

THE INNOVATION FACTORY: MANAGEMENT SYSTEMS, KNOWLEDGE MANAGEMENT AND PRODUCTION OF INNOVATIONS

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Abstract. In these presentation notes we explore the nature of innovation as an integral part of a company's 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, strategy, technology, mass customization, and some others. The purpose is to outline several methodology foundations for transforming a company into a Factory for Innovation.

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.

In the global era of hypercompetition, telecommunications and accelerated information/knowledge sharing, the innovation process has to become a systemic property of a company and its organization. All individuals work in and are 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. An effective and company-wide innovation cycle is the prerequisite for maintaining strategic competitiveness in a fast-moving, turbulent era. The whole company, with all its employees, whether production or service oriented, must become an Innovation Factory.

How is the Innovation Factory to be conceived, designed and implemented? How does it become a part of not only the system and organization, but also of the corporate culture?

What is Innovation?

There are clearly many definitions and conceptions 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.

These kinds of definitions are important because practicing the Innovation Factory requires a system of incentives and rewards - so that the innovation process does not become a spontaneous, brainstorming "beer club" - and thus the criteria and measurements of added value are crucial.

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).

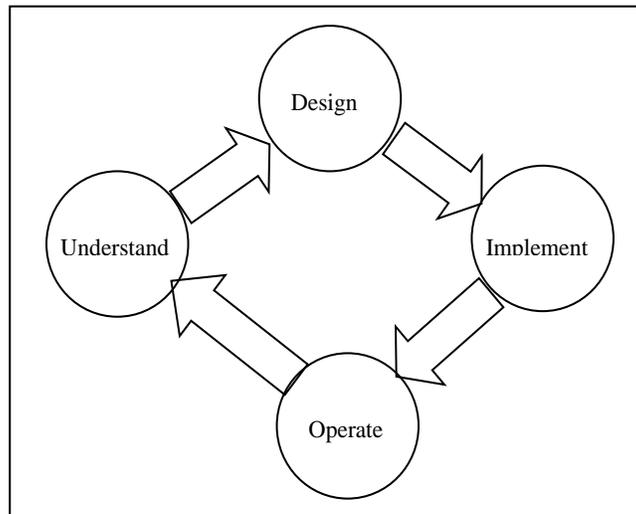


Figure 1. Innovation U-D-I-O Cycle

The U-D-I-O cycle of Figure 1 is a simplified interpretation adapted from Jackson (2004). This is a self-reinforcing learning cycle which must be continually repeated if any *learning from operating* is to take place.

It is crucial to have a system of criteria in place in order to determine and decide whether each idea of a potential product or service should be moved forward to the next stage of the U-D-I-O cycle. Both the speed and the cost of this cycle are increasingly important and the right questions must be asked at each stage. 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.

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.

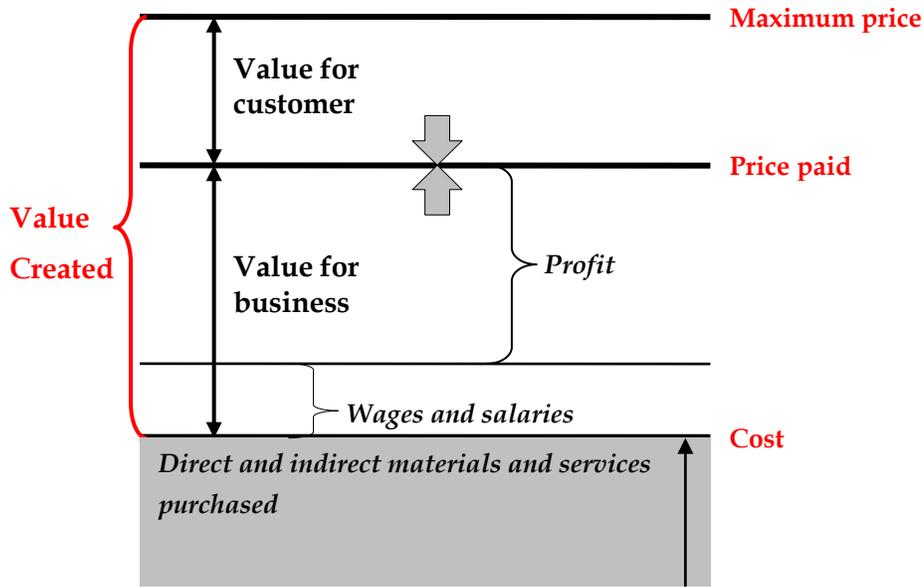


Figure 2. Adding Value for the Customer

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.

