THE CONSERVATION OF EXTENCIA: A NEW LAW OF CONSERVATION

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To Elena Aleinikov who dedicated 34 years of her life to helping this discovery happen

ABSTRACT

Managing global economic developments with massive deployment of people and material resources requires not only a special kind of thinking (global vision, big picture), but also precise formulas for logistics and, therefore, a solid scientific foundation. To meet these global level calculation needs, Oscar Morgenstern over 50 years ago tried to create a theory of organization (Morgenstern, 1951), while Pobisk Kuznetsov, following the works of La Roche, offered a new branch of economy - physical economy (Kuznetsov, 1980). To help political and economic leaders in managing human and material resources, physical economy has already introduced two new laws of conservation with the measurements in the range of L^6T^{-4} *and* L^6T^{-6} *which have been successfully used for transportation problem solving and long-range construction planning.*

This article is a short report on over 23 years of meticulous research and data analysis that finally led to the discovery of the next law of conservation. A new conservation law fills the gap in the Bartini/Kuznetsov system. It deals with the Conservation of Extencia - the term offered for the displacement, or linear extension of power: $Ext = P \cdot S = E \cdot S/t = const$. *The range of measurement for Extencia is* L^6T^{-5}. *A new unit for measuring the Extencia is called Alger (coined from the names of researchers involved in the discovery of the law Aleinikov + Gera = Alger). Time and place of discovery: October 16, 2006, Monterey, California.*

This law is applicable to all complex economic systems such as transportation, communication, construction, military operations and certainly must become a foundation for numerous calculations in strategic management.

INTRODUCTION: A SHORT HISTORY OF RESEARCH

Whether it is a case of strategic management, such as deployment of mass military forces to a distant region of the world or just a case of economic development of national transportation system, a scientific approach is a must. Science in a sense is the strategic management of the future. Organizational, technical, monetary, and managerial resources should be neither under delivered nor over delivered because the perspective of losing a war due to the lack of a proverbial nail in the horse shoe of the king's horse (under delivery) may be disastrous, but, on the other hand, the perspective of shooting a mosquito from a cannon (over delivery) may be economically expensive and politically damaging. A scientific approach saves human lives, natural and financial resources, time and prestige.

No surprise that particularly big logistic movements on the strategic economical level, requiring lots of calculations, caused Oscar Morgenstern to offer his Prolegomena to the Theory of Organization (Morgenstern, 1951) and became the starting point for the science of Organization - Organizology (Aleinikov, 2004). Scientific reflection of the world and conservation laws (as the backbone of this scientific reflection) play an exclusive role not only in technology and education, but also in strategic management of the economic resources. As it was mentioned above, Kuznetsov offered a new branch of science - physical economy - to employ science in the issues of economical development.

Note: Kuznetsov and Bartini, both belonging to the group of legendary constructor-generals, were less famous than Tupolev (Tu), Antonov (An), Mikoyan (Mi), and Sukhoy (Su), but they have made enormously powerful scientific discoveries that will shape the future. Two new conservation laws that put their names in the row of Kepler, Newton, and Maxwell are just an example. For more information about Kuznetsov and Bartini, see Wikipedia.

The heuristic and explanatory power of conservation laws is tremendous. After being discovered and formulated (and many times rediscovered or restated - see details at www.humanthermodynamic.com), the conservation laws give mathematicians, experimental physicists, and managers a solid foundation for numerous applications (Cera, Phillipson & Wyman, 1989; Friedrichs & Lax, 1971; Wigner, 1952; Wigner, 1964). They demystify the natural events and make scientists look for the seemingly "missing" mass or energy. For instance, the discovery of the neutrino was based on the fact that some of the total (calculated) energy was "missing," and it led to the theoretical prediction of a little particle later confirmed by experiment.

The list of some of the most well-known conservation laws includes:

- ♦ *Law of Equal Areas*: A line joining the sun and any planet sweeps out equal areas during equal intervals of time (Kepler, 1609).
- ♦ *Harmonic Law*: The ratio of the squares of the revolutionary periods for two planets is equal to the ratio of the cubes of their semi-major axes (Kepler, 1619).
- ♦ *Law of Conservation of Impulse* (Newton, 1686).
- ♦ *Law of Conservation of Moment of Impulse* (Laplace, 1800).
- ♦ *Law of Conservation of Energy* (Mayer, 1842).
- ♦ *Law of Conservation of Power* (Maxwell, 1855).

