

DIGITALIZATION AND INDUSTRY 4.0, STRATEGIES... NOT ONLY TECHNOLOGIES!

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Abstract

Industry 4.0's investments and approaches will actually increase the levels of competitiveness of companies only if they are used to enable new levers of competitive advantage. It is therefore necessary to have a strategic vision that can identify the new Products/Services that can be offered to the market and the related business models. Companies have also to avoid investments that will generate little real value in the market place. Quite often they even generate new complexity that can affect the current competitiveness of the Company. Strategic methodological approaches should be used to design and develop new Digitalized Value Propositions and Business models. This article describes how to realize the new Organizational Digital Configurations.



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THE CURRENT CONTEXT OF INDUSTRY 4.0

There have been already a lot of talks and writings on "Industry 4.0 ". Perhaps they have given too much emphasis on its technological dimensions without a full understanding of its strategic value.

It means that there is the risk of investing in digitalization (quite often exploiting the advantages of the financial/tax promotional campaigns available in many Countries), assuming that the possible increased efficiency and flexibility can be automatically translated into a higher turnover of the company.

Adequate technological investments may indeed increase the productivity rate of the companies, allowing a reduction in the number of employees and therefore an increase of their EBITDA. But these investments may generate some negative by-effects.

First of all, if they have been implemented with the financial support of the local Government (such as tax recoveries linked to the "over-amortisation" for such investments), it will generate the side-effect of the need to find somewhere else the amount of the missing fiscal income.

Secondly it will anyway generate unemployment that will affect the local Consumers buying possibilities. We should also ask ourselves whether the reduction of employment is and the transfer of tax charges to the Community are really the real primary objectives of our countries.

The primary objective of a Country should be the increase the competitiveness of the industrial system in order to support the Country GDP increase (with consequent GDP per capita increase).

For this purpose the reduction in operating costs is a "necessary but not sufficient" lever to use. An increase in industrial efficiency, especially in western industrialized Countries, would not be sufficient in itself to ensure a significant increase in the turnover of our enterprises (and consequently of GDP).

This is because the efficiency gap on products manufactured also in the emerging countries would be anyway higher due to the low cost of manpower. In addition, we have to consider that also the emerging Countries are now digitalizing

their industries (and probably even faster and deeper than in the west).

Let's think about the magnitude of the Digitalization Program in China ("CM 2025").

Increasing the efficiency "alone", cannot therefore guarantee a real increase of the competitiveness of companies. Investments and approaches of Industry 4.0 will really be able to increase the competitiveness of our businesses only if they will be used to enable new competitive levers of "value".

These levers are to be sought in the ability to provide products/services that have to be innovative, differentiating, higher value perceived by the market.

They must at least enable a Mass Customization capability in the industrial system. It should also be considered that innovation of the Production Systems, in itself, does not guarantee innovations in Products/Services that can be perceived by the market-customer.

The strategy to use the 4.0 technologies just to increase the efficiency of the production of existing products/services is, in conclusion, a losing Strategy.

THE STRATEGIC ROLE OF INDUSTRY 4.0

In order to make a strategically valuable use of the 4.0 technologies, it is necessary to have the awareness of the strategic, organizational and cultural levers they can enable.

It is with such awareness that best and suitable technologies can be chosen to create more business leverage and avoid low investments return. In this context, however, it is also necessary to know how to make the right changes in the Reference Paradigms.

A vertically integrated implementation approach is also needed (Strategy-Organisation-Culture-Technology) and horizontally as well (Machine-Human, Virtual).

As far as the Company's Operating Model is concerned, it must be analysed, and probably reviewed in an integrated way, in all its dimensions: Structure, Business Processes, Organisation, Management, Culture, Systems and Technologies.

