The new economy of complexity: the sense and challenges of the incoming digital transition

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Abstract

Framing of the research: *The transition that pushes forward the massive use of digital technologies is leading businesses, communities and people towards a new paradigm, that is, towards a new (coherent) system of working and living. But, if we look at the many breaks and the many innovations that emerge, day by day, in the present, it is difficult to anticipate the meaning and challenges of the future paradigm.*

Purpose of the paper: *The thesis set out in this paper is that the most relevant change of digital transition is the assignment of a new role to complexity: variety, variability, interdependence and indeterminacy cease to be critical factors to be compressed by any means, and become an increasingly important source of economic value, along new evolutionary paths.*

Methodology*: This is a perspective paper that presents the author's assessment of evidence in the business and social environment*

Results*: Digital technology supports this transformation by providing users with global communication networks and flexible machines that work at low cost and quickly, on demand. These two conditions are the premise for a radical change with respect to industrial modernity that we have known in the past.*

With the advent of the digital modernity, four levers of value are becoming relevant: the offer of customized varieties, on-demand responses to novelties, increasingly extensive and interdependent supply chains, exploratory processes projected towards the new and the possible. These will also be the factors destined to change the role of labour, called upon to provide a contribution of creative intelligence in the expansion and management of emerging complexity. Three different, yet interconnected, evolutionary paths emerge: digital neo-Fordism promoted by the propagation of standards, the re-personalization of the world, the exploration of the new and the possible.

Research limitations*: Different observable business and social phenomena could collide with the viewpoint proposed in this paper.*

Managerial implications: *From this paper, managers and decision makers who are searching for ways of using knowledge to generate value can gain an original viewpoint on the new role assigned to complexity and reflect on the emerging value drivers identified as results of the study.*

Originality of the paper: *This is a conceptual paper that provides new insights that advance our understanding of value drivers induced by digital transition.*

Key words: digital transition; complexity; generated value; growing risks

1. The backbone of early modernity: the downward compromise between science and complexity

The ongoing digital transition is changing the experience of all of us and, in particular, that of companies in search of new ways of using knowledge to generate value. In the current business landscape, there are many emerging changes that are often gathered in a rather confused way: on the one hand, digital networks, which provide communication and interaction skills on a global scale, introduce new protagonists, who, in the past, were hardly reachable or even unreachable due to distance. On the other hand, the material processes of manufacturing goods and producing services move away from the typical standards of mass production thanks to the use of automatisms and learning algorithms that allow firms to manage a range of coded variants at a low cost.

In both cases, the resulting effect consists in a *net increase in complexity,* i.e., in the variety, variability (over time), interdependence and indeterminacy that characterize products, processes, relationships and meanings in new business models. Nevertheless, this growth in complexity does not receive the right amount of attention in the literature and public opinion. In truth, the supply's greater capacity to adapt to demand and its variants today is becoming a formidable *source of value* because it allows demand to develop expectations and meanings that are not bound to consolidated standards, thus proposing new solutions that are suitable for different contexts and situations (De Toni and Rullani, 2018).

As a result, digital transition is travelling along a radically new trajectory, compared to the forms of production that have been expressed by modernity over the two centuries that have elapsed since the industrial revolution of the late eighteenth century. Since then in fact, modern society has begun to systematically use *science as a productive force* and materialize it in machines. This entails two fundamental advantages: the advantage of being able to *exploit natural energy* (coal or oil) instead of the physical energy of man or animals; and, above all, the advantage of being able to *create value* by leveraging *the zero cost of the reproduction of knowledge* once it is codified in the form of technology and incorporated into a machine or a replicable procedure.

Under these conditions, in fact, any re-use of abstract knowledge deriving from science and technology generates an additional value, that may be more or less relevant, at no (cognitive) cost. By *multiplying the uses* that replicate this kind of knowledge, it becomes possible to obtain an economic surplus (in value), that is proportionate to the achieved propagation of its uses.

