financial economic system with induced nonlinearities *ECE James Cook University Townsville Australia, Kharkov Ukraine.*

876. Ledenyov D O, Ledenyov V O 2015p *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; 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 algorithm ECE James Cook University Townsville Australia, Kharkov Ukraine.

877. Ledenyov D O, Ledenyov V O 2015r MicroIMF software program: the MicroIMF software program to make the computer modeling of 1) the interactions between the information money fields of one cyclic oscillation and the information money fields of other cyclic oscillation(s) in the nonlinear dynamic economic system, 2) the interactions between the information money fields of cyclic oscillation and the nonlinear dynamic economic system itself, and 3) the density distributions of the information money fields by different cyclic oscillations (the economic continuous waves) in the nonlinear dynamic economic system ECE James Cook University Townsville Australia, Kharkov Ukraine.

878. Ledenyov D O, Ledenyov V O 2015s MicroSA software program 1) to perform the spectrum analysis of the cyclic oscillations of the economic variables in the nonlinear dynamic economic system, including the discrete-time signals and the continuous-time signals; 2) to make the computer modeling and to forecast the business cycles for a) the central banks with the purpose to make the strategic decisions on the monetary policies, financial stability policies, and b) the commercial/investment banks with the aim to make the business decisions on the minimum capital allocation, countercyclical capital buffer creation, and capital investments ECE James Cook University Townsville Australia, Kharkov Ukraine.


880. Bernoulli J 1713 Ars conjectandi (The art of guessing).


882. De Moivre 1730 Miscellanea analytica supplementum (The analytic method).
686. Bunyakovsky V Ya 1825 Rotary motion in a resistant medium of a set of plates of constant thickness and defined contour around an axis inclined with respect to the horizon Ph D Thesis no 1 under Prof. Augustin - Louis Cauchy supervision École Polytechnique Paris France.
692. Chebyshev P L 1846 An experience in the elementary analysis of the probability theory Crelle’s Journal fur die Reine und Angewandte Mathematik.
895. Chebyshev P L 1936 Theory of probability: Lectures given in 1879 and 1880
Lyapunov A N (lecture notes writer) Krylov A N (editor) Moscow - St Petersburgh Russian
Federation.

896. Markov A A 1890 On one problem by D I Mendeleev Zapiski Imperatorskoi Akademii

897. Markov A A 1899 Application des functions continues au calcul des probabilit’es Kazan

898. Markov A A 1900, 1912, 1913 Calculation of probabilities St Petersburgh Russian
Federation; Wahrscheinlichkeits-Rechnung Teubner Leipzig-Berlin Germany; 3rd edition
St Petersburgh Russian Federation.

899. Markov A A 1906 Extension of law of big numbers on variables, depending from each
other Izvestiya Fiziko-Matematicheskogo Obschestva pri Kazanskom Universitete 2nd series
vol 15 (94) pp 135 – 156 Russian Federation.

900. Markov A A 1907, 1910 Research on fine case of depending trials Izvestiya Akademii
Nauk SPb 6th series vol 1 (93) pp 61 – 80; Recherches sur un cas remarquable d’épreuves

901. Markov A A 1908, 1912, 1971 Extension of limit theorems of calculation of probabilities
to sum of variables, connected in chain Zapiski Akademii Nauk po Fiziko-Matematiceskomu
Otdeleniyu 8th series vol 25 (3); Ausdehnung der Satze über die Grenzwerte in der
Wahrscheinlichkeitsrechnung auf eine Summe verketteter Grossen Liebmann H (translator)
in Wahrscheinlichkeitsrechnung Markov A A (author) pp 272 – 298 Teubner B G Leipzig
Germany; Extension of the limit theorems of probability theory to a sum of variables
connected in a chain Petelin S (translator) in Dynamic probabilities systems Howard R A
(editor) vol 1 pp 552 – 576 John Wiley and Sons Inc New York USA.