It would be wise to note here that authors and years of discovery are taken from the work of Pobisk Kuznetsov (Kuznetsov, Kuznetsov & Bolshakov, 2000), but discussions about authorship are never ending. The law of Conservation of Energy is a great illustration. For example, some authors say it was Hermann von Helmholtz who stated the law of Conservation of Energy in the form we know it now (Asimov, 1966). Other authors give the honor of discovery to three people: Mayer, Clausius, and Helmholtz. Third authors consider that the first researcher to state the law was Hess (1840) as opposed to Mayer (1842) (see www.humanthermodynamics.com). Finally, some authors even speculate it was Newton - see the new edition of The *Principia* about this issue dismissed due to the wrong translation in the previous edition (Newton, 1999). For the sake of simplicity, this article mentions only Mayer.

Another contradictory issue is the issue of expression. The conservation laws are expressed in a great variety of ways, both informally and mathematically. For instance, the Law of Conservation of Energy was stated at least 30 times and, in addition to Mayer's statement, "Energy can be neither created nor destroyed," it is expressed in such formulas as:

- ♦ $E/m = \text{constant} = c^2$ or better known as $E = mc^2$ (Einstein, 1905)
- ♦ $dE = DQ - DW$ (Koltz, 1950)
- ♦ $E_{total} = \text{constant}$ (Bent, 1965)
- ♦ $[E_{total}]_{\text{Final State}} = [E_{total}]_{\text{Initial State}}$ (Bent, 1965)
- ♦ $\Delta U = Q + W$ (Schroeder, 2000). For more details see www.humanthermodynamics.com.

On one hand, this variety of formula expressions may be needed for calculations and thus it is justified. On the other hand, it sometimes brings confusion, prohibits one from seeing the whole system of natural laws of conservation, and actually holds back the discovery efforts. No wonder that the search for a proper system of conservation laws and consequently for the proper expression of conservation laws is still ongoing (Serre, 1999-2000).

As a case in point, in 1981, German Smirnov (Smirnov, 1981) in a popular magazine article reported that R.O. di Bartini introduced a simple system of expressing all physical constants and laws of conservation through the concepts of space (*L*) and time (*T*). Such interpretation, called the *LT* system, allowed him to see regularities never seen from the traditional point of view. For example, the above mentioned laws are represented by the following *LT* measurements:

Table 1. Traditional Conservation Laws in *LT* measurements.

Traditional Law	Expression in the *LT* system
Law of Equal Areas (Kepler, 1609)	$[L^2T^{-1}]$ = const
Harmonic Law (Kepler, 1619)	$[L^3T^{-2}]$ = const
Law of Conservation of Impulse (Newton, 1686)	$[L^4T^{-3}]$ = const
Law of Conservation of Moment of Impulse (Laplace, 1800)	$[L^5T^{-3}]$ = const
Law of Conservation of Energy (Mayer, 1842)	$[L^5T^{-4}]$ = const
Law of Conservation of Power (Maxwell, 1855)	$[L^5T^{-5}]$ = const

The new way of expression is clearly illustrated by the following. Kepler's Second Law, as shown in the above table, is:

"Sector area" (L^2) divided by "equal period of time" (T) = $L^2/T = L^2T^{-1}$ = const.

Kepler's Third Law, as shown in the above table, actually states that the ratio of the cube of the planet's orbital radius to the square of the orbital period is constant (for any planet):

$$\frac{P_1^2}{P_2^2} = \frac{R_1^3}{R_2^3} \text{ or in a generic form } \frac{R_1^3}{P_1^2} = \frac{R_2^3}{P_2^2} = \frac{L^3}{T^2} = L^3T^{-2} = \text{const}$$

Where

P is period

R is radius

By using this unique *LT* system, Bartini developed a periodic table of conservation laws. Chutko mentioned this in his book about Bartini (Chutko, 1982). Chuyev later stated Bartini's priority by saying that Bartini was the first to use the *LT* system for describing the relationship between physical constants (Chuev, 2004). In other words, Bartini offered something similar to Mendeleyev's Periodic Table of the Elements, but this time for the laws of physics, the most important of which are known as the conservation laws. This is called Bartini's Table (BT).

