ECONOMIC THEORY OF RELATIVITY or "INNOVATION SNAIL"

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This work appeared largely by accident. The author became a professional business angel (investor in small innovational companies) in 2006, and it seemed odd to him that there was no fundamental theory of valuation of innovative companies and their projects.
Standard approaches of business valuation methods are reduced to three methods:

- Asset-based business valuation methods;
- Market-based business valuation methods (by analogy);
- Discounted cash flow method (DCF).

They are mostly applicable when there is a similar business which normally does not exist, because it is innovative.

Wherein:

- Powerful financial crisis in 2008-2013 identified problems with the adequacy and the governments’ paying capacity. Even the “Big Four” rating agencies: Pricewaterhouse Coopers, Deloitte, Ernst & Young and KPMG, did not foresee the approach of the global crisis.
- The sharp decline in the capitalization of the "old" business types lead to the rethinking of previous valuation models.
- The emergence of the "new" business models that has no analogues in the past requires new theoretical approaches - in fact, on 01/20/2014 the Facebook was worth $145B and «the Great» Gazprom was worth just $103B ($255B and $50,5B on 08/21/2015, respectively).
- The growing influence of creative staff on competitiveness and thus the business assessment which requires to make estimating of the assets of this factor.
- The flourishing business of "patent trolling", patent war and inflated capitalization of the companies based on their patents database.

All these factors contributed to the search of theories which could describe the value of companies through a new understanding of the business processes.
In economics, the theory of S-curves and "circular" process are widely applied. Thus, the theory of the "Triple Helix Innovation» (THI, G. Etzkowitz [1, 2]) was developed for consideration of the economic and cultural development of modern society in general and its elements separately. THI application as a manual for managing relationships and links between Universities, Industries and Government, which allows to develop a special technology for management of complex processes in these subsystems.

Therefore, the theory of "Triple Helix" was used as the basis for the construction of "Economic theory of relativity." The system of spheres of economic life is called «UIG»: Universities, Industry and Government, and their respective functions titled «EBA»: Education, Business and Authority, was a detailed system of four major economic factors in three consecutive stages of substitution of the other main factors followed by the principle: «Thesis-Antithesis-Synthesis».

Analysis of the interaction between EBA areas presented by the four major factors in the economy, made it possible to construct a theory of the economical life cycle on the basis of 12 stages model of the development cycle - "Innovation Snail".

