

## Emerging Autopoiesis: On Coherence in Complexity within Organization

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### Abstract:

**Research Question (RQ):** How can we minimize the operational dissipation within businesses?

**Purpose:** How to minimize dispersed activities ('collisions'  $\approx$  'energy loss') in an organization.

**Method:** Research is based on a qualitative approach. In a direct analogy with electron correlations physics, applied to a business type of organization.

**Results:** By introducing the concept of operational coherence, the performance should improve. There is not just the concept of organization, the most important is correlation, cooperation as a harmony in autopoietic systems. Autopoiesis of an organization is inter-connected from small to large scales and can provide a harmony of life within a successful organization.

**Organization:** The management enhances coordination, then the organization runs optimally. If we could achieve a quantum level in an organization, we may be successful at a higher level. But this level is a human in human-organic organization.

**Society:** It enhances communications, increases social responsibility and improves the environment. With focus on natural evolution and improving the human in inner and outside process, we could improve the environment and as a result achieve a 'green' society.

**Originality:** This is a new approach to test the correlation concepts within a business organization.

**Limitations / further research:** We need to perform experiments with real teams in a company. For further research we need the study of research patterns in a self-organization environment.

**Keywords:** autopoiesis, correlations, coherence, cooperation, organization, management, complexity, performance, losses, business.

## 1 Introduction

In the internet age, the finances of our global society have adopted many colossal physics numbers without understanding all the implications for dynamic complexity of the intricately intermingled Wi-Fi 'village'. From the natural sciences point of view, it is evident, that as we are developing ever smarter artificial intelligence and approach the Kurzweil singularity (= when robots on average become more intelligent than mankind, around 2030.), there will occur a phase transition within our society organization(s).

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However, most colleagues in ‘social’ sciences and even management are rather shy to address some of such complex questions that are facing all of us, and rather soon. Here we briefly outline some rather bold and crude analogies that may help us all evolve in to the better organizational autopoiesis paradigm. Hence, we firstly consider recent insights into contemporary physics and economic distributions, by briefly discussing some basic correlated phenomena. Specifically, superconductivity is a stunning phenomenon: below the system's critical temperature ( $T_c$  = critical temperature),  $10^{22}/\text{cm}^3$  electrons behave as one, a perfect quantum fluid that conducts electricity with zero resistance, yes, 0 (zero)! Such a perfect, coherent state is possible to induce into complex, highly correlated systems.

Over the years we have contemplated with our colleagues the possibility to induce similar behaviour patterns into much smaller, yet highly complex, business environment, obviously in somewhat ‘imperfect’ fashion. It may sound like as utopia, yet artificial intelligence was also non-realistic perhaps just a century ago, therefore we should at least boldly consider it. Hence, in what follows, we discuss some options, as well as opportunities within creative business systems.

Namely, in all complex systems the key factors are dynamic correlations. These are successful if we continuously re-new self-adapting and self-production systems. Maturana and Varela (1980) set the thesis that this is as a natural circular process, as a creative circle, named “Autopoiesis”. We go in to vertical spheres, and physics is found in some patterns. Some research organization (Jantsch, 1980; Capra, 2002) set such quantum-like patterns in the centre of organizations. Different processes, such as correlations, oscillations, coherence co-exist in complex systems, and consequently these eventually tend to harmonize, hence emerging into an autopoietic system.

Our 20<sup>th</sup> century physics successfully used a set of experimentally verified models (Asimov, 1987; Feynman, 1965; Neumann, 1958; Gleick, 1992 and Davies, 1983) that enabled us to mathematically describe measurable natural phenomena (Davies, 1983, Hawking, 1988; Pavuna, 2012; Lévy-Leblond & Balbar, 1990; Wilber, 1984 and Penrose, 1994). As scientists we know that these are not dogmatic ideas and so it is very plausible that some future generations will drastically modify or, at best, gently update such an understanding of nature.

However, let us try to take the view of modern physics by non-physicists. What always strikes a ‘common man’ is the huge range of orders of magnitude that physicists deal with. We mostly treat them like particles that carry quanta of energy and we study their space-time distributions.

Obviously, that is exactly what banks do, albeit with dynamic money distributions! Physicists are interested in dynamic energy distributions, while the manager mainly analyses dynamic €-units distributions, ideally profitable! Also, it is not an accident that the most advanced investment schemes are invented and tested by mathematicians and physicists.