As a further step, by using this Table, Bartini discovered the next conservation law - the Law of Conservation of Mobility characterized by the measurement range of L^6T^{-6}. An example that Bartini used, as Smirnov describes it, was from economics (or physical economy, as Kuznetsov called it). According to Bartini, at a certain point in time, a country has a certain number of excavators (power), and these excavators can be transported to other locations to use their power. Since the country has a well-developed system for transportation, the country does not need to build more excavators - it can transport the available ones to the places where they are needed. For a specific moment of time, when such a transportation system exists, the mobility of this number of excavators remains constant. This constitutes the Law of Conservation of Mobility.

Then, in the same article Smirnov wrote that there was one more law of conservation discovered around 1980 by P. Kuznetsov and R. Obraztsova who offered a new unit of measurement of the form L^6T^{-4}. They called the unit "tran" because they used it for calculating the transportation costs and, therefore, salaries within transportation systems such as railroads earlier miscalculated because of the wrong formulas (Kuznetsov, Kuznetsov & Bolshakov, 2000).

Due to the secrecy of the majority of research materials at that time (Cold War), not much was known about these most recent laws. An interesting fact is that Curt Suplee's book titled *Physics in the 20th century* does not mention conservation laws (Suplee, 1999) as if no laws have been discovered. This corroborates the point of view that finding any information was extremely difficult. Bartini himself published only two articles (Bartini, 1965, 1966). After Bartini's death in 1974, Kuznetsov was the only person who could shed some light on Bartini's ideas and views. In 2000, Kuznetsov died (Tannenbaum, 2001), and some of his works were published posthumously. Thanks to the Internet, the works became accessible to the broader public (Kuznetsov, Kuznetsov & Bolshakov, 2000). In 2005, Dmitri Rabounski, Editor-in-Chief, *Progress in Physics*, published the translation of the first Bartini's article to English, and this gave the English-speaking world an opportunity to see the depth of Bartini's original ideas (Bartini, 2005).

To the author of this article, who specializes in creativity and innovation, the use of BT - a periodic table - meant that new conservation laws could be predicted and discovered, just as new chemical elements (germanium and scandium) were predicted and then later discovered thanks to Mendeleyev's Table (Hazen & Trefil, 1991; Kedrov, 1987). In 1983, the author began to research the heuristic aspects of BT. In 1985, he made the first report on it to the Soviet Academy of Sciences in Moscow. In one of the 1988 articles, the author described the peculiarities and the unique heuristic aspects of BT and made some predictions for new units, new sciences, and new conservation laws (Aleinikov, 1988). In 1994, the author published his first article in the United States, where he stated that using matrices paved the way to MegaCreativity (Aleinikov, 1994). In 2002, the author introduced Novology, the science of newness (Aleinikov, 2002b), and in the same year he published a book on how to create genius level newness by using the matrix (Aleinikov, 2002a). In 2004, the author offered a broader interpretation of BT and introduced two new sciences that were predicted in 1988: Organizology and Intensiology (Aleinikov, 2004) and then introduced new units for measuring organization (Aleinikov, 2005). Finally, in October 2006, the author concluded his work on the discovery of the next Conservation Law, and, together with Dr. Ralucca Gera (Naval Postgraduate School, Monterey, CA), he reported the results at the Allied Academies International Conference in Reno, NV (Aleinikov & Gera, 2006).

Now is the time to report the discovery of the new conservation law to the public. It is time to fill the gap between the two previously mentioned laws with the measurement ranges of L^6T^{-4} and L^6T^{-6} by introducing the missing link - the law that must have the range of measurement of L^6T^{-5}.