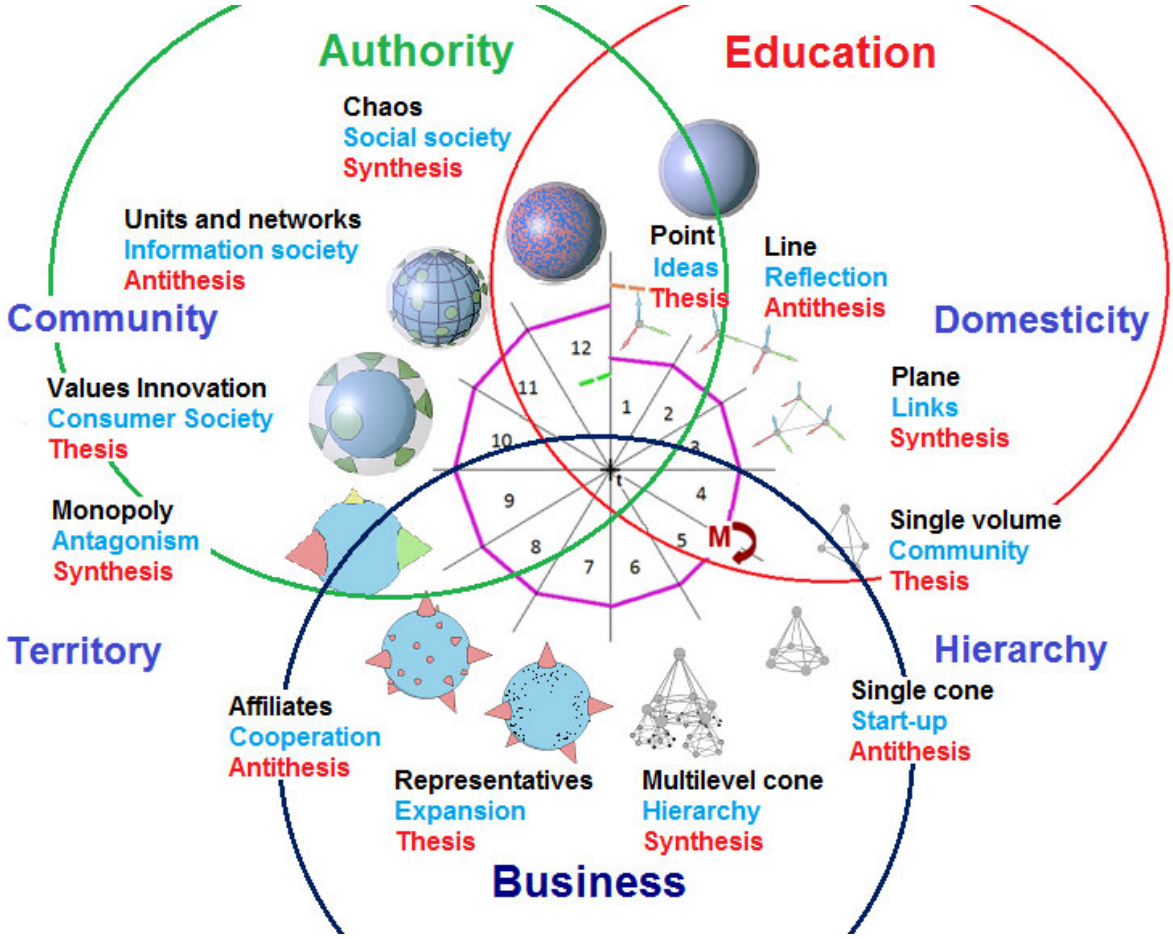

Figure 1. «EBA» economic life spheres: Education, Business and Authority as a system of four major economic factors in the three phases with substitution of the other main factors, followed by the principle: «Thesis-Antithesis-Synthesis».

It is interesting that the idea of periodic "circular" systems is used not only in business. So, in inorganic chemistry the Mendeleev periodic system was built on the basis of studying the interaction between two main properties of chemical elements:

- an atomic weights (measurable for particles – analogue of the substance corpuscular characteristics);
- valences (measurable for the connection material).

In biology mutations theory is based on a tree-annular mutagenesis and gene theory, based on the DNA double helix, which consists of a combination of four nitrogenous bases (adenine, guanine, thymine and cytosine, wherein the nitrogenous base of one of the chains connected to a nitrogen is connected to other chains with hydrogen bonds according to the principle of complementarity: adenine binds only with thymine and guanine - with cytosine only). Surprisingly, in 1957 the American scientists Alex Rich, Gary Felsenfeld and David Davies described nucleic acid composed of three spirals [5]. In 1985-1986, Maxim Frank-Kamenetskii showed how a double-stranded DNA formed in the so-called H-shape made up not two but three DNA strands [6].

As shown in the example of Industry sphere, all the circular models can be constructed based on the description of flow of net income (NPVi) and its components increments (CFi) [3].

Any society has four key resources for its development:

1. Human resources as the productive force (HR);
2. Technology as sets of skills and practices that have been recorded and are repeatable;
3. Capital as the funds accumulated as a result of exploitation of factors 1 and 2;
4. People as the consumer society forming market demand for the goods/service for final consumption, information and knowledge produced by factors 1-3 (CS).

For example, a major resource for HR - step «Thesis» is the “Birth of ideas”; at the stage of «Antithesis» is the discussion about them, the so-called "Reflection of ideas"; at the stage of «Synthesis» it is passed through the discussion of the ideas embodied in the design specification.
Similarly, the process of change can be built for the other three main resources (Fig. 3).

These resources constantly interact during the whole life cycle of business, and one of the resources is dominant at a given point of the cycle, with the rest resources being only secondary, and changes occur according to a three-step algorithm: thesis – antithesis - synthesis.

This is the reason why changes in the cycle may form 12 different steps with different main development factors, like ancient Chinese zodiac cycle 地支: 子、丑、寅、卯、辰、巳、午、未、申、酉、戌、亥, see Fig. 2). When linking 12 signs in three synergistically related categories can be divided into three main synergistically conditioned functions, with fundamentally different principles of development: Education, Business and Authority.

Figure 2. 12 signs in ancient Chinese zodiac.

In the process of institutionalization of economically diverse functions, they are widely known in the Triple Helix areas: Education - in the University; Business - in the Industry and Authority - in the Government (see Figure 1).

Aggregating three times in four successive stages, we get three "spheres" of THI - "Education-Business- Authority":
• the sphere of "Education" - from 1 to 4 steps;
• the sphere of "Business" - from 5 to 8 steps;
• the sphere of "Authority" - from 9 to 12 steps.