Throughout the course of *early modernity,* from the industrial revolution to the present day, the process of replicating products and processes in the abstract form required by science and the technology has progressed at great speed. However, it has come into conflict with the high complexity of the natural environment and social ecosystems (people, communities, states) that are produced by the evolution of the real world (Rullani and Rullani, 2018).

To obtain the advantages of the zero-cost replication of reproducible knowledge applied to the different problems and contexts of the economy, modernity has had to *drastically reduce the complexity* that is admitted in the social environment and in production processes, by standardizing and programming products and operations in function of the (rigid) machines to be used. In every sector and in every enterprise, the *variety* of previous artisanal or agricoltural products and processes has been reduced to the standard and codified for the efficient use of the chosen machines and technologies. The *variability* of products and processes has been fixed in programs over time in order to be maintained as constant as possible. The *interdependence* of each firm with other activities or actors has been reduced to a minimum, thus creating strictly delimited and controlled supply chains. Similarly, the *uncertainty* linked to unpredictable events has been traced back to adaptation or innovation flows that were planned in advance.

2. Understanding the transition: the de-construction of old assets and the contemporary re-construction of new ones

In the history of industrialization, it is possible to recognize different stages *ex post facto*, each of which is characterized by the - partly spontaneous and partly consciously designed - construction of a *coherent system* of rules, behaviors, meanings, and targeted resources. In other words, it does not consist in a disordered set of elements, but rather in a *paradigm* with a coherent logic in order to connect different elements within an efficient and sustainable order (Rullani 2019).

When a paradigm that has been inherited from the past loses its internal coherence, and therefore its efficiency in value generation due to disruptive innovations that have taken place over the years, a period of *transition* begins. During such transition, new solutions are experimented: it is up to the *intelligence of the subjects* at stake and their ability to share a feasible future project to better manage the state of disorder that is typical of transition in order to give shape to a new, and different, system of coherences. By doing so, they pass from one paradigm to another.

Transition processes are therefore characterized not only by the many changes they bring about, but also by the shared search for a *new systemic order* that is aligned with the incoming technological potential and capable of making the planned future efficient and sustainable together. This is necessary in overcoming contingent conflicts of interest among the various parties.

Companies are also part of this existence on the brink of transition, which requires not only its systemic contribution (of efficiency, organization, routine) but also its vital, creative intelligence (Vicari 1991). In fact, subjectivities play a fundamental role in every transition because it is up to them to consciously introduce designed innovations in the consolidated systemic framework. Transition, in fact, must not only de-construct the existing order, but also propose a vision of the future and coherence that allows the *creation of a new order*.

This is the logic of systemic evolution that I tried to outline with Salvo Vicari at a delicate moment during the transition from Fordism to another paradigm, at the end of the last century (Rullani and Vicari 1999). In this sense, the system should not be seen as a construction that is fitted to the stability of the existing order, and therefore necessarily hostile to its transformation, in order to re-invent its own self-reference and historical identity. In truth, the direction of change is not towards pure contingent disorder, but rather that of a meaningful transition from one systemic order to another. In other words, transition is a worksite where innovations take shape by triggering divergent processes: the de-construction of old assets, on the one hand, and re-construction of new ones, on the other.

A suitable reference to transition and the role of subjects in it, which is crucial in the current digital revolution of the world and business, is not obvious at all. In fact, during the twentieth century, the logic of *systemic stability,* which was adverse to any important transition, was strongly represented in the *classical systems theory,* which was also widespread in managerial literature. In fact, this theory represented the internal logic of the large managerial enterprise, which had become the reference paradigm of economic and social thought in the 1900-1970 period (Galbraith 1967) in a rather profound way. This representation of things was based on the hypothesis that industrial modernity had found a stable self-referred center of gravity, presided over by large systems (big corporations and nation states), in the order expressed by *Fordism*. Consequently, little space was given to the possibilities of evolution, that is, to innovations that could lead beyond the simple adaptation of the *status quo ante*. The admitted dynamics were mostly adaptive, rather than really evolutionary, and referring to the slow consolidation of ecologies that was produced by case-by-case adaptations (Kauffmann 1993, Nelson and Winter 1982, Saviotti and Metcalfe 1991).