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.

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 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.

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

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.

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 thing that matters is *what they do*.

Unsalable goods, products or services *cannot be* of high quality, by definition. (It reminds me of a Czech automaker who insisted that their cars are of the highest quality in the world – except that nobody buys them. And can I help? No, I can not.) 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 with the customer.

Customer Value and Mass Customization

What constitutes the value for the customer? What increases the maximum price he is willing to pay?

Customers are willing to pay money for:

- Good price
- Fitness for usage
- Customized fit
- Speed of delivery
- Reliability
- Image

and some other factors. These factors affect the value for customers and are therefore good criteria for judging innovation.

Customers are of different types: some prefer effectiveness (more value, better fit), others efficiency (lower cost, speed), for different products at different times. Depending on the *portfolio of customers* and its management, the innovation strategy will emphasize effectiveness or efficiency or both, and so build up a distinct, requisite *product/service portfolio*.

Mass customization, as practiced for example by Dell Corp., is a good example of delivering value for the customer as a guide to the innovation process. Mass Customization (MC) represents a new way of *understanding* (eliciting customer preferences), *designing, implementing* (producing and distributing) and *operating* (selling and using) processes, products and services: fitted, individualized and customized for specific customers, yet provided *at the cost* of mass-produced, standardized, off-the-shelf items. In this sense MC emerges from a special fusion of two traditional approaches: *mass production* and *custom made* modes. MC retains the best features of both: low cost and good fit for use.

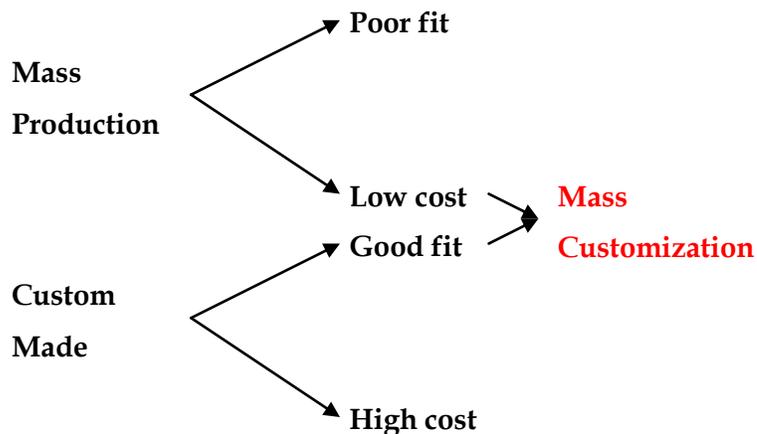


Figure 3. Mass Customization

Mass production offers poor-fit, low-quality items at a low cost. Poor fit and lack of individualization is tackled by sorting and classifying, usually by size, but also by color, style, taste, ingredients, etc. This sorting into classes (like the Czech “*jakost*”) reduces the poor-fit, but increases the *proliferation of variety* (and numerousness) at the same time - leading again to the higher cost of warehousing, displaying and selling.

At the other end of the traditional spectrum of choices is the “custom made” or “made to order” mode of production. This offers a much better or even individually perfect fit, but at a much higher cost. Traditional consumers are thus forced into *tradeoffs* they would not normally care to make: you can have either a good fit at a high cost, or a poor fit at a low cost. Such *forced tradeoffs* are the heritage of the industrial era of mass production and mass consumption.