## **2 Theoretical framework**

### **2.1 Modern Physics: The range of numbers**

Shown in Table 1, are some very large and some very small numbers that are part of our present understanding of nature. When we try to think of them within the dynamic energy ‘distribution-model’ within the universe, some novel insights begin to emerge.

Firstly, by now billions have clearly become ‘financial numbers’, and, if present trends continue (plus some inevitable inflation), the financial world will deal with trillions and even quadrillions in their annual or ultimately, daily dealings. However, rather comfortably we note that extremely large or truly small numbers remain firmly in the domain of contemporary physics.

Nevertheless, when we also learn that every day the major banks win or lose close to €50 million just in daily fluctuations of various currency rates, we begin to grasp that, at least to the society’s financial distribution centres and to the decision-makers, some of our existing, applicable models may appear rather useful. For this reason we have selected one aspect: the coherence in quantum fluid, the superconductor, to illustrate that in nature there exist organizational models with no dissipation, no energy loss, where all particles move in perfect harmony.

This could be creatively extended to the business context. And this is indeed the goal in our approach. Numbers used in global finances as compared to those used in modern physics (see Table 1).

### Table 1 represented modern physics in numbers

Table 1. Modern physics in numbers (Pavuna, 2005)

Numbers that we use in our daily life, presented in an 'unusual' form (for consumers):

$10^0$	1
$10^1$	10
$10^2$	100
$10^3$	1000
...	

Numbers used by most financial institutions and major bank managers: billions:

$10^9$	1 000 000 000
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Very large numbers in physics:

$10^{22}$	10 000 000 000 000 000 000 000 - number of electrons in a $\text{cm}^3$ of metal
$10^{28}$	Estimated number of atoms in the human body
$10^{84}$	Estimated number of atoms in the Universe

Very small numbers in physics:

$10^{-10}$	= Diameter of an atom in meters
$10^{-34}$	= Planck's constant, $h = 0,00000000000000000000000000000001$ Js

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## 2.2 Autopoiesis and Self-organization

The fundamental characteristic of a theory of living systems, which are autonomous, self-referent and self-constructing closed systems, were discussed by Maturana and Varela (1980, p. v-vii). The theoretical framework attempted to answer the questions: »What is the living system?« and »What is cognition?« Maturana writes: »Living systems are cognitive systems, and the living process is a process of cognition.« Capra and Luisi (2014, p. 139) asked themselves: »What is death?« They offered a schematic representation of life and death in the human body. This analogy is important for understanding living systems, which are in correlation with each other, while death is a fragmentation – no more integration.

The emerging pattern is the understanding of the phenomena of self-organization. The idea of patterns in relationships with a focus on systems thinking in cybernetics is due to Capra (1996, x-xi): The manifestation of material, energetic and informational processes in self-organization. Life and human life, as a process of self-realization are in the inner human, a highly co-ordinated process. This idea does not have dualistic opposition between God and Man (Jantsch, 1980). Moreover, Maturana in Varela (1980) described the general form of closure with respect to self-production as well as constitution in a recursive network.

The paradigm of self-organization is the central aspect of emergence with macroscopic dynamics of process systems, co-evolution within the environment and self-transcendence in the evolution process. This phenomenon is leading to the spontaneous formation in addition to evolution of the system's structure. The principle of order by coherent evolution is a new approach to the information theory, based on pragmatic information (Jantsch, 1980, 9-11). All new ideas tend to form toward greater unification and harmony. Jantsch (1980, 11) established the beginning of a great new synthesis. Self-organization is dynamical at many levels, such as the dynamic holistic phenomenon. He understood the evolution of consciousness as the evolution of the mind, that exhibits an inner co-ordinating aspect. And he considered human life as an ongoing process of self-realization.

**Research Question (RQ) to be asked in this proposed context is:** How can we quantify and subsequently minimize the operational dissipation/loss within businesses?

