THE INNOVATION FACTORY
PRODUCTION OF VALUE-ADDED QUALITY AND INNOVATION

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Abstract: ***The Innovation Factory: Management Systems, Knowledge Management and Production of Innovation***
We explore the nature of innovation as an integral part of corporate strategy and organization. The Knowledge cycle represents a necessary embedding for the Innovation cycle – so, we also explore the relationship of these two corporate cycles. We offer useful definitions of a number of necessary categories, like innovation, quality, knowledge, information, added value, strategy, technology, mass customization, and some others. The purpose is to outline methodological foundations for transforming a company into an Innovation Factory.

Abstrakt: ***Továrna na inovace: systémy řízení, řízení znalostí a produkce inovací***
Zabýváme se podstatou inovací jako nedílnou součástí podnikové strategie a organizace. Znalostní cyklus podniku poskytuje nutné uložení pro Inovační cyklus – takže se též podíváme na vztah těchto dvou podnikových cyklů. Nabízíme použitelné definice celé řady potřebných kategorií: od inavací, kvality, znalostí a informací až po přidanou hodnotu, strategii, technologii a masovou kustomizaci. Cílem článku je náčrt metodologických základů pro transformaci podniku na Továrnu na Inovace.

Key words: *innovation, quality, knowledge, added value, strategy, technology, knowledge management, innovation factory*
Klíčová slova: *inovace, kvalita, znalosti, přidaná hodnota, strategie, technologie, řízení znalostí, továrna na inovace*

1. Introduction
Innovation is a strategic necessity in the global era. The process of innovation must be integrated and embodied within the entire cycle of the business process. It has to be continuous, purposeful and strategically coherent. Innovation cannot remain an isolated function of selected, qualified individuals or departments. It cannot wait for inspiration or creative enlightenment, nor can it be dependent on certain attributes or characteristics of "innovative" individuals.
Every individual works in and is a part of some key corporate processes; all of these processes are subject to both continuous and often discontinuous improvement. That means that continuous (quantitative) and discontinuous (qualitative) innovation drives must be embodied in each individual and embedded in the system of their daily interaction and work. The whole company, with all its employees, whether production or service oriented, must become an Innovation Factory.

2. What is Innovation?
There are clearly many definitions and concepts as well as many popular images of what innovation entails. For our purposes, we define innovation as the change in the hardware, software, brainware or support network of a product, system or process that *increases the value for the user or customer*.
From this definition it should become clear that not every *invention* (a discontinuous, qualitative change) is an innovation, and so not every *improvement* (a continuous, quantitative change) is an innovation. Innovation adds value and value can only be

realized after the purchase. While invention can exist even without a customer, innovation , in order to exist, must be valued and purchased by a customer.

3. Innovation Cycle

The value is being added through the *Innovation cycle*.

It is clear that innovation is a process, self-reinforcing and continually repeating cycle of activities. It starts with *understanding* (U) what a customer wants and how the resources are to be used to satisfy him. Then a corresponding *design* (D) solution is prepared and its value-adding (and money-making) potentials evaluated. If they are found to be significant, the design is *implemented* (I). The actual service delivery is achieved through its actual *operation* (O).

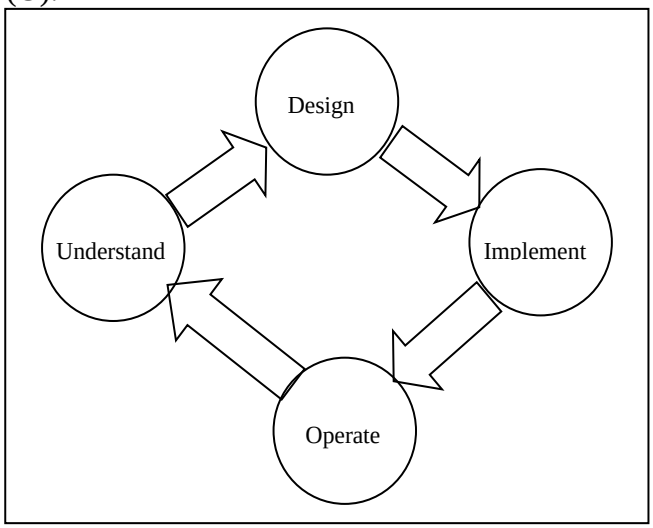

Figure No. 1: Innovation U-D-I-O Cycle

The U-D-I-O cycle of Figure 1 is a simplified interpretation adapted from Jackson [1]. This is a self-reinforcing learning cycle which must be continually repeated if any *learning from operating* is to take place.