The following strategic capabilities can thus be enabled:

- Ability to innovate the Value Proposition in the Product-Service mix ("*Servitization*")
- Ability to customise products in real time and flexibly produce high volumes ("*Mass Customization*")
- Ability to offer customers co-engineering, co-design and co-manufacturing services ("*Pro-sumership*")

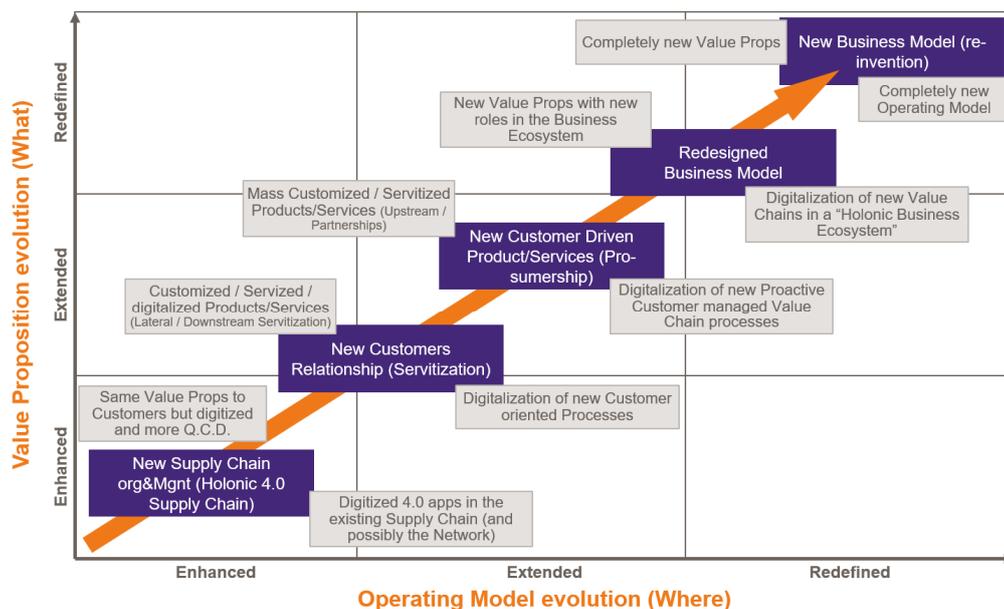
- Ability to produce and deliver "what is needed, where it is needed, when it is needed ("*On demand*")
- Ability to operate in an integrated and interactive way with the business ecosystem ("*Open Business*")
- Ability to operate in a "digitalized" way at every management and operational level ("*Smart business*").

BUSINESS MODEL EVOLUTIONS

More generally, the possible evolutions of Business Models in the logic of "Digitalization 4.0" can be identified through the combination of different perspectives/dimensions: Value Proposition (products/services offered), Operating Model, Technology.

Each of these perspectives can be seen in evolutionary sequence through the following incremental steps: Enhancement, Extension, and Re-definition.

Let's examine some incremental reference configurations of the Business Model, synthesizing in a corresponding way the three dimensions "Products/Services", "Operating Model", Technology.



Level 1: Digitalisation of the existing Business Model

This is the level of "simple" digitalization of current transactional, managerial and operational processes of the company (inside the current network of suppliers, partners and customers). The Business Model and the Operating Model do not change their structure, but their digitalization generates anyway advantages and also a potential increase of business.

The digitalization of existing processes allows improving its performance on the three dimensions *Quality, Costs, Time*.

As far as *Quality* is concerned, it will in fact be possible to eliminate the occasions for defects connected with manual management and those generated by non-integrated IT applications (having now uniqueness of data generation and source) and the level of "compliance with the purpose" (due to the faster recovery/retrofitting/re-alignment processes). The company will

significantly improve the management capacity of Customer Satisfaction and Customer Experience (by enriching CRM processes and their real-time connections with other business and operational processes).

As far as *Costs* are concerned, it is a question of having more efficient processes and reducing costs. This applies both to internal management processes (Accounting, Programming, Tracking, etc.) and to operational processes (Production, Supply Chain, Customer Management, etc.). Of course, it is also possible to reduce the number of staff to manage them.