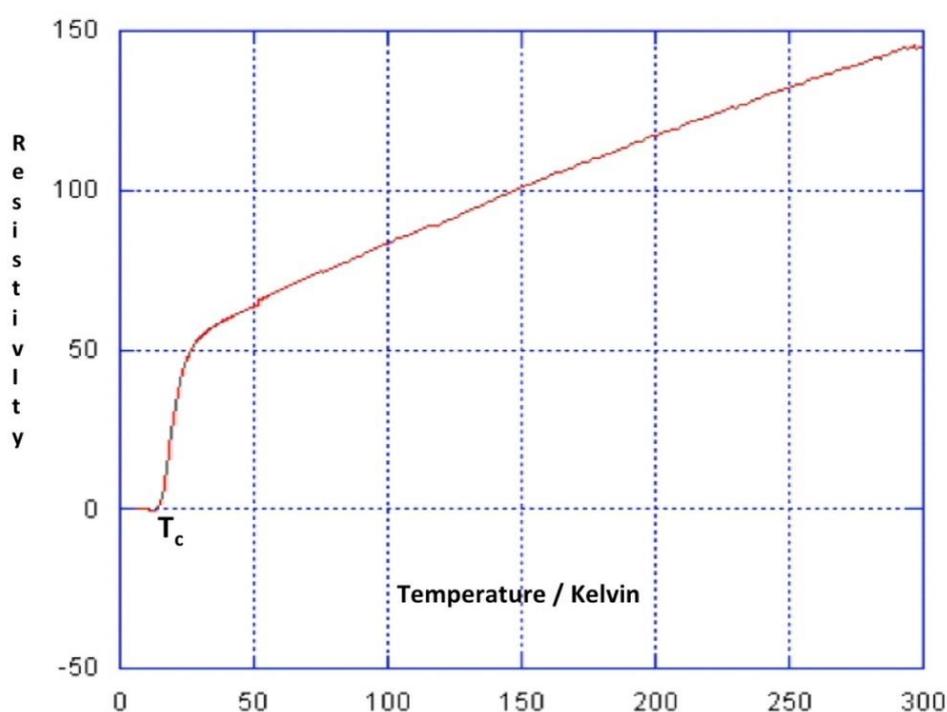
## 3 Method

Initially, we tried to use a direct analogy with electron correlations physics (superconductivity for example), applied to a business organization. Then we critically studied analogy with autopoiesis, characteristics from nature related to a given person and to the whole organization. The research on autopoiesis in organizations is based on an interdisciplinary view of complexity and dynamic mutual intertwinement. Finally, we have attempted to correlate these views with novel business organizational patterns.

## 4 Results

### 4.1 On Preliminary Analogy and Insights

Can we learn from nature!? Indeed, the answer is at least partly in physics of correlated phenomena, perhaps specifically in superconductivity (Cyrot & Pavuna, 1992; Bok et al., 1998; Pavuna & Bozovic, 2004) In a superconducting material, above the critical temperature  $T_c$ , ten thousand billion billion ( $10^{22}$ ) electrons move with collisions, and cause measurable electrical resistivity. However, below the critical temperature,  $T_c$ , conducting electrons form ‘stuck’ pairs and such pairs flow coherently with no collisions, as one quantum fluid, and the resistance is zero, yes, 0 (zero)! (see also Picture 1).



Picture 1. Example of a superconducting transition (Parameters: Resistivity in arbitrary units / Temperature in Kelvin)

**Consequently, the clear purpose is to focus on the main operational goal:** How to minimize dispersed activities (‘collisions’ = ‘energy loss’) in a professional organization. Another simple example is illustrated in Figure 2: the V-formation of a flying wild geese flock can achieve app. 70% longer flight than an individual bird (without such deliberate flock support).

**Proposed methods in a business environment may vary:** Obviously, in a direct analogy with correlations physics, one should introduce certain forms of performance enhancements into educational, preparation and certainly into management courses. Evidently, some such schemes have already been and are currently being used in many complex systems, ranging

from military activities and various sports to artistic dancing or even correlated robots in a car factory production and clearly much beyond!

#### **4.2 What is the concept of operational coherence?**

**Results obviously depend on the specific experimental program that one chooses:** By and large one can expect lower energy loss, higher performance and measurably enhanced productivity for carefully optimized highly correlated systems. Each researcher should decide on a detailed analysis and final output criteria for a given sociological system. By introducing the concept of operational coherence, the performance should improve.

Self-organization is a result of the inner dynamics of the system. This is not just a concept of organization, most important is the actual correlation, the cooperation within a harmony of autopoietic systems. Autopoiesis of organization emerges from small to large numbers of participants and eventually results in harmonious, a successful organization. If we could eventually provide a quantum-like level of organization, then we could possibly have the highest organizational level. However, this is an emergent process and also requires the gradual raising in human consciousness.