Combination of three "spheres" with four of main resources in each where three phase changes

leads to twelve subsystems with thirteen crisis zones, that allow to simulate the Innovative business entire life cycle (Fig. 3).

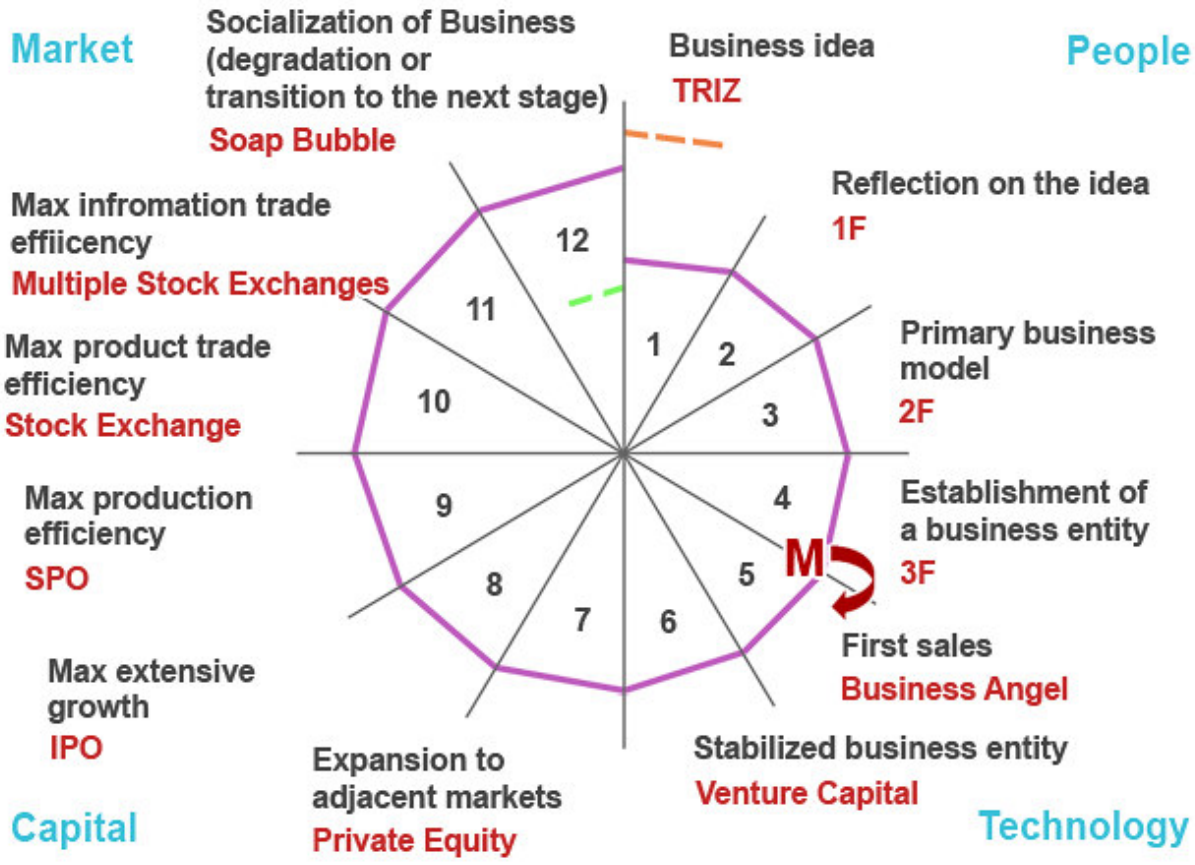

Figure 3. Model of the innovative business lifecycle with four main resources, each of which passes through three-phase changes. From step 1 to 4 - "University"/"Education" sphere, from step 5 to 8 – "Industry"/"Business" sphere, from step 9 to 12 - "Government"/"Authority" sphere.

A similar approach is used for three spheres: the University (where the Education is based on the Science), the Business (where Economics is separated from the Real Economy) and the Government (where the Authority is different from the Society) that allows us to simulate certain processes at different levels of socio-economic formations in society. It gives the opportunity to predict critical periods in the systems, which allows to propose specific measures to reduce losses during the crisis.

The process of economic calculations is based on the modified method of DCF (Discounted Cash Flow), which is advanced in stages from birth of the idea to the real cash flow creation. The foundations of THI theory were analyzed and comparisons with other economic theory of complex evolving systems were made. The possibilities for the application in forecasting, business valuation and the building of strategies for the various UIG/EBA systems development were created. The prediction of crisis periods of complex evolving systems development from individual households to the global economy, as well as methods of reducing the costs of such crises became possible.