As far as *Time* is concerned, the digitalization of processes allows faster and more flexible programming/scheduling/dispatching phases in the management of production/logistic flows and in the management of customer relations as well (including claims).

The improvement of some of these performances probably also allows to generate more sales potential, thanks to the new performances offered (Quality, Response and Delivery times, Customization of products/services, etc.).

In conclusion, with this level of digital evolution, with the only digitalisation of Management and Organizational Processes, it is possible to improve Business Performance without substantially modifying the products/services and the Operating Model. In this evolutionary stage the main advantages are determined by the increase in Efficiency of the entire company system.

Level 2: Digitalization of Down Stream Processes

The digitalization of company processes in their downstream phases (i.e. in business relations and transactions with customers) allows the activation of new businesses, made up of new services that can be associated with pre-existing ones. These range from associating better or new services with traditional products, to devising real new Value Propositions. More specifically it can range from the mere combination of new services with previous products/services, to the sale of such products through services or even to the transformation of the product into a service. This approach is identified by the term "Servitization". Examples already widely known of Product Servitization include the possibility of having

Products/Services in "pay per use" (smartphones, cars, machines for laboratory analysis, packaging systems, aircraft, etc.).

This mode is enabled and enhanced by digital applications, which allow to monitor and manage services and payments in real time.

Technologies such as IOT, Cloud, RFID, QR, can support the creation of new value by themselves enabling business models with integrated management of all processes and interfaces. Think about the possibility of remote management of machinery operating at customers' premises, the car sharing business, the automatic payment of countless services with smartphone apps, all the new digital services provided in Smart Cities, the self-management of insurance, etc..... As already mentioned these new Value Propositions can be offered through the Servitization of existing products/services or through completely new services enabled by Digitalization and its devices.

Better specifying the concept, when we talk about Products sold through the service, it can be identified as a "down-stream" Servitization that means, flanked or substituted of the already existing products, but with prevalence of the new transactional modality (service vs. product). This can be applied both in B2C and in B2B environment. In the case of "flanked" enlarged services offered to its customers, it could be better identified as "Lateral Servitization".

In these cases, Servitization, in addition to being aimed at increasing the volume of Business is often used to build customer loyalty in the new context of liberalised market. The main protagonists of this approach are Utilities suppliers (water, electricity, gas, etc.), offering their customers new complementary services in other dimensions not previously covered, or even completely new services (entertainment, insurance products, etc.).

This is usually done in an integrated way with the previous traditional services (water, electricity, gas), in order to be able fidelize customers through these new services. This is done through the possibility to have an integrated Customer Management System enabled by digitalized technologies.

This level of Digitalisation can also be seen as a possibility for the Customer of self-testing products directly in a virtual way (as offered by

Rayban to test glasses on client photography). Of a similar level of digitalization can be considered the possibility of recognition of the client in the fashion customer's store through RFID on the label of the garment he wears (tags that can be used also to launch the appropriate washing program in the washing machine at home).

The above obviously implies changes in the operational models of the companies, needing new processes (especially towards customers) and new relationships with the business ecosystem (new partners, new value chains, new supply chains). It deals with amendments to the Company's Business Model. At this evolutionary stage Digitalization allows to enhance turnover and margins of the company.

Important in this regard are the "Customer Experience" possibilities offered by these levels of Digitalization, as they can provide significant competitive advantages.

Level 3: Digitalization of Up-Stream Processes

This represents a higher level of relationship with the market/customer. While the down-stream servitization concerns the possibility of the customer to manage directly what before he was supplied, in the up-stream dimension, it means proposing and selling to the customer the possibility of self-configuring what he intends to buy.