The *global consumer* wants to have it all: good fit and low cost, effectiveness and efficiency, and quality. Mass Customization has started responding to such deeply seated, natural wants, needs and preferences. Unnecessary tradeoffs are not suitable for consumers and producers of the global era.

The purpose of innovation is to add value. The purpose of good innovation is to *eliminate tradeoffs* (Zeleny, 2000).

MC allows companies to *disintermediate*: communicate directly with their customers, without the expensive and slow interlinks of assorted agents, intermediaries, dealers and “facilitators.” Such direct contact makes the customer real and specific, not anonymous anymore. Masses of anonymous customers cannot be as effective and loyal as masses of specific individuals. *Markets do not buy anything, individuals do.*

MC has other innovative advantages for the business and customer:

- First sell, then produce: cash at the start of production
- No finished products inventory
- No retail outlets, no unsold or returned goods
- No anonymous customer
- No intermediaries, and some others.

Technology Innovation

Because of the nature of this conference, 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.

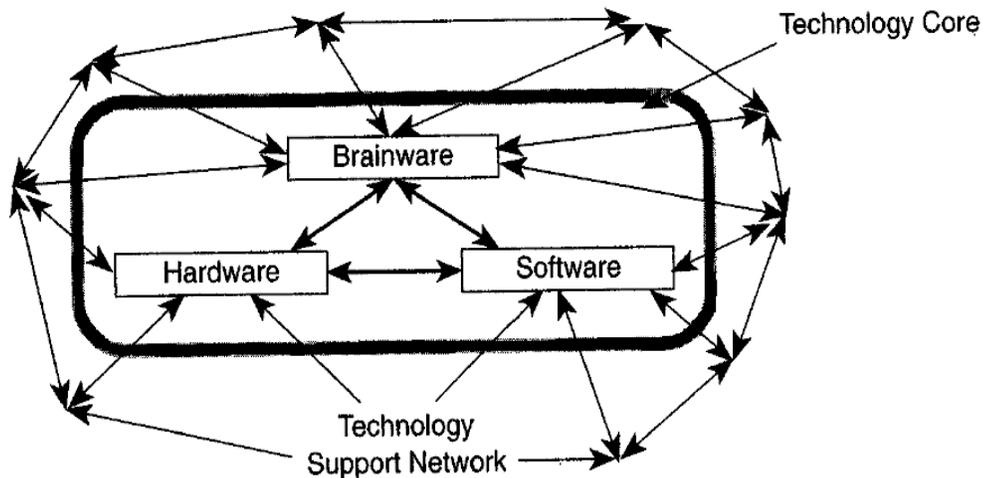


Figure 4. Components of Technology

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 than 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.

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.