**Organization is clearly an important element of the enhancement scheme:** By introducing now, creative cooperation schemes, the management does improve the coordination among individuals, and gradually the organization begins to run optimally. A wild geese flock flies in a highly correlated V-formation, thereby reducing the individual energy losses. Such a highly coordinated flock, correlated into a V-formation can fly some 70% longer distances than an individual bird.



*Picture 2. Example from nature – a V-formation of wild geese (Pavuna, 2005).*

## 5 Conclusion

**Society is clearly improved by proposed types of correlations as also enhanced cooperation:** It favours communications, increases social responsibility in addition to improving the living environment and overall functioning of diverse daily activities. Self-organization in autopoietic systems should gradually emerge within collective human consciousness.

**Originality is mainly in chosen schemes as well as experimentation:** To test the correlation concepts that emerged from quantum matter systems is rather new within business organizations hence by definition, at this stage, it is highly original. Self-organization in autopoietic systems is an emerging process with increasing higher awareness of all participants and leaders.

**Limitations are rather obvious and further systematic research is clearly required:** One needs to perform diversified creative experiments with real teams in a variety of companies until the full range of management and business advantages will be firmly established. Such schemes and studies are currently in gradual progress worldwide.

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**Tanja Balažič Peček, PhD** received her PhD in “Autopoietic Building Blocks in 4.0 Organization” at the Faculty of Organisation Studies (FOŠ), Novo mesto. With this PhD thesis she positioned a concept of autopoietic bulding blocks for further research of autopoietic organization in all dimensions. Her research interest is a human being in organization, knowledge management, organic-human paradigm in connection with the phenomenon of »autopoiesis«. She has focused on qualitative research. Her challenge is applicative research of transdisciplinary teams. In 2017 she was selected in the team of excellence FOŠ. Since 2018 she has been the President of the Alumni club of FOŠ.

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**Professor Davor Pavuna, PhD** in Quantum Physics (1982). Since 1986 at the Swiss Federal Institute of Technology at Lausanne (EPFL), his main focus is on macroscopic quantum phenomena within given disorder in various complex systems. He published >200 research papers, 35 reviews, 30 edited professional books, a textbook on superconductivity (translated also into Polish) widely used in more than 4000 courses at universities worldwide. Co-organized more than 28 international conferences and 7 summer schools. In addition to more than hundred invited conference talks and as many invited lectures in leading academic institutions worldwide, has also delivered as many popular lectures. Advises 36 government agencies and high-tech companies across the world. Tesla World Foundation President.

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### **Povzetek:**

### **Pojavljanje avtopoieze: Temelj koherence v kompleksnosti znotraj organizacije**

**Raziskovalno vprašanje (RV):** Kako lahko minimiziramo operativno izgubo znotraj podjetja?

**Namen:** Kako minimizirati razpršene aktivnosti («energijsko izgubo») v strokovni organizaciji.

**Metoda:** Raziskava temelji na kvalitativnih metodah. Neposredna analogija s fizikalno soodvisnostjo elektronov, ki jo apliciramo na poslovno organizacijo.

**Rezultati:** Z uvajanjem koncepta operativne koherence (so-odvisnosti) bi morali uspešnost izboljšati. Tukaj ne gre samo za koncept organizacije, najbolj pomembna je korelacija in sodelovanje kot harmonija v avtopoietičnih sistemih. Avtopoieza v organizaciji pomeni povezavo od majhnih do velikih števil, s čimer zagotovimo življenjsko harmonijo uspešne organizacije.

**Organizacija:** Z izboljševanjem koordinacije menedžmenta organizacija deluje optimalno. Če dosežemo kvantni nivo organizacije, potem smo mogoče lahko uspešni na višjem nivoju. Ta nivo je človek v humani-organski organizaciji.

**Družba:** Boljša komunikacija, krepitev družbene odgovornosti in izboljšanje okolja. S perspektivo v naravni evoluciji v osebni rasti človeka v notranjih in zunanjih procesih, ki izboljšujejo okolje in zeleno družbo.

**Originalnost:** Gre za nov pristop, za preizkušanje koncepta soodvisnosti v poslovnih organizacijah.

**Omejitve/nadaljnje raziskovanje:** Potrebno bo izvesti poizkuse z resničnimi timi v podjetjih. Pri nadaljnjih raziskovanjih potrebujemo raziskovalne vzorce in samo-organizacijsko okolje.

**Ključne besede:** avtopoieza, soodvisnost, koherenca, sodelovanje, menedžment, kompleksnost, izvajanje, izgube, poslovanje.

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