The cycle must be *effective*, i.e. delivering the right answers to the right questions, not just *efficient*, i.e. delivering the right answers to possibly wrong questions – and thus developing *wrong* services and products quickly and cheaply; this would be the worst possible outcome.

The most important "right" question is *Why*. That represents strategic *wisdom* (Zeleny, 2005). Asking *How* comes second. That represents strategic *knowledge* (Zeleny, 2000, 2004). While asking *why* always contains the potential for change and innovation, asking *how* already accepts a system or process as fixed or given, leaving little room for innovation.

Doing the right things is so much more important than doing things right.

Doing the right things means adding value.

4. What is Added Value?

Any worker, any product, any design and any innovation *must add value*.

There are of course two kinds of value to be considered: *value for the business* and *value for the customer*. Both parties to the transaction must be able to derive value, both must

benefit: the business – in order to make it; the customer – in order to buy it. In the global age it is precisely this business-customer *value competition* that is emerging as the hardest and the busiest battleground.

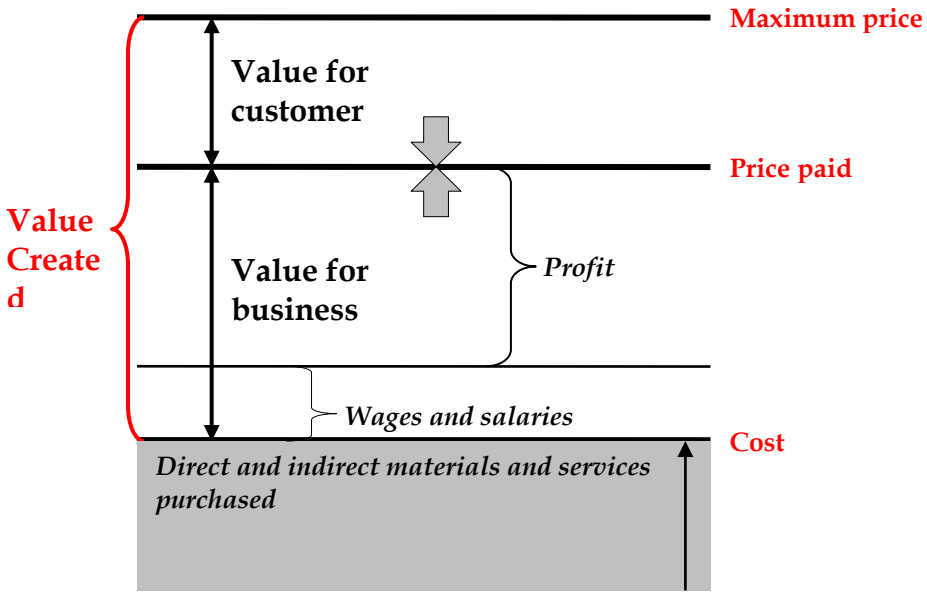

Figure No. 2: Adding Value for the Customer

In Figure 2 we attempt to explain the process of creating new value. This is crucial for the identification and assessment of innovation.

First, the customer pays for the service or product: the *price paid*. The producer subtracts the *cost incurred*, including all direct and indirect materials and services purchased. The difference is the *added value* for the business. This added value can also be interpreted as the *value of knowledge* engaged in producing the service or product. In order to pay wages and salaries, the production process and its coordination must generate this added value. Added value is the only source of corporate wages and salaries and profits.

If the added value does not *cover* the wages and salaries, then these must be correspondingly lowered. If no value has been added, then the value of knowledge is zero and no payment can be due to it. The business must add enough value in order to *cover* at least its workers and managers, their salaries and wages. If even more value has been created, then *profits* can be realized, up to the price received.[1]

A business which does not generate sufficient added value cannot cover its wages and salaries, has no profits, and cannot function over an extended period of time. Added value is the key to assessing the quality of human knowledge in business.