902. Markov A A 1910 Research on common case of trials, connected in chain Zapiski

903. Markov A A 1911 On one case of trials, connected in complex chain Izvestiya Akademii

904. Markov A A 1912 On trials of connected in chain unobserved events Izvestiya Akademii

905. Markov A A 1913 Example of statistical research on text of “Eugene Onegin”,
illustrating interconnection of trials in chain Izvestiya Akademii Nauk SPb 6th series vol 7


914. Slutsky E E 1915 Sulla teoria sel bilancio del consumatore Giornale degli economisti e rivista di statistica 51 no 1 pp 1 – 26 Italy.


921. Slutsky E E 1925b Ueber stochastische Asymptoten und Grenzwerte Metron Padova Italy vol 5 no 3 pp 3 – 89.

923. Slutsky E E 1927a The summation of random causes as sources of cyclic processes.


925. Slutsky E E 1929 Sur l’erreur quadratique moyenne du coefficient de corrélation dans le cas des suites des epreuves non independantes.

926. Slutsky E E 1935 To the extrapolation problem in connection with forecast problem.

927. Slutsky E E 1937a Quelche propositione relative alla teoria delle funzioni aleatorie.

928. Slutsky E E 1937b The summation of random causes as the source of cyclical processes.


930. Slutsky E E 1960 Selected research works.

931. Bowley A L 1924 The mathematical groundwork of economic.


933. Kolmogorov A N 1938 On analytic methods in probability theory.

934. Kolmogorov A N 1947 The contribution of Russian science to the development of probability theory.


945. Neyman J, Scott E L 1948 Consistent estimates based on partially consistent observations Econometrica 16 pp 1 – 32.
951. Mandelbrot B B 1963a The stable Paretian income distribution when the apparent exponent is near two International Economic Review no 4.


964. Mandelbrot B B 1977 Fractals: Form, chance and dimension W H Freeman San Francisco USA.

965. Mandelbrot B B 1982 The fractal geometry of nature W H Freeman San Francisco USA.


967. Gnedenko B V, Khinchin A Ya 1961 An elementary introduction to the theory of probability Freeman San Francisco USA.


979. Shiryaev A N 1988 Probability *Springer-Verlag* Berlin Heidelberg Germany.


1009. Lamperti J 1966 Probability Benjamin New York USA.


1015. Breiman L 1968 Probability Addison-Wesley Reading MA USA.


1022. Box G E P, Jenkins G M 1970 Time series analysis: Forecasting and control Holden Day San Francisco California USA.


1043. Taylor S 1986 Modeling financial time series John Willey and Sons Inc New York USA.


1051. Lancaster T 1990 The econometric analysis of transition data *Cambridge University Press* Cambridge UK.


1055. Cleveland W S 1993 Visualizing data *Hobart Press* Summit New Jersey USA.

1056. Pesaran M H, Potter S M (editors) 1993 Nonlinear dynamics, chaos and econometrics *John Willey and Sons Inc* New York USA.


1058. Peters E E 1994 Fractal market analysis: Applying chaos theory to investment and economics *John Wiley and Sons Inc* New York USA.


1063. Moore G E 2003 No exponential is forever – but we can delay forever *ISSCC*.


1072. Hubbard B B 1998 The world according to wavelets A K Peters Wellesley MA USA.


1074. Teolis A 1998 Computational signal processing with wavelets Birkhauser Switzerland.


1091. Koop G 2003 Bayesian econometrics John Wiley and Sons Inc New York USA.


Weatherall J O 2013 Physics of Wall Street Houfton New York USA.

Quantum Physics, Quantum Electronics, Quantum Computing, Quantum Mechanics:

1101. Planck M 1900a Über eine Verbesserung der Wienschen Spektralgleichung On an improvement of Wien's equation for the spectrum Verhandlungen der Deutschen Physikalischen Gesellschaft 2 pp 202 – 204
http://archive.org/stream/verhandlungende01goog#page/n212/mode/2up.

http://archive.org/stream/verhandlungende01goog#page/n246/mode/2up.