CONCEPTS AND EXAMPLES

Basic Concepts

Power is the rate at which work is done (W/t) or energy is converted (E/t). Work or energy is meaningless until it is applied or delivered. Machines are built to do work on objects. Typical examples are tractors, excavators, mobile cranes, etc. The process of moving (displacing) the power to the place where it can be applied is actually extending the power, or extencia. The equation for extencia is the following: a unit of extencia is equivalent to a unit of power displaced through a unit of distance.

$$(1) \qquad Ext = P \cdot S$$

Where

Ext is extencia
P is power
S is the distance, or displacement

In simple terms, the Law of Conservation of Extencia means that the extension of power, or linear displacement of power is constant if conditions do not change. Symbolically, this is:

$$(2) \qquad Ext = P \cdot S = \text{const}$$

In the history of science, conservation laws have been traditionally stated for the so-called ideal (invented), or absolute situation. In the case of the Law of Conservation of Energy, the system was perfectly isolated, which certainly does not exist in reality. In the case of Ampere, the law was based upon an equally unrealistic pair of an infinitely small diameter and infinitely long wires in a vacuum.

For the Law of Conservation of Extencia, such an ideal experiment could be described as follows: electric power (when we take electric power as an example) will be carried without any loss for infinitely long distances and times if transported (extended) via a conducting line of infinitely small diameter in conditions of superconductivity (-271^0 K) in a vacuum.

In situations less than ideal, this law implies that two linear extensions of the identical type, length, direction, and technical condition will carry the same amount of power through the same distance. In other words, the Extencia will be constant under steady conditions.

The formula expression for power is work/time (or energy/time). Now, if the expression for power is W/t or E/t, the expression for Extencia can be rewritten as

(3) $$Ext = W/t \cdot S = E/t \cdot S = \text{const}$$

Where

W is work
E is energy
t is time

Further, since the expression for velocity is displacement/time, the expression for conservation of extencia (3) can be rewritten once more as work · velocity, or energy · velocity:

(4) $$Ext = W \cdot S/t = E \cdot S/t = W \cdot V = E \cdot V = \text{const}$$

Where

V is velocity

This new expression for Extencia actually reveals that Extencia is the velocity (speed, rate) of moving the work, or the velocity (speed, rate) of moving the energy.

Terminology

A long search for an appropriate term for the studied phenomenon finally led to the word *extension*. The Merriam-Webster Collegiate Dictionary traces the word's etymology back to Middle English and Late Latin (*extension-, extensio),* from the Latin *extendere,* and gives eight meanings. The first meaning - "the action of extending: state of being extended"- is exactly what is needed to describe the process of extending, or rather the process of extending the power.

Just as the words *energy* (1599) and *power* (13c) were not coined by Newton or Maxwell (but rather applied by them to Physics and given a certain scientific definition within the terminological system), the word *extension* also has not been coined by the author. The author's task was to check whether this word could be used as a term for the phenomena under consideration. This test turned out to be negative. The word *extension* was not only widely used but also overused. So there was a necessity to find or coin another term that would satisfy the basic rule for terms - one meaning/one word. The closest possible variant with the minimum change from Latin *extensio* was a variant of *extencia* - never used before and, therefore, open for the application with the new concept.

Now when the phenomenon of extending power, or extension of power, becomes scientifically measurable and testable, the word *extencia* becomes a term in the system of physical terminology, where it is related to the terms *energy*, *power*, and through them to *force*, *impulse*, *moment of impulse*, etc.

Phenomenon Described

The phenomenon of Extencia can be found in all corners of life. The following are examples of this phenomenon.

Mechanical Power

Animal world: A predator may have a powerful beak, teeth, or claws. However, these advantages are useless until the distance is small enough to delivering the power of the strike. The process of running, jumping, flying, stretching, uncoiling, etc., that delivers the power to strike over some distance is an Extencia.

Athletics: A boxer who throws practice punches in the air is demonstrating power but is not applying it. A boxer that takes a step forward toward the opponent to deliver a punch is extending his power or making an Extencia.

Construction: An excavator creating a trench uses power to dig out the soil to a certain depth. This excavator represents the power to move soil. However, after time, the length of the arm and scoop is not enough to reach for new soil, and the excavator moves forward. It actually moves the power to dig. This move is an Extencia.