The customer, of course, must be willing and ready to pay more for the service/product than he actually paid. The *maximum price* the customer would be willing to pay must

[1] Traditionally, wages and salaries are included as a cost *a priori* and profits then computed directly. Such an approach, of course, hides the true source of wages and salaries (added value), and does not identify creators of value and the value of their knowledge. It is poorly suited for analyzing innovation, knowledge or profitability.

exceed the price the producer has asked for. The difference is the added *value for customer*.
If there is no value for customer – the maximum price is lower than the price to be paid – then the customer would not buy the service or product.[2] In a competitive market, the customer pays money only for the value received, i.e. the value for the customer.
So, there is a dynamic "struggle" between the two parties: the customer wishes to maximize his value while the producer tries to maximize his value. The most visible aspect of this is the price pressure: the customer tries to minimize the price paid so that the value for customer is maximized; the producer tries to maximize the price paid so that value for the business is maximized. In a healthy, competitive economy an optimal price is identified: it provides acceptable value for the customer and for the business. Both parties must benefit from the transaction.
In Figure 2, one can see how different strategies for maximizing added value can emerge, dictating a corresponding requisite *innovation strategy*.
The business can drive down the cost of purchased materials and services: it can optimize the use of its resources and processes. This refers to *efficiency of production* or "doing things right". Or, the business can drive up the maximum price the customer is willing to pay and thus increase the value to the customer. This refers to *effectiveness of production* or "doing the right things". The tension between the focus on efficiency and effectiveness (the cost and value) must be resolved through the corporate strategy.
The business can also concentrate on increasing the value of knowledge and thus extract higher added value from given resources. Observe that the total value for the customer and value for the business represents a new total *value created*, as in Figure 2. The larger the overall value created, the larger is the prosperity of both the customers and the producers. A healthy economy, healthy company, healthy department and healthy individual produce large and increasing value created. Any innovation – to be an innovation – must create value.
It is clear that the innovation process must be customer driven, continuous and cyclical, embodied in the corporate strategy and embedded in business systems and organization. Only then can an Innovation Factory start emerging.

5. What is Quality?

It is clear that the notion of quality must be closely associated with the notion of added value. In fact, quality and value seem to be inseparable, although value is more encompassing, while quality is often stripped to minimal technical and efficiency standards.
Quality is the optimal balance between effectiveness and efficiency.
A quality product, process or service provides the right customer balance between doing the right thing (value) and doing things right (cost). The value the customer receives for his money – that's quality.
The price (money) is therefore a constitutive part of quality. A "high quality" item cannot be priced above the maximum price a customer is willing to pay because then the added value is reduced to zero and the item is not purchased. It has "low quality" for me, it does not deliver value, and I don't want it.

[2] Unless *forced to* by circumstances of monopoly or the lack of alternative choices.

Quality does not exist *per se*. It is realized and thus created in the act of purchase (more precisely in the subsequent use) and through the transaction. So, the notion of quality is intimately associated with the customer and his act of purchase. Quality is not stored in warehouses; it only emerges through the act of purchase and the subsequent use.
We can of course recognize and acknowledge quality in items we do not purchase, but that is recognizing the quality for others and not for ourselves. Such "quality" is meaningful only as a point of reference or benchmark, not as a living aspect of our own economic behavior. In business, it does not matter what people think, say or imagine; the only think that matters is *what they do*.
Unsalable goods, products or services *cannot be* of high quality, by definition. Quality is derived from customers' preferences and realized through the purchase. Quality is not "built in" by engineers and "stored" in a warehouse – waiting for the customer to recognize the engineer's sincere imagination and vision. The Innovation Factory starts and ends with the customer.

6. Technology Innovation

As an example, we shall take a closer look at the innovation issues related to technology. It is important to establish that an improvement or change in hardware is not innovation, unless it affects the use of technology and creates value for the user (customer). Also, *hardware is not technology*.
What is technology?
Any technology can be divided into several clearly identifiable components:
1. *Hardware*. The physical structure or logical layout; the plant or equipment of the machine or contrivance. This is *the means* to carry out required tasks of transformation to achieve purpose or goals. Hardware therefore refers not only to the particular physical structure of the components, but also to their logical layout.
2. *Software*. The set of rules, guidelines, and algorithms necessary for using the hardware (program, covenants, standards, rules of usage) to carry out the tasks. This is the *know-how* – how to carry out tasks to achieve purpose or goals.
3. *Brainware*. The purpose (objectives and goals), reason and justification for using or deploying the hardware/software in a particular way. This is the *know-what* and the *know-why* of technology. That is, the determination of what to use or deploy, when, where and why.
These three components form the *technology core*.
There is a fourth and most important aspect of technology:
4. *Technology support net.* The requisite physical, organizational, administrative, and cultural structures: work rules, task rules, requisite skills, work content, standards and measures, styles, culture and organizational patterns.
Any technology core (hardware, software and brainware), in order to function as technology, must be embedded in a supportive network of physical, informational, and socioeconomic relationships which enable and support the proper use and functioning of a given technology. We refer to such a structure as the *technology support net* (TSN).
TSN is a network of flows: materials, information, energies, skills, laws, and rules of conduct that circulate to, through and from the network in order to enable the proper functioning of the technology core and the achieving of given purpose or goals. The TSN

is sketched in Figure 4. It should be clear that the shape and form of the TSN is the main determinant of technology use.