In truth, as we wrote in the Introduction to *Sistemi ed evoluzione nel management* "When the Fordist organization loosens, we realize that the spaces for freedom and experimentation are much greater. They do not depend as much on the conditions' '(structural) objective', but on the ability to induce, innovate, and take risks. Entrepreneurship and business strategies are rediscovered as constitutive variables that are able to set social interaction in motion, thus overturning the structuralist assumption: structures are no longer an *a priori,* but rather the result of a process" (Rullani and Vicari, 1999, our translation).

In this process, technological innovations or emerging changes in the natural and social environment are not enough to activate the transition and lead it to a positive outcome (with the creation of a new system of coherences). Disruptive technologies can deconstruct the previous order by bringing the old system to the "edge of chaos", that is, a condition of instability that sets the search for possible innovation in motion. However, this spontaneous process admits the possibility of falling into a condition of dissipative inertia that is devoid of coherence and a highly conflictual situation (Rullani, 2020a). In order to escape it and re-construct a coherent order in the form of a new system of rules and behaviors, it is necessary to field the *creative intelligence* of the subjects who act in companies and

social life. Subjective intelligence, with its capacity of planning the possible future and sharing the changes to be made, is necessary to overcome the obstacles that are encountered along the path from time to time. Above all, it is necessary to manage emerging conflicts by transforming them into reasonable and shared syntheses that are oriented towards the construction of novelty.

However, systemic inertia counts even in the transformations that are oriented by subjects with a project. Indeed, it is not possible to initiate a transition to novelty without taking defensive behaviors, emerging obstacles and additional costs into account. But it is also true that when the existing system shows its failures, the sacrifices and constraints that are imposed by the previous order also become evident.

This is what happened to the industrial system that emerged from early modernity with its *forced compression of complexity.* Indeed, it was not easy to standardize life forms and consumption in line with the needs of mass replicative production, thus finding an acceptable compromise between the abstract nature of basic knowledge (science and technology) and the differentiated nature of uses and applied knowledge.

On these grounds, various methods have been experimented to achieve an efficient systemic coherence *between science and complexity*, thus giving rise to a succession of very different paradigms. Early modernity (analogue, pre-digital), which marks history from the industrial revolution of the late 1700s to the year 2000, has in fact resulted in a range of systems characterized by very different levels of complexity and required *different mediators* in the relationship between science and the application environment.

3. The mediators of analogical modernity

Three reproducible mediators took shape course of early modernity (see Rullani, 2010; 2020b; 2021):

a) the *machine*, which incorporated the abstract knowledge of technology that derived from science and was applied by the inventor-entrepreneurs of mercantile capitalism, representing the paradigm that emerged from the industrial revolution during the 19th century;
b) the *organization*, which structured reproducible processes and production procedures within the Fordist paradigm that was hegemonic during the 1900-1970 period;
c) the *territory*, which organized reproducibility by mobilizing widespread intelligence within *local proximity* circuits in the years 1970-2000.

Initially, the basic mediator was represented by the rigid machine (agricultural or industrial) that was developed in the course of the first industrial revolution, and was propagated in different sectors and places during the century of mercantile capitalism (the 19th century) by multiplying its re-uses.

The modern machine was designed and built using the finest technological knowledge, thus giving shape to a reproducible tool with zero cognitive costs that incorporated useful knowledge. In this manner, it

became possible to activate the *multiplier of value*, which was obtained by increasing the number of machines produced and the number of products that each of them was able to process. The factory, that is the environment in which the machine is inserted, had to be an orderly, low-complexity place, where there were no unplanned events or links. The users of the supply chain and the final consumers had to adapt to the standard product thus obtained. They were not obligated, but almost always chose to do so in order to take advantage of the most convenient prices of the standard products that were offered by the industry as opposed to the cost of non-standard products that were obtainable from pre-industrial artisans or traditional farmers.