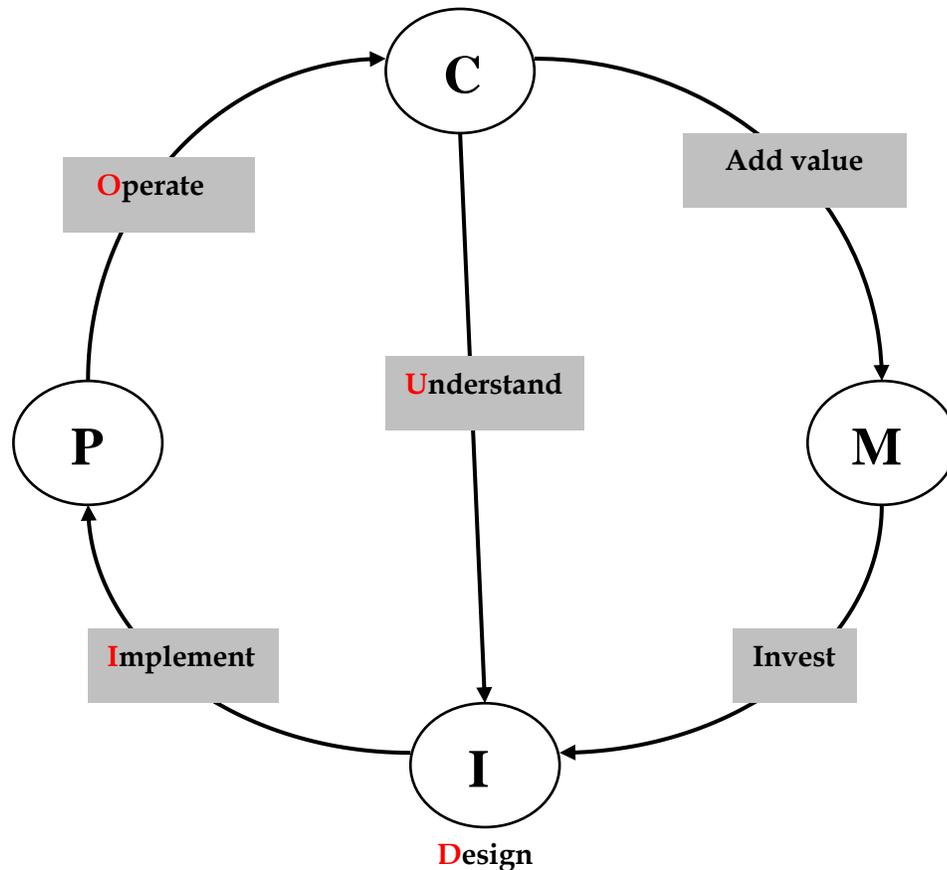


Figure 5. Cyclical Business Organization

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.

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 through 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* ($I \rightarrow I$), transforms information into better, more suitable, actionable information (The traditional domain of IT and MIS).
- *Internalization* ($I \rightarrow K$), transforms information into knowledge, that is a purposeful, effective coordination of action.
- *Socialization* ($K \rightarrow K$), transforms knowledge into a more effective knowledge through sharing, learning and cooperation.
- *Externalization* ($K \rightarrow I$), 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.

All corporate cycles, like C-I-P, C-M-I-P, U-D-I-O and C-I-S-E, form the foundation of innovation-producing corporate *organization*: the underlying circular concatenation of corporate processes. *Organization is different from structure*. Corporate structure is a static, symbolic description, a “snapshot” of produced positions, functions, roles and their connections. Organization is a dynamic process, structure is a static outcome: process and product.

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, 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.

Environmental Embedding

The entire circular organization of a company, with all its cycles, must be embedded within its environment of markets, competitors, suppliers and customers. No company is an island and no company can be better than is the network of which it is a part.

Companies do not succeed or fail because of their strategy, but because of how well they *fit with their environment*. In order to fit well, they have to actively analyze their environment, its competitors and customers. To fit well means, like everywhere in nature, to create a *niche*, to differentiate itself from others, and to compete as little as possible.

One has to *find a space in the market*, not just mindlessly emulate what all others are doing. In order to identify such “open spaces”, we often have to create them. Whether we uncover or create them, we have to abandon “benchmarking”. The purpose of business is not to be good at what others are doing, but to be different. Traditional benchmarking leads to standardization, commoditization and “sameness”. The name of the game is *differentiation*.

Successful companies have to *create new value*, and new value for the customer is not created by emulating what others are already doing. As Jack Welch practiced, if you cannot be the best or second best in your competitive environment, get out of that business and enter a new business space.

In Figure 6 we display a *profile map* of the environment. Any product or process can be analyzed according to at least the key dimensions of price, quality, and speed, but possibly to many others, like service, image, etc. Our product can be compared with their product and both with what the customer wants. Our, Their and Desired value profiles can be created and compared. The map shows the “gaps” or spaces to enter.