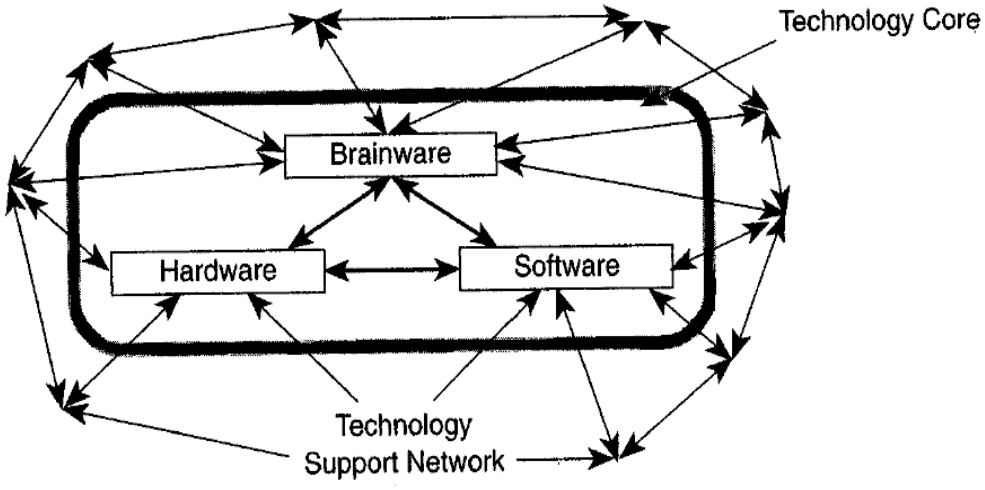

Figure No. 4: Components of Technology

Every specific technology core gives rise to a specific and requisite TSN and thus to a specific set of relationships among people. Ultimately, the TSN can be traced to and translated into the relationships among human participants: initiators, providers and maintainers of the requisite flows in cooperative social settings.

In terms of the introduced changes in the technology core, we can explore *discontinuous* (qualitative), *continuous* (quantitative) and *neutral* (conservative) effects on the support network. Only if there are perceptible effects on the support network can a created value be measured through purchase and the change declared a *qualitative, quantitative or conservative innovation.*

No matter how "radical" are the changes in hardware, software or brainware, if there are no perceptible effects on the TSN, no value can be added for the user/customer and the change is *not an innovation*.

This is important in order to avoid generating, supporting and rewarding useless and repetitive manipulations of superficial or artificial attributes while believing that such might constitute "innovations". There are too many "innovations" that are nothing other then very costly inventions with no perceptible benefits, no added value and no TSN effects.

The Innovation Factory concept is providing directed motivation, serious criteria, justified rewards and systems embedding for the generated stream of innovations.

The three types of effects on the TSN are:

1. *High technology* is any technology core that affects the *effectiveness* of the TSN. It *qualitatively* changes the very architecture (structure and organization) of the components of the technology support net. High technology therefore changes the qualitative nature of tasks of the TSN and their relations, as well as their requisite physical, energy and information flows. It also affects the skills required, the roles played, the styles of management and coordination – the organizational culture

itself. In short, it allows (and often requires) not only to *do things differently* but often to *do different things*.

2. The *technology core* affects only the *efficiency* of flows over the TSN, i.e., it activates only *quantitative* changes over the qualitatively identical architecture of the TSN. It allows users to perform the same tasks in the same way, but faster, more reliably, in larger quantities, or more efficiently, while preserving the qualitative nature of flows and the structure of the support, skills, styles and culture. Technology allows us to do the same thing, in the same way, just more efficiently.
3. The *appropriate technology core* essentially conserves everything: the support net as well as the flows through it; its effects are neutral with respect to the TSN. It allows users to do the same thing in the same way at comparable levels of efficiency. Improving efficiency is not the purpose here, preserving and protecting the TSN is. Appropriate technology is important in situations where the stability of the support net is primary for social, political, cultural or environmental reasons.