Nevertheless, the mechanized production of mercantile capitalism in the 1800s suffered from a basic drawback: the *rigidity of the machines* that were employed. Rigidity prevented firms from adapting to demand or changing market situations. As a result, it significantly limited the propagation of the knowledge that was incorporated into the machine and made it necessary to concentrate mechanization only in certain operations. Consequently, most of the operations that were required by the supply chain were positioned upstream or downstream of the processing phase entrusted to modern technology.

This limit was partially removed, in the early 1900s, with the advent of Fordism, the paradigm which fielded a *new mediator* between science and complexity, i.e., the *organization* managed by large companies. This consists in a capacity for programming and commanding an *ex ante* fixed line of chain processes, and therefore a line of machines that could sequence many specialized operations until a finished product, such as a car or a suit, is obtained. It was a disruptive change that drastically reduced the cost of finished products but it required a strong capacity of control on business operations and the external market (suppliers, intermediaries and final consumers). This condition favored the development of large and very large companies, focused on economies of scale (from replication) that could be obtained both by means of a well organized use of machines and the direct management of administrative and service operations.

In this case, the rigidity of the technological apparatus was planned by *the power of command* over the production organization, which reduced variety (to standards), variability (to programs), and interdependence (to control).Moreover, with its own power of influence, it attempted to better manage the emerging complexity in the external environment that was not directly controlled.

However, the priority that was assigned to the compression of the admitted complexity severely limited the application field of the Fordist synthesis between science and complexity. In fact, the proper functioning of this system came to depend on the creation of a strong control system in order to stabilize the environmental variance and regulate the behavior of the various actors involved.

In the 1970s however, it became clear that this compromise between science and complexity was creating giants with feet of clay. In fact, the efficiency of the system was greatly reduced, due to the rigidity of the programs in place, every time the behaviors of the uncontrolled subjects

ended up creating important systemic instabilities. Suffice it to remember the explosion of conflict in work relationships, the exponential increase in the cost of oil, the wild devaluation of the dollar, the invasion of the Western market by Japanese competitors outside the dominant oligopolistic circuit, etc.

Then a *third mediator* between science and complexity had to be deployed in response to the growing demand for flexibility. This pressure of facts promoted the growth of *territorial ecologies*, such as *Italian industrial districts* or *Japanese lean production chains*.

In these systems, flexible forms of production could be created, leveraging on he consolidated relationships of proximity ecologies. They exploited an alternative resource to top-down control that was typical of large Fordist companies: If customers and suppliers in the local supply chain know and trust each other, the programs can be varied without great costs by relying on the adaptability and re-invention capabilities of the many players in the local supply chain.

In this manner, it was possible to create productions that exploited the abstract knowledge that was incorporated in modern technologies and machines, and, at the same time, that admitted a certain degree of variance, interdependence and uncertainty. The complexity to be faced was "naturally" reduced by the *barrier of distance*, which encompasses the circuit of local relationships, thus separating it from the variants outside, in the rest of the world. Typically, in an *industrial district*, the knowledge of production processes circulated and was replicated internally. The proximity circuit was opened only downstream when products and services were exported to external customers.

In summary, the evolution of modernity, and that of corresponding business models, has established itself over time - in the pre-digital world - by managing the conflict between the abstract nature of science and the polyvalent nature of environmental complexity. For this purpose, different mediators and compromises were experimented in order to compress the complexity present in production and consumption processes. However, these solutions sacrificed a whole range of needs and possibilities to the logic of industrial standardization and significantly marginalized the intelligence of the men involved. This first took place in the sphere of production, with the deployment of workers and employees who were called to carry out only pre-programmed operations with an executive contribution. The same influence was exercised on the sphere of consumption and social life: indeed, the conditioning power of large organizations drastically reduced the active capacity of users in the fields of inventive solutions and shared sense-making.