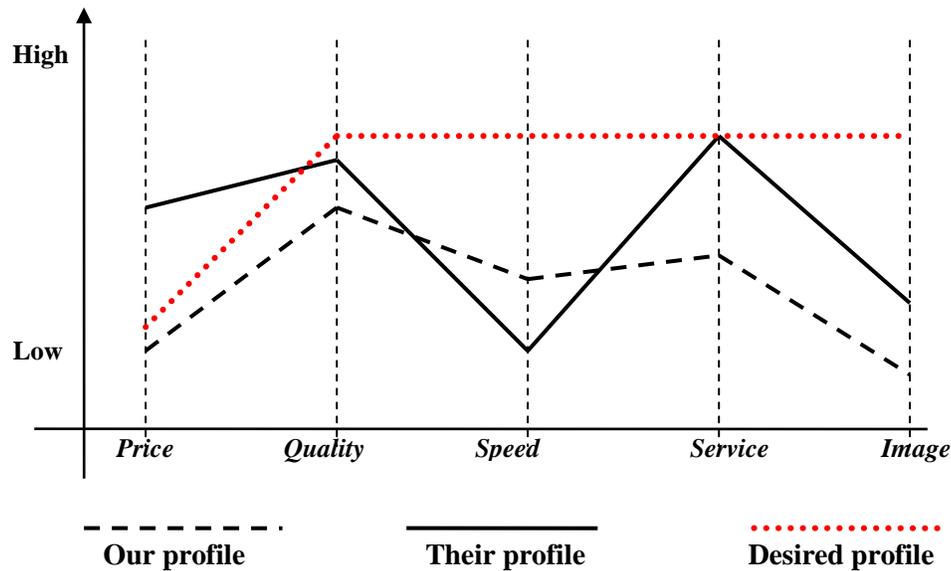


Figure 6. Profile Map of the Environment

A specific example of the use of Value Profile maps is represented in Figure 7.

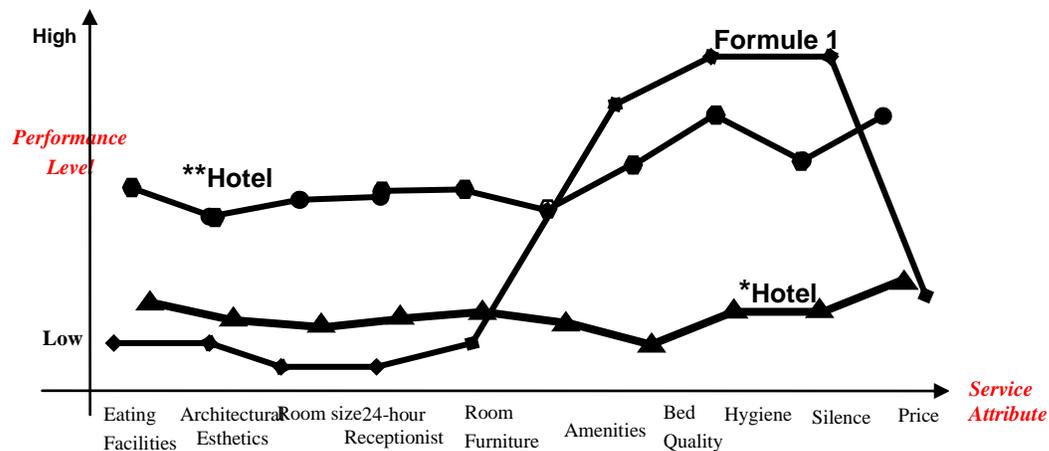


Figure 7. An Example of Introducing Innovative Service

The example (Figure 7) of *Formule 1* is adapted from the works of Kim and Mauborgne (1997, 1998).

Observe that comparing two kinds of hotels with respect to ten service attributes leads to virtually parallel *value lines*, adding little to the customer. One can continue up and up, all the way to four or five-star hotels, at higher and higher prices. That is the result of benchmarking and the resulting hypercompetition.

It is extremely difficult to enter such a competitive and well covered market at any interesting environment level, other than strictly local.

Formule 1 hotels is an example of a successful innovation which created its own new space and a significant new value for customers. They chose not to compete along traditional "hotel" dimensions (got rid of the "piano music in the lobby") and focused on *bed quality, hygiene, silence* and *price*. In these four key customer-driven areas they easily surpass their "industry standards". Their innovation adds value.

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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