These three effects have to be clearly differentiated in evaluating corporate innovations.

7. Innovation Cycle Within a Cyclical Business Organization

It is clear that the U-D-I-O Innovation cycle must become embedded in the organization of a company.

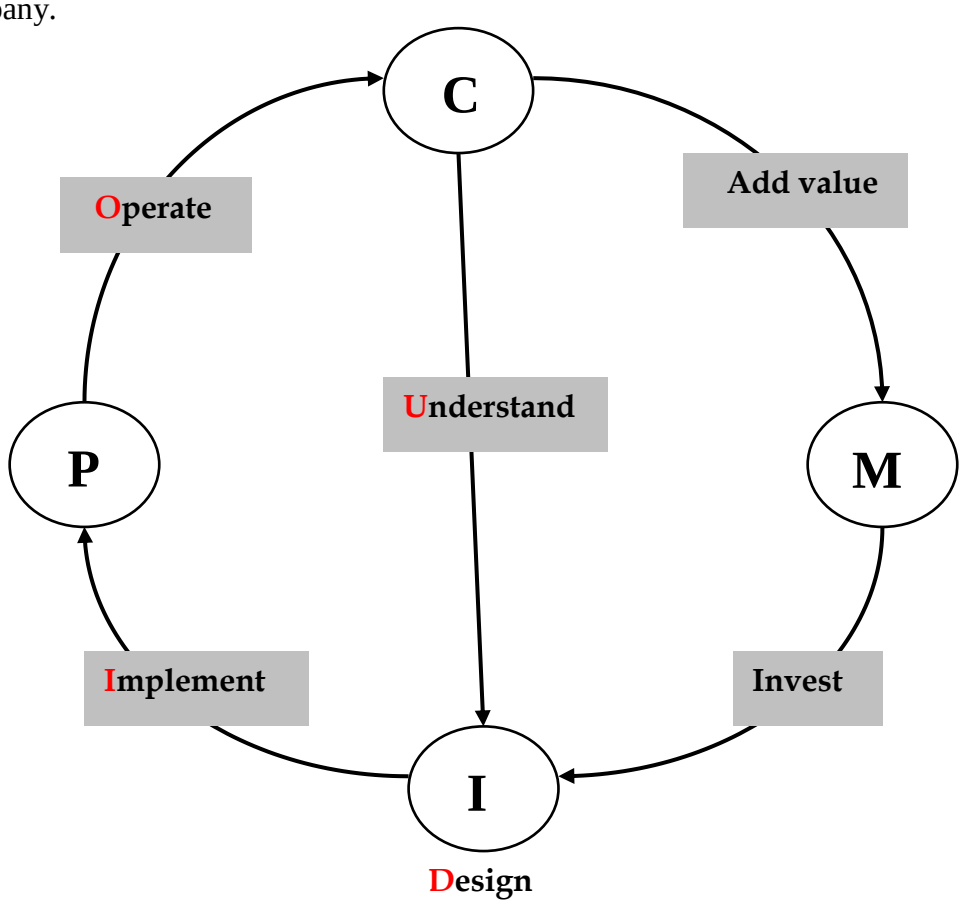

Figure No. 5: Cyclical Business Organization

In Figure 5 we show a highly simplified *cyclical business organization*, based on the interconnection of processes rather than the static display of functions, roles or positions.
Each business has to coordinate four basic dimensions: *Customer* (C), *Innovation* (I), *Processes* (P) and *Money* (M). According to Jackson (2004), all business, *as a minimum*, has to use resources/processes to satisfy the customer in order to make money. Innovation can be viewed as the fourth dimension, necessary for assuring the long-term, sustainable performance of business.
So, in a healthy business organization we can distinguish two interwoven cycles:
1) C-I-P, the *Knowledge Cycle*, which transforms customer information into innovative products and processes and operates them in order to serve and satisfy the customer.
2) C-M-I-P, the *Money Cycle*, indicating the overall circulation of capital. It transforms customer satisfaction into money and then reinvests the money in order to redesign the processes so that their operation serves the customer better, creates more value for him and therefore more money for the business.
Observe that both cycles, C-I-P and C-M-I-P, are embedded within each other and are mutually reinforcing. They represent the *overall strategy of business*.
Strategy is the *portfolio of activities* of a company. Strategy is *not* a statement (of vision, mission, etc.). Strategy is not a description of action, but action itself. In this sense, all companies *have strategy* because they do – something. Your strategy is what you do, not what you say you do. And what you do *is* your strategy.
It is here, within the overall strategy, that the U-D-I-O cycle of Figure 1 must be embedded. Its embedding is indicated by red letters and it is clear that only through the embedding can the Innovation *process* become a part of the corporate strategy, embedded in its organization, embodied in the knowledge of all employees and harnessed towards adding value for the customer. It is only in this way that a company can become an Innovation Factory, where every employee, through his actions, is engaged in innovating processes and products, which bring improved satisfaction to the customer, add more value for him and so make more money for the company.
Each cycle, C-I-P, C-M-I-P and U-D-I-O, in each of its iterations, enhances (or should enhance) *experience, learning and knowledge* among the employees and managers of a corporation. Without continuous knowledge enhancement there can be no innovation enhancement.