In practice, the customer from the role of Consumer/Customer, as he was previously, it can thus be transformed into a "Pro-sumer" (i.e. into a customer acting proactively in the Supply Chain that will generate what he wants). Its proactivity can reach different up-stream levels. It can be just managing a self-delivery of what is available or already scheduled by the supplier or could mean the possibility to "customize" or even to design a tailor-made product/service.

After Dell's first B2C applications, followed by Nike ("configure your shoes"), there are now possibilities for self-design and delivery in many B2C sectors. In the world of clothing/fashion the trend of Pro-sumership digitalization has also affected many other companies. Nike was followed by Adidas and Converse. In the suite/fashion business it is possible today to "tailor-made self-customized dress on line

(Bonodos, Indochino, Reda-Lanieri, Miroglio-TaylorItaly, etc...) The trend in B2B is now also noteworthy.

In the packaging business, for example, it means selling the possibility of self-configuring and self-designing customized packages (with images and indications that can be modified directly by the customer batch by batch). In addition, it is possible (and already widely used) to include digitalised components in the product itself. In the packaging example, RFID/QR tags can be integrated into the package to manage the entire life of the product through to its final recycling, (passing through all management and Customer Experience moments).

These RFID-based applications are typical of the Fast-Moving Goods/Retail sector.

Similar applications are now becoming widespread in the pharma and health care sector as well. Up-stream digitalization, in addition to having a strong impact on the type of offering, can also allow a considerable "upgrading" in the logistic and production performances. But it is possible only if Operations enable it modifying their operating Model.

Quite often the "simple" Digitalization of operational processes can be the source of the possible new Value Proposition. First of all, the possibility of "Mass Customization", which is also one of the major objectives mentioned in the Industry 4.0 programs. In fact, thanks to digitalisation and other 4.0 technologies, it is today possible to achieve high flexibility in manufacturing, reducing set-up and start-up-times to a minimum.

The same in the scheduling / reprogramming / launch process time, greatly simplifying the handling of bottlenecks. Similar significant improvements can be obtained in the management of problems, in the quality of products/services (having processes under better control and capability of simulation in augmented reality), and in the decision-making process (thanks to transparency and "real time" of the data management).

As far as new technologies are concerned, an important contribution to the Mass-Customization is given by 3-D technologies, co-boting systems and artificial intelligence. RFID and/or or VKM

(Visual Knowledge Management) innovative technologies are well supporting this process.

The simple application of digitalisation to Kanban systems, thanks to the speeding up of the information process, in many cases enables the possibility of move upstream the "decoupling point" of the Supply Chain, thus enabling a further upstream movement of the customization of the product/order.

In this level of digitalization, the Business Model is strongly modified with significant up-grading both in the products/services offered to the market and in the Operating Model, which may provide potential for additional value in the offer (due also to the continuous technological developments).

Level 4: New Business Models (redesign-enlargement)

Digitalisation enables and easily supports the possibility of identifying new possible Business Models in the Ecosystem in which the company it traditionally operates.

These opportunities can indeed be found more through a strategic creative capability than analysing the menu of the technological opportunities. It is necessary to look beyond the traditional boundaries of business sectors and value chains. Sometimes it could be enough to investigate which business opportunities are present in the current environment of our clients. In fact, in this case, we should just change the perspective: from the ecosystem of our sector to the ecosystem of the customer/market that is presently receiving our products/services.

Digitalisation, with its transversal presence in the world of Big Data Management, offers in itself new perspectives and stimuli.

In the Automotive world, this level of approach has led to the identification of new models of transport business. Examples of this are Fleet Management of cars (Leasys, Debis, Avis, etc.) and Car Sharing (large number of players already present in the e-market). With the possibilities offered by digitalisation, these services are becoming more and more sophisticated (from "pay as you drive" to "Km/time recharge", etc.).

These new business models can be activated within existing Organizations, exploiting existing activities for the new purposes ("bubble in"), or

creating new external organizations ("bubble out"). These new businesses have been added to the traditional Automotive business, which was essentially the one of just selling cars. These new business models see the Transportation Service as primary business, being the car just a mean for it (with the by-product of selling cars as well).