Military: A stationary machine gun delivers fire power to the enemy lines. However, if the enemy lines are too far away, this fire power is useless. So when a machine gun is installed on an armored personnel vehicle or a tank and this vehicle or tank moves forward, this is an Extencia.

Transportation: All cars, buses, trucks, trains, and planes are the extension of human power. Without this extension (movement of power), millions of people would not be able to work because they would have used their internal energy to cover the distance on foot, thus losing energy and time. Any use of the transportation system is an extension of human power, or Extencia.

Electrical Power

With the electromagnetic radiation (that Maxwell proved to follow the Power Conservation Law), it was clear that, even if the power remained constant within a sphere of any radius around the transmitting antenna, the power received by an individual receiver decreased very quickly with increasing distance. This made it obvious that, if the receiver needed more power, there had to be some device that would carry the power to the place where it would be applied. So instead of non-directional spread (with colossal decrease), a specially designed line was used to channel the power toward the receiver. Electrical lines and systems of electrical circuits became wide-spread in the 20th century. Any electrical line from the power station, whether it be from a generator or from a battery, that carries the power to the consumer is an Extencia. Since Earth conditions are far from ideal, and power from that line is dissipated to the environment, the power company takes every step possible to maintain this line intact, i.e., as straight (short) as possible, insulated, clear from the trees that can short-circuit the line, etc. And, while the line is intact, it maintains the level of conservation (of Extencia) that it was designed to have. Thus, any electrical power extension is the transportation of power, or the displacement of power, and, therefore, it constitutes the case for the Extencia Conservation Law, stating that under the same conditions the linear displacement of power will stay the same.

Information systems

Radio and TV systems, as well as wireless telephone systems, all use Maxwell's Law of Conservation of Power directly, and they rely upon increasingly more powerful transmitters and relay stations to deliver the signals to the consumer. Creating the system of extension lines (radio, telephone, and cable) that delivered electromagnetic signals directly to the consumer was a necessary step. The Law of Conservation of Extencia is applicable to every one of them. If something goes wrong and the power extension is not operating to the designed level of conservation, the maintenance people will find and fix the problem.

Heat

Heat needs to be transported to the consumers too. Fires and fireplaces are romantic but are highly labor intensive and consume great quantities of natural resources. They also require human attention to add woods and to keep the fire burning. In some big cities, heat delivery is often accomplished through the use of hot water pumped through well-insulated pipes that connect the houses and heat the individual room radiators. In any case, the natural power of fire is often not enough to spread the heat by conduction, convection and radiation, and thus the extension lines are designed to deliver more heat in a more direct manner. The Law of Conservation of Extencia certainly applies to all of them, and two identical lines running from the same source of heat for the same distance in the same conditions will deliver an equal amount of heat per time, which means that they have the same level of conservation.

These examples demonstrate that any process of extending the power in a linear manner is an Extencia.

New Unit

A new unit offered for measuring the Extencia in the SI system is called Alger (pronounced as [′al-ger] with "g" as in *get*, or *gear*) because it was coined from the names of researchers involved in the discovery of the law: Aleinikov + Gera = Alger.

In relation to the other SI units, one Alger equals one Watt through one meter:

$$1\text{Alger} = 1\text{Watt} \cdot 1\text{m}, \tag{5}$$

or in terms of energy, one Alger equals one Joule through one meter per second:

$$1\text{Alger} = 1\text{Joule} \cdot 1\text{m} / 1\text{s}. \tag{6}$$

The Missing Link

To simplify matters, the following table (Table 2) lists the elements needed for the conservation law to be established in the left column, and to the right lists the laws of conservation under discussion. The missing data in the works of other researchers is shown by question marks, and the empty cells represent the missing law with only one known, or rather predicted, item - measurement range = L^6T^{-5}.