4. Second modernity: during the digital transition, complexity becomes a source of value

Since 2000, the three mediators that characterized the management of complexity during early modernity (rigid machines, programmed organization, proximity circuits) gradually lose ground. The incoming

digital transition brought forth new technological and production solutions based on the development of digital automatisms. Thanks to algorithms and data that enabled producers to manage coded (or codifiable) variances at a low cost, the handicap of rigidity is being overcome.

In today's economy, there are three new elements that intervene in the management of the relationship between science and complexity:

1) No more rigid machines, but *flexible machines* (robots, self-regulated lines, multifunction devices) and *flexible services*, which allow one to pass from standardization to a certain level of variety and variability with limited costs and in real time. Production no longer needs to be planned well in advance, but can be carried out *on demand;*
2) No more commands from above, in closed vertical pyramids, but great use of *extended supply chains and network relationships*, in which individual nodes can interact to feed self-organization processes in response to codifiable problems relating to adaptation or expansion;
3) No more closed proximity circuits, but *platforms and media* that allow one to communicate and interact *remotely*, giving access - for a series of activities - to an *ubiquitous space* that surpasses the barrier of distance. Digital networks allow everyone to interact with the variety, variability, interdependence, and indeterminacy that are present in the global world.

Thanks to these three levers, the value generated by the application of abstract science is taking off, in a series of applications, towards ever greater multipliers. In fact, it involves the replication of owned cognitive bases in a series of contexts, uses, and functions that previously remained excluded from the industrial world due to their excessive complexity. The exponential growth of the value that is generated by certain digital innovations has enabled successful businesses and enterprises to emerge with a speed that has never been seen before. The strength of this trend rests on the expansion of the complexity that was previously left "free" (i.e., not used by the industrial system) and which today, in contrast, it is possible to try to make manageable by exploiting the value that users (people, communities, institutions) attribute to previously unacceptable variants, relationships and explorations of novelty.

The digital transition therefore relies on new mediators (*automatisms governed by data and learning algorithms*) that change the sense of modernity. In an increasingly extensive series of productive and social functions, one can now observe the increasingly clear transition from first to second modernity. Such change is clear and relevant: from one form of modernity, in which complexity is *antagonistic* to the use of science in production, value generation shifts to a form of complementarity, in which great possibilities open up to use the replication of abstract knowledge in a complex environment, once this is made digitally governable at low costs and in real time.

But it is not a one-size-fits-all process, as it often seems to those who think that the transition from old to new can be easy and visible. In truth, every day changes of different signs, which, at first glance, are difficult to trace back to a unitary trajectory, may be observed.

Meanwhile, it is easy to notice the triumph of standards, to which all users end up adhering sooner or later, in a series of services: it is now possible to use the algorithms of Google, Facebook, LinkedIn, Windows, Amazon etc., regardless of previous skills and differences.

Alongside this trend - which promises the birth of a world aimed at impersonal and widespread standards - there are also opposing experiences in which producers and consumers re-personalize their activities, thus giving space to individual ideas and preferences, or promoting collective meanings shared by sense communities. For instance, it is possible to hunt for particular information and relationships on Google that previously would have been too expensive or time-consuming to search. It has become easy to choose niche products that would have never been found in stores close to home and have become accessible to meet the different needs of customers on Amazon. Whoever, today, is continuously invited to establish relationships with new people and professionals on Facebook and LinkedIn, following preferences that were difficult to specify and practice in the past because of the limitations of the pre-digital environment.

Therefore, a multipurpose transformation that is difficult to represent is to be faced. All of us are part of a trajectory that certainly takes us away from the previous environment, but we do not know which direction to take.

5. Three drivers to create value by increasing complexity

The fundamental breakthrough due to the current transition, as previously mentioned, lies in the new relationship that digital automatisms - supported by learning algorithms and data-rich environment - are creating between science and complexity. This is the end of a history that is based on the artificial compression of variety, variability, interdependence and indeterminacy in the production processes that use abstract science. The creative flexibility of new digital mediators makes it possible to maintain the replicability of abstract knowledge (with all of its advantages) in conditions of application that can vary from case to case, from moment to moment, from person to person (De Toni and Rullani, 2018).