In the Pharma world, new business models have instead been created exploiting the new opportunities in the Health Management business ecosystem, such as Telemedicine/Remote Diagnostics, Home Nursing Care, etc... The analysis systems sold as service to laboratories and hospitals is a new business as well (machinery on free loan, conditioned to the utilization of supplier's chemical reagents). A remote management of the analysis machinery could be also considered (as in the packaging business).

In the Utilities world, the birth of new business models is becoming exponential driven by the new Smart City services and technologies (as already mentioned).

All of the above is in continuous evolution thanks to the possibilities offered by the progress of digitalisation technologies. The key capability at this level of strategic approach is the capacity of a strategic analysis of the "enlarged" Ecosystem in which the company operates.

Level 5: New Business Models (Re-Invention)

The previous level of identification of new business models is still linked to the business activities currently carried out by the company in its ecosystem or to the ones existing in the ecosystem of customers (albeit in an innovative logic), where new value chains can be set up (more or less connected to the existing ones).

Today, however, the case of Business Models invented on green field logic (completely new), is quite frequent.

The basis for these new models is generally based on the exploitation of new technological opportunities or new business areas, generated by other new business models or by their evolution. In these cases, they are generated by technological-entrepreneurial combinations. Precursors of this were companies such as Google, Facebook, Booking.com, UBER, etc...

STRATEGY AND EVOLUTIONARY ROAD MAP

The strategic approach and the evolutionary path can be the most diverse, but it has anyway to go through an interactive process combining Value Proposition, Operating Model and Technology in a pull-push logic. Sometimes the lead comes from the desire to offer new Value Propositions (requiring amendments to the Operational Model and Technologies).

Sometimes it is the Operating Model that offers new opportunities for Value Propositions supported by technological evolutions. Sometimes the starting point is a new technology that offers possible evolutions of the Operating Model and/or of the Value Propositions. Much depends on the Ecosystem in which the company operates and on its entrepreneurial and managerial culture, but certainly the three dimensions interact continuously.

In typically very market-oriented companies, the most likely evolutionary path is the one starting from the desire to create new Value Propositions, thus launching projects to design and develop the Operating Model to be able to deliver them. Instead, in typically very Operations oriented companies, the most probable path is the one starting from the development of the Operating Model, followed by analysis and decisions on new possible Value Propositions.

In both cases, the driving dimension requires an adequate alignment of the other one, enabling the possible evolution of the business model. In fact, the new Business Model is the result of the combination of New Value Proposition, New Operating Model and new Technologies.

HOW TO DESIGN THE BUSINESS MODEL

Whatever the level for which the Business Model is to be designed, we must identify the necessary and sufficient "ingredients" to carry out the most appropriate "Strategic - Organisational - Technological" recipe.

In the case of the model to be built internally ("bubble in" approach) it is also essential to have awareness of the starting level of the Company's Operating Model (there are now models for assessments in this respect). In case of "bubble

out" decision, the design is conceptually simpler, but its realization is more indeterminate (it is a "Start-up"). But we need anyway a project covering all the necessary dimensions, albeit in a very pragmatic way and as fast as possible (time can make the difference).

The first requirement that the new Model should have the structure of the "Holon Systems". Only with these features the Business Model will be able to have an Operating Model integrable into the Business Ecosystem through an "Open Business" logic, i.e. the one of the digitized world. With reference to the Operating Model, a "holonic" system can be defined in this way: *"An integrated end-to-end Operations system, capable of interacting vertically and horizontally in an organic way in its ecosystem. This includes the ability to activate autonomous but co-operative ("holon") systems, capable of self-organizing in order to realize its activities and business objectives (served by smart-digital systems)".*

"Holon" is an intelligent operating unit (with learning and improvement capability) that owns the three following basic skills/characteristics:

- Autonomy (ability to create and control the execution of its programmes)
- Cooperation (ability to develop plans with other entities in a mutually acceptable way and to execute them)
- Holarchy (capable to operate in a Holons system to achieve shared objectives with a horizontal hierarchy, which may be multiple, variable and/or temporary).