Table 2. Latest Laws of Conservation (with gaps)

	Law of Conservation of Energy	Law of Conservation of Power	Law of Conservation of **?**	Law of Conservation of	Law of Conservation of Mobility
Name of discoverer	Mayer	Maxwell	Bartini, Kuznetsov, Obraztsova		Bartini
Year	1742	1855	Around 1980		By 1973
Definition	Energy = transfer of force	Power = rate of energy flow	**?** = propagation of energy		Mobility = rate of **?**
Unit and relations in SI system	Joule = 1N · 1m	Watt = 1J /s = 1N · 1m/1s	Tran = 1J · 1m		**?** = 1W · 1m/1s
Measurement Range	L^5T^{-4}	L^5T^{-5}	L^6T^{-4}	L^6T^{-5}	L^6T^{-6}

The author certainly sees a possibility that the missing data can be found later (it may already exist in the literature that the author does not have access to), but for now, following the heuristic principle, “It is better to rediscover than not to discover at all,” the author offers to fill in the gaps.

1 The suggested name for the unit of Mobility is “Bart” to honor <u>Bart</u>ini - the discoverer of the law.

2 The suggested name for the phenomenon measured by L^6T^{-4} (and not named by Bartini, Kuznetsov, and Obraztsova) is “Transfer” because it deals with the propagation of energy, <u>tran</u>sfer of energy, <u>tran</u>sportation of energy. The unit introduced by these authors already utilizes the root *tran-* obviously related to these words.

Now all the cells of the table can be filled because the new unit, Alger, introduced for measuring the Extencia in (5) and (6), can be used to express the unit of Extencia in Trans and the unit of Mobility in Algers.

(7) 1Alger = 1Tran / 1s

and

(8) 1Bart = 1Alger / 1s

With the additions made (new item are in **bold**), Table 2 becomes Table 3

Table 3. Latest Laws of Conservation (completed)

	Law of Conservation of Energy	Law of Conservation of Power	Law of Conservation of **Transfer**	Law of Conservation of **Extencia**	Law of Conservation of Mobility
Name	Mayer	Maxwell	Bartini, Kuznetsov, Obraztsova	**Aleinikov**	Bartini
Year	1742	1855	Around 1980	**2006**	By 1973
Definition	Energy = transfer of force	Power = rate of energy flow	**Transfer** = propagation of energy	**Extencia = displacement of power = speed of energy transfer**	Mobility = rate of **Extencia**
Unit and relations in SI system	Joule = 1N · 1m	Watt = 1Joule /1s = 1N · 1m/1s	Tran = 1J · 1m	**Alger = 1Watt · 1m = 1Tran / 1s = 1J · 1m/1s**	**Bart** = **1Alger /1s** = 1Watt · 1m/1s
Measurement Range	L^5T^{-4}	L^5T^{-5}	L^6T^{-4}	L^6T^{-5}	L^6T^{-6}

Now you see from Table 2 and Table 3 how the phenomenon of Extencia gets its measurement range.

(9) Ext = L^5T^{-5} (Power) · L (displacement) = L^6T^{-5}

Alternatively, in addition to its definition as displacement of power, Extencia can be described as the rate of Transfer, or the speed of transferring the energy.

(10) Ext = L^6T^{-4}(Transfer) : T (time) = L^6T^{-5}

Certainly, the Extencia Conservation Law also means that the speed of transferring (moving, propagating) the energy remains constant under the unchanging conditions - an intuitively correct statement.

Furthermore, Mobility now can be described as the rate of Extencia, or the speed that the power is transported in the linear displacement.

(11) Mob (Mobility) = L^6T^{-5} (Extencia) : T (time) = L^6T^{-6}

Now, what was stated in (4) is clearly demonstrated by Table 3 and also is very logical because the term Mobility in its ultimate sense is the number of linear extensions that the observed power system can make. Empirically, this means that the higher the number of extensions, the higher the mobility of the system.

Thus the missing link is filled in its totality: mathematically, physically, logically, and empirically. Consequently, the Law of Conservation of Extencia can be considered discovered.

Time and Place of Discovery

October 16, 2006, Monterey, California.

CONCLUSION

As you see from the examples, Extencia (extending power through a distance) is an everyday phenomenon. An understanding of how to calculate Extencia is a must. All transportation, construction, military, and other complex economic systems need this understanding to function well. So, the Law of Conservation of Extencia is just as necessary as the Laws of Power and Energy Conservation for traditional physics and the Laws of Transfer and Mobility Conservation for physical economy.

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