As a result, the generation of value is no longer limited to the compression of costs that is obtained thanks to the reproduction of a few standardized products, processes or services, but it is now due to the exploration of a new field of action: the creation of value is achieved by adapting knowledge and technology to a potential demand that admits great variety, recurring variability (over time), strong interdependence among everyone, and a high degree of uncertainty. In this manner, the user is able to use modern technology to respond to personal needs and expectations, which differ from case to case and change over time. Furthermore, he or she can initiate important processes of sharing knowledge and meanings, and design visions with other protagonists of the digital transition, thus creating new types of utilities through individual and collective sense-making.

However, this process can be pushed forward by several drivers, which are very different from one another but united by the function they

perform in the current transition: increasing complexity at low or zero costs and using digital automatisms in order to extract value from growing variety, variability, interdependence and indeterminacy.Accordingly, there are three fundamental drivers that are changing our way of living and working by enabling the complexity that had previously been banned from production and consumption processes (Rullani and Rullani, 2018):

1) the *global propagation of standards* that are achieved by breaking down the distance barrier and creating a global infosphere in which to insert infinite (local) points selected for their diversity (Floridi, 2014);
2) the *re-personalization* of the world of production and consumption by putting the self-referenced - and therefore differentiated - identity of single people and single companies, with their ability to elaborate and share projects, meanings, and visions, at the center. All these ideas are not dictated only by technology, but rather are born from the history and experience of every person;
3) the *exploration of novelty* by working on the "edge of chaos", that is, in highly indeterminate situations in which, however, digital technology makes it possible to represent and experiment reliably at a low cost.

As can be seen, these are drivers that move in very different and somewhat contradictory directions. Nevertheless, they coexist in the transition underway, and therefore must be addressed with methods that can make them compatible and, if possible, synergic.

The *new entrepreneurship* that is required by the ongoing transition is characterized by its ability to move in the three directions mentioned above, thus processing the problems it faces in order to make the most of the capabilities of each subject through the growth of complexity. In some cases, it may be more effective, in terms of results, to use the global propagation of standards by extending the field of action from local to global, and vice versa.

In other cases, however, it may be best to resort to customized products, processes and meanings in order to derive value from the many potential or emerging differences that are present in the world of users. In the end, the strategy of adapting to differences or promoting them is not enough when those who offer and those who demand understand the existence of a potential of value that goes beyond what already exists. It is therefore a matter of investing in novelty. In this perspective, producers and users may explore possibilities that have not been tested yet but which are full of promise for the future on an individual and collective scale, possibly in forms that bring out both the creativity of supply and the capabilities of demand.

The directions marked by the three drivers mentioned above have very different effects on human work. The propagation of standards that are replicated by digital automatisms requires a limited use of work, and in particular that of blue collar and office work. The same happens for tertiary work in commercial and relationship functions. In this sense, digitization destroys jobs because the new skilled jobs that are necessary to produce robots or digital algorithms, cannot numerically compensate for the merely executional jobs that are lost because these tasks are now performed by the new machines. However, things change upon looking at the effects

produced by the second (personalization) and the third driver (exploration of novelty): they initiate two trajectories of evolution in which the growth of complexity can be only partially delegated to digital automatisms because il requires the creative, fiduciary and empathic intervention of human intelligence. It will be necessary to increase the quality and number of people who must be involved to manage such an increase in complexity and give sense to the new activities. It is only by considering the evolution of the digital transition as a whole that it becomes possible to understand the intertwining of these divergent and ultimately complementary trends.

The three drivers should therefore not be trivially juxtaposed as opposing ideologies linked to different ways of understanding digital transformation In contrast, they must be used in an integrated way by exploiting the specialized skills of each driver to provide effective answers to the problems to be faced. These problems can be solved in part by propagating known standards, in part by adapting solutions to differences, and in part by evading pre-existent solutions to look at the vast range of new possibilities connected with the emerging technological potential. The world is changing and new technologies have to deal with new problems, such as health, environmental sustainability, and the emerging meanings that are assigned to life and work.