Note that each of the stages has laws describes different patterns.
For example, the basic psychophysical law, discovered by E. Weber (1834) and G. Fechner (1860), which is applied on the step 1: "Birth of ideas" (Fig. 1), says that the strength of feeling p is proportional to the logarithm of the intensity of the stimulus S, referred to a primary irritation S_0:

$$P = k \cdot \ln\left(\frac{S}{S_0}\right) \quad (1)$$

A similar logarithmic law, which is oriented negatively and applied on stage 7, is diametrically opposed to law applied on the stage 1. It is a known as Bernoulli diminishing marginal utility [7], where the marginal utility of wealth (capital) *U (w)* is put inversely proportionally to the wealth w with the proportionality coefficient *k*, which defines a unit of utility of wealth, i.e.:

$$U(w) = k \ln w \quad (2)$$

However, it is logical that, as the utility decreases with time, where $k < 0$, and (2) with $k' = -k$ will be:

$$U(w) = -k' \ln w \quad (3)$$

If we indicate and infer patterns of development for each of the "Innovation Snail" stages graphically, we obtain the living systems laws matrix (Fig. 4, App.1):

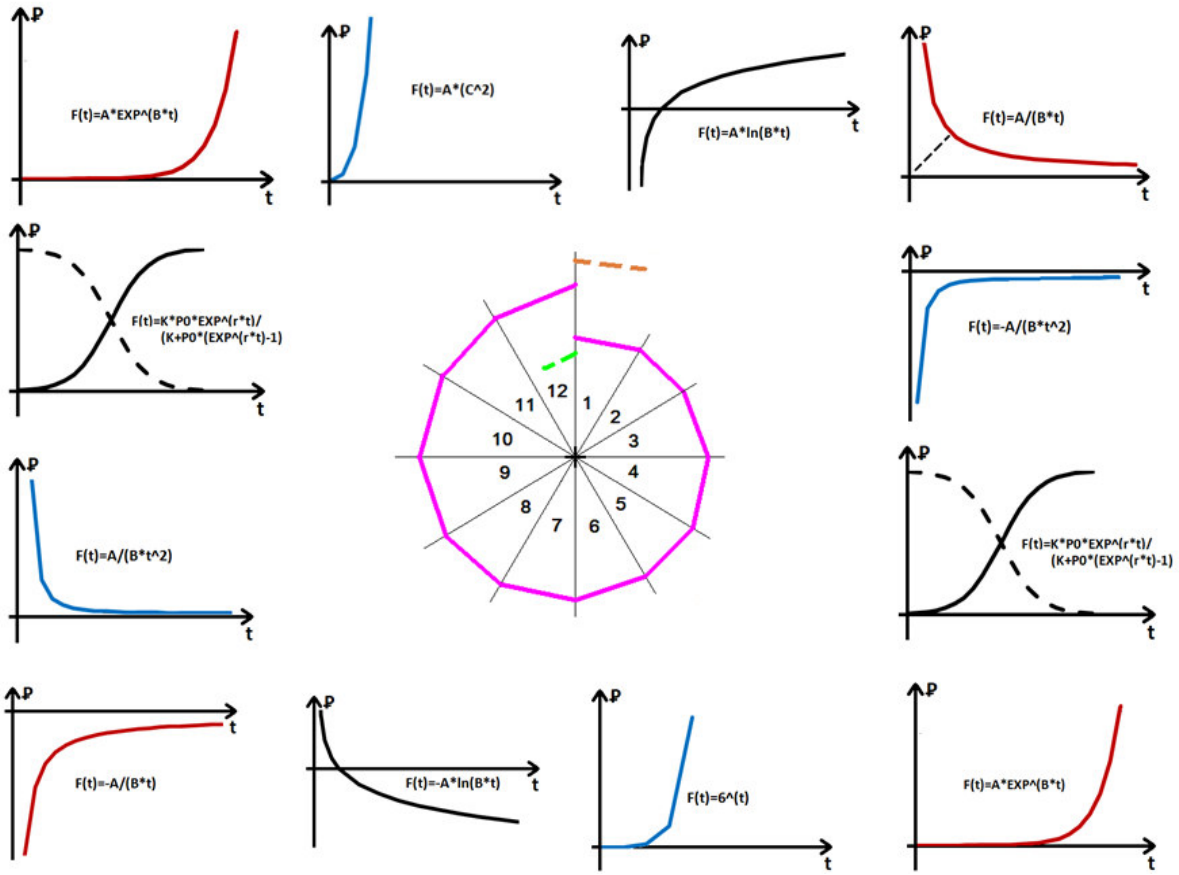

Figure 4. Living systems laws matrix: "Innovation Snail Laws" (App.1).