This basic logic is fundamental for realizing the more advanced levels of the Operating Model.

Given these characteristics, we could identify this Model with the abbreviation "HSM4" (Holon Smart Manufacturing 4.0). It contains all the dimensions necessary to give substance to the strategic value of Industry 4.0. The dimensions of this model are both the Strategic, Organizational, Operational and the "enabling" ones, i.e. Structural, Cultural, Managerial and Technological.

STRATEGIC DRIVERS	<ul style="list-style-type: none"> ▪ Innovation ▪ Servitization ▪ Mass Customization ▪ Flexibility ▪ Pro-sumership ▪ On Demand ▪ Open Business ▪ Productivity
ORGANIZATIONAL DRIVERS	<ul style="list-style-type: none"> ▪ Decentralized Manufacturing ▪ Autonomous Manufacturing ▪ Advanced Automation ▪ Holonic Organization ▪ Horizontal Hierarchy/Decentralized Decision HM* Integration ▪ Profit Centers/Interoperability ▪ Real Time Orders Modification ▪ CPPS** based <p style="text-align: right; margin-right: 20px;">*Human Machine **Cyber-Physical-Production-Systems</p>
OPERATIONAL APPROACHES	<ul style="list-style-type: none"> ▪ DFM (Design For Manufacturing) ▪ Lean Manufacturing ▪ Production Autonomous Cells ▪ Additive-3D production ▪ Information Transparency ▪ Interactive digital tracking and planning ▪ Digitalized WCOM

A summary of the main possible "Driving" Dimensions of the Digital-Industry 4.0 Model

STRUCTURE	<ul style="list-style-type: none"> ▪ "Business Ecosystem based" ▪ Networked ▪ Open Business ▪ "Extended Enterprise" ▪ Virtual Holonic Enterprise ▪ Intercompanies Process Management ▪ Open Innovation
MANAGEMENT	<ul style="list-style-type: none"> ▪ CREMA (Cloud-based Rapid Elastic Mfg) ▪ IOT (Internet Of Things) ▪ CPPS (Cyber Physical Production Systems) ▪ Big Data Analytics ▪ Open Standards ▪ Digital Life-Cycle Management ▪ Artificial Intelligence ▪ Virtual RealTime Representation ▪ Distributed Intelligence ▪ Secure Value Creation System ▪ CIM/CAD/CAM/3D ▪ RFID
CULTURE	<ul style="list-style-type: none"> ▪ Human dynamics management based ▪ Entrepreneurial ▪ Flexible ▪ Proactive ▪ Improvement oriented ▪ Innovative ▪ Cooperative objective and performance oriented
TECHNOLOGIES	<ul style="list-style-type: none"> ▪ "Holarchy" (Decentralized, Multiple, Temporary Hierarchies) ▪ "Entrepreneurial" (Autonomous, By Priority, Real Time, Bottlenecks focused / driven) ▪ Objective vs Hierarchy Led (the most competent on issue leads) ▪ "Integrated" (Virtual-Physical / Humans-Machines) ▪ "Intelligent" (self-adapting, learning, interacting) ▪ Profit vs Cost Centers

A summary of the possible content of the "Enabling" Dimensions of the Digital-Industry 4.0 Model

The best design is the one that identifies the mix of ingredients that best can guarantee the integrated implementation of the desired Business Model. A redundancy of ingredients can be as harmful as a deficiency.

This is the logic I referred to in the initial thesis of this article.

But, however, that is what I believe entrepreneurs and managers should keep in mind when they decide to invest in "digitalization".

A balanced, ad-hoc "recipe" must be configured for each specific company situation, in order to make targeted effective investments and avoiding waste.