In other words, it is a matter - in every business sector, but also in every consumption lifestyle - of using the present time as a "construction site" in which the assets that are inherited from the past lose their coherence and value but are used to set up a new building, in order to synergistically use the different capabilities of the three drivers.

This is what needs to be done if, starting from the transition, one wants to shape a new paradigm, that is, a *coherent system* that integrates new technology with all the aspects of producing and living. For this purpose, the materials deriving from the de-construction of the past, which accumulate in the construction site of the present, must be used to progressively set up a three-story building. In it, each floor is entrusted to the action of one driver that selects the problems that are closest to its abilities without conflicting with the other two drivers.

In short, it is necessary to fully understand the specificity of the complex innovations carried out by each of the three drivers of digitization in order to highlight the contradictions and complementarities that are possible in the evolutionary paths undertaken by each firm or community.

6. First trajectory: digital neo-Fordism promoted by the propagation of standards

The propagation of digital standards takes advantage of the zero - or near zero - replication cost of coded knowledge (algorithms, data, and devices that embed them). This is the most visible manifestation of today's way of living and doing business: the value of ideas, products or services is based on the number of likes, accesses to websites, followers, sales, and volumes. In other words, it is based on the multiplicative replication of software and hyper-standardized devices (such as smartphones, computers, smart TVs etc.).

Such multiplication brings the *economies of scale* linked to the sales volumes of each product, which were typical of Fordism, to the digital world. Many elements of the old paradigm are remediated in a new form that is associated with the growing complexity to be managed in today's glo-cal space.

The emerging paradigm is rather a highly complex form of digital *neo-Fordism*. This consist in a system that, like classic Fordism, still rewards the protagonists with greater weight and power and engages them in the global spread of each successful product. However, the propagation driver does not exclude small niche producers who, thanks to the digital network, can significantly broaden their search for new customers in the global space by concentrating on segments that are specialized in particular products or processes.

The propagation of the standards therefore recalls elements of the Fordist paradigm but it clearly distances itself from it due to two basic characteristics:

a) the *growth of complexity,* which in any case must be promoted and managed to serve an increasingly broad and differentiated potential market, instead of being compressed a *priori*;
b) the *new cycle of value* that is associated with the use of the three drivers, starting from the global propagation of standards. Indeed, digital transition gives increasing weight to intangible assets, such as knowledge, digital codes and algorithms, human capital, reputation, brand, trust in the system of relationships, and - in general - the meaning that is assigned to products and services that can arouse empathy and sharing. This dematerialization makes it impossible to pursue the classic ideal of Fordism, i.e. the *stability* of techniques, competitive hierarchies and financial evaluation. As a matter of fact, the value of the immaterial assets is systematically dependent on a trajectory of instability that continuously alters the value assigned by the markets to competing products.

   Continuous changes in business models ensue.

First of all, complexity grows, as has been previously mentioned, because the barrier of distance falls, thus eliminating its "protective" filter effect with respect to external complexity. In contrast, today's digital network gives access to outer space, hence allowing fast and effective long-distance relationships. Consequently, it allows each company to enhance its standard products by dramatically expanding its range of potential customers even if they are distributed all over the world and belong to different market segments.

Furthermore, as companies find themselves operating in a data-rich environment, great opportunities open up for the active *practice of marketing.* Indeed, large and small producers can profile the preferences of individual customers (or selected groups) by using the personalized information to develop a new type of communication since profiling makes it possible to adhere to the (supposed) preferences of each customer. By doing so, business marketing can sell more and better (with prices that are also modulated on the type of customers it targets). It can also affect many of the preferences of current or potential consumers.

Finally, the global propagation of the most efficient digital standards feeds the formation of increasingly extended value chains (GVC) with multiform production lines. The single contributions to the chain can be thus recombined from time to time to exploit the differences between places within a glo-cal logic. This is a logic that Fordism could not adopt in the past because it was bound to the idea of direct control (maximum vertical integration of the chain