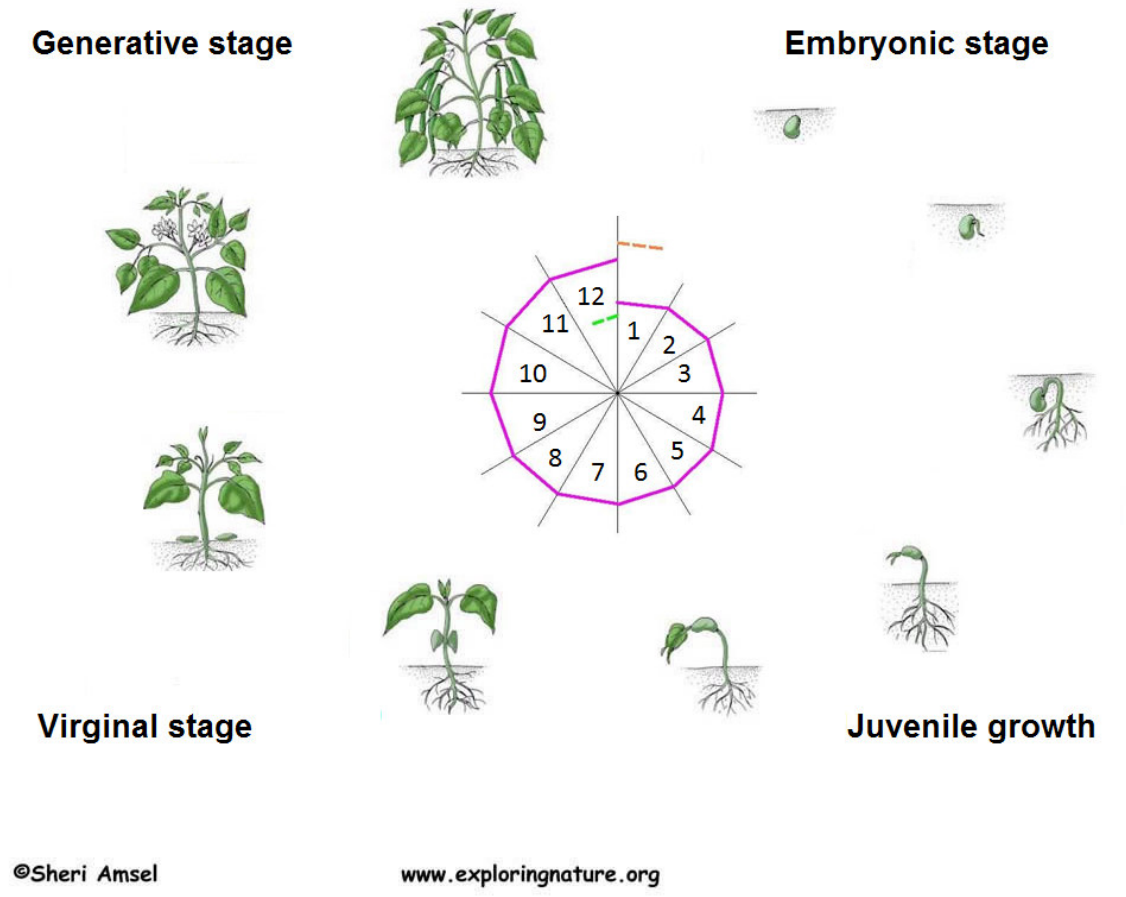

Figure 5. Age-related stage changes in higher plants (The Plant Life Cycle).

As seen from a comparison of Fig. 4 and Fig. 5, age-related stage changes in higher plants (The Plant Life Cycle) and "Innovation Snail" stages are practically the same.

Conclusions.

Applying the identified laws of development makes it possible to achieve sustainability of the economic system as a whole by the means of:

- Matching sequences of different economic models by stages as functional types;
- Harnessing the power of self-adjustment systems through filling "Innovation Snail" matrix, such as missing resources from external economies included in the analysis and cluster development;
- The use of "breakthrough innovation", the essence of which is to determine the maximum growth potential through the development of the "Innovation Snail" economic system of diametrically opposite phases;
- Reducing costs of economic development by predicting the crisis in fundamentally different types;
- Applying the methods of stimulation on the most appropriate stages as functional types of the economic system (sets of privileges and preferences, lot of financial, tax and other incentives).

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