1103. Planck M 1900c Entropie und Temperatur strahlender Wärme Entropy and temperature of radiant heat Annalen der Physik 306 (4) pp 719 – 737
http://adsabs.harvard.edu/abs/1900AnP...306..719P,
https://dx.doi.org/10.1002%2Fandp.19003060410.

http://adsabs.harvard.edu/abs/1900AnP...306...69P,
https://dx.doi.org/10.1002%2Fandp.19003060105.

http://adsabs.harvard.edu/abs/1901AnP...309..553P,
https://dx.doi.org/10.1002%2Fandp.19013090310,

1106. Planck M 1903 Treatise on thermodynamics Longmans, Green & Co London UK
http://archive.org/stream/treatiseonthermo00planuoft#page/n7/mode/2up,
http://openlibrary.org/books/OL7246691M.

1107. Planck M 1906 Vorlesungen über die Theorie der Wärmestrahlung JA Barth Leipzig Germany
http://lccn.loc.gov/07004527.

1108. Planck M 1914 The theory of heat radiation 2nd edition P Blakiston's Son & Co
http://openlibrary.org/books/OL7154661M.


1111. Einstein A 1905 Zur Elektrodynamik bewegter Körper On the electrodynamics of moving bodies *Annalen der Physik* Berlin Germany (in German) 322 (10) pp 891 – 921 
http://onlinelibrary.wiley.com/doi/10.1002/andp.19053221004/pdf ,
http://adsabs.harvard.edu/abs/1905AnP...322..891E ,
http://dx.doi.org/10.1002%2Fandp.19053221004 .

1112. Einstein A 1917 Zur Quanten­theorie der Strahlung On the quantum mechanics of radiation *Physikalische Zeitschrift* (in German) 18 pp 121 – 128 
http://adsabs.harvard.edu/abs/1917PhyZ...18..121E .


http://journals.aps.org/pr/pdf/10.1103/PhysRev.47.777 ,
http://adsabs.harvard.edu/abs/1935PhRv...47..777E ,
http://dx.doi.org/10.1103%2FPhysRev.47.777 .


http://www.cond-mat.physik.uni-mainz.de/~oettel/ws10/bks_PhilMag_47_785_1924.pdf,
https://dx.doi.org/10.1080%2F14786442408565262 .


1119. de Broglie L 1926 Ondes et mouvements Waves and motions *Gauthier-Villars* Paris France.

1120. de Broglie L 1927 Rapport au 5e Conseil de Physique Solvay Brussels Belgium.
1121. de Broglie L 1928 La mécanique ondulatoire Wave mechanics *Gauthier-Villars* Paris France.

   https://www.worldcat.org/oclc/1871779.

1123. Compton A; Allison S K 1935 X-Rays in theory and experiment *D Van Nostrand Company Inc* New York USA
   https://www.worldcat.org/oclc/853654.

1124. Schrödinger E 1926 Quantisierung als Eigenwertproblem *Annalen der Phys* 384 (4) pp 273 – 376
   http://adsabs.harvard.edu/abs/1926AnP...384..361S,
   https://dx.doi.org/10.1002%2Fandp.19263840404.


1126. Fermi E 1934 Radioattività indotta da bombardamento di neutroni *La Ricerca scientifica* 1 (5) p 283 (in Italian)

   http://adsabs.harvard.edu/abs/1934RSPSA.146..483F,
   https://dx.doi.org/10.1098%2Frspa.1934.0168.

1128. Townes Ch 1939 Concentration of the heavy isotope of carbon and measurement of its nuclear spin *PhD thesis* Caltech California USA
   http://thesis.library.caltech.edu/4202/.


1130. Gordon J, Zeiger H, Townes Ch 1955 The maser — new type of microwave amplifier, frequency standard, and spectrometer *Physical Review* 99 (4) p 1264
   http://adsabs.harvard.edu/abs/1955PhRv...99.1264G,
   https://dx.doi.org/10.1103%2FPhysRev.99.1264.

1132. Shimoda K, Wang T, Townes Ch 1956 Further aspects of the theory of the maser
Physical Review 102 (5) p 1308
http://adsabs.harvard.edu/abs/1956PhRv..102.1308S ,
https://dx.doi.org/10.1103%2FPhysRev.102.1308 .