8. What is Knowledge?

Knowledge is the *purposeful coordination of action*. Achieving an intended purpose is the sole proof or demonstration of knowledge. Its quality can be judged from the quality of the outcome (product) or even from the quality of the coordination (process).
If we can engage in any activity in a purposeful and coherent way, then we demonstrate knowledge or *we know*. Such purposeful action can be both physical and mental, ranging from doing and behaving to speaking and thinking.
In order to coordinate our action, we have to embody certain enabling structures, like neural patterns, physical and mental dexterities, appropriate concepts, distinctions and guiding images, and so on. All such enabling structures can be embodied though

inheritance, learning, training or similar processes. A more comprehensive definition of knowledge would then read as follows:
Knowledge is an embodied complex of action enabling structures, externalized through a purposeful coordination of requisite activities.
Information is a *symbolic description of action*. Whenever we describe, in words, numbers, pictures or symbols, past, current or future action, we have created information. *Information is not knowledge*. What we do is knowledge; what we say we do is information. All knowing is doing, and all doing is knowing. Information is an input into the process of coordination of action, into knowledge.
Managing a company through information, that is, through symbolic descriptions, is quite inappropriate in the global era. No business adds value through descriptions, but only through action. Managing action is different from managing statements and other symbolic descriptions. Reading a cookbook (information) is fundamentally different from knowing how to cook (knowledge).
Innovation is not just about ideas, inventions and designs, but about the entire, self-enhancing U-D-I-O cycle. Innovation is about action because it is about adding value and value can only be added through action. So, the Innovation cycle must be embedded in the Knowledge cycle and that in the Money cycle, as in Figure 5.
Knowledge is measured by added value. Added value is produced by customer satisfaction expressed by the purchase. Otherwise, no added value has been realized. Only the purchase brings money. So, knowledge is measured by added value, i.e., by the money paid for it by the customer.
Innovation adds value through knowledge.
So, the Knowledge cycle is crucial for business in the global era. It consists of at least four fundamental and interconnected transformations:

- *Combination (I→I)*, transforms information into better, more suitable, actionable information (The traditional domain of IT and MIS).
- *Internalization (I→K)*, transforms information into knowledge, that is a purposeful, effective coordination of action.
- *Socialization (K→K),* transforms knowledge into a more effective knowledge through sharing, learning and cooperation.
- *Externalization (K→I)*, transforms successful action back into symbolic description, effective knowledge into usable information.

This Information-Knowledge cycle, C-I-S-E, is being continually repeated, coordinated and enhanced, forming the base for so called *Knowledge management* (KM). It is clear that KM cannot exist *per se*, on its own, but must be embodied in people and embedded in corporate systems. The Knowledge cycle is the *enabler* of the Innovation cycle.

Process is more important than product. A high-quality process implies a high-quality product, but not *vice versa*. Similarly, corporate organization implies corporate structure, but not *vice versa*. Because the organization is action and doing, and structure is its description and "snapshot", then organization, as a concatenation of key corporate processes, is the strategy. So, strategy implies structure. Innovation flows from organization (and strategy), not from structure. Innovation management must be

intimately embedded within all relevant corporate cycles. Then the business organization becomes driven by the Innovation Factory embedded within.

9. Conclusion

We could present only partial and incomplete sketches of our innovation methodology. However, it should become clear that modern innovation has to be studied and practiced not *per se*, in isolation, but as an integral part of the entire circular organization of a company and its business. This represents a huge challenge but promises even larger returns for modern, forward-looking companies of the global era.

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