1133. Townes Ch H 1964 Nobel Prize in Physics Stockholm Sweden

1134. Townes Ch H 1966 Obtaining of coherent radiation with help of atoms and molecules
Uspekhi Fizicheskiih Nauk (UFN) vol 88 no 3.

1135. Townes Ch H 1969 Quantum electronics and technical progress Uspekhi Fizicheskiih
Nauk (UFN) vol 98 no 5.

1136. Townes Ch 1995 Making waves American Institute of Physics Press New York USA

1137. Townes Ch 1999 How the laser happened: Adventures of a scientist Oxford University

pp 1 – 404.

1139. Blokhintsev D I 1954 Development of first nuclear reactor for nuclear power plant
Moscow Russian Federation.


1141. Prokhorov A M, Basov N G 1955 Molecular generator and amplifier Uspekhi Fizicheskiih
Nauk (UFN) vol 57 no 3 pp 485 – 501.

Physics JETP 16 1489.


1144. Prokhorov A M Quantum electronics 1965 Uspekhi Fizicheskiih Nauk (UFN) vol 85 no 4

1145. Karlov N V, Prokhorov A M 1976 Laser’s separation of isotopes Uspekhi Fizicheskiih
Nauk (UFN) vol 118 no 4 pp 583 – 609.

1146. Prokhorov A M 1979 To 25th anniversary of laser Uspekhi Fizicheskiih Nauk (UFN)
vol 128 no 3.


1152. Schawlow A 1963 Modern optical quantum generators Uspekhi Fizicheskikh Nauk (UFN) vol 81 no 12.


1162. Petersen A 1968 Quantum physics and philosophical tradition *MIT Press* Cambridge USA.


1172. Mygind J 1997 Private communications on the new sources of noise in the single electron transistors *Department of Physics* Technical University of Denmark Lyngby Denmark.


1178. Ledenyov V O, Ledenyov O P, Ledenyov D O 2002 A quantum random number generator on magnetic flux qubits *Proceedings of the 2nd Institute of Electrical and
Wave Function in Schrödinger Quantum Mechanical Wave Equation in Quantum Mechanics:


1182. Schrödinger E 1935 Die gegenwärtige situation in der quantenmechanik (The present situation in quantum mechanics) Naturwissenschaften 23 (49) pp 823807 – 828812.


1215. Ryllov Y A 2015 What is the wave function and why is it used in quantum mechanics? pp 1 – 18


Artificial Intelligence Science, Computer Science:


Continuous Time Signal, Analog Signals, Discrete Time Signal, Digital Signals, Spectrum of Signals, Electromagnetic Field, Gravitation Field, Calibrating Field, Information Field

Theories in Physics and Engineering Sciences:

1237. Maxwell J C 1890 Introductory lecture on experimental physics in Scientific papers of J C Maxwell Niven W D (editor) vols 1, 2 Cambridge UK.


1239. Walsh J L 1923b A property of Haar’s system of orthogonal functions Math Ann 90 p 3845.


http://cm.bell-labs.com/cm/ms/what/shannonday/paper.html .


CiteSeerX: 10.1.1.154.2879

http://dx.doi.org/10.1016%2FS0019-9958%2859%2990376-6


http://dx.doi.org/10.1109%2FT-C.1972.223524 .


1250. Fountain T 1987 Processor arrays, architecture and applications Academic Press London
UK.
Englewood Cliffs NJ USA.
Englewood Cliffs NJ USA.
1254. Van de Goor A J 1989 Computer architecture and design Addison-Wesley Wokingham
England.
1255. Priemer R 1991 Introductory signal processing World Scientific Singapore
1256. Jeruchim M C, Balaban Ph, Shanmugan K S 1992 Simulation of communication systems
Plenum Press New York USA.
Upper Saddle River NJ USA, 2nd edition Noble Pub Corp Atlanta GA USA
design and detection Prentice-Hall Englewood Cliffs NJ USA.
approach to performance analysis 1st edition John Wiley and Sons Inc USA.
Upper Saddle River NJ USA.
941413-35-7.
Chichester UK.
University Press Oxford UK.
1266. Wanhammar L 1999 DSP integrated circuits Academic Press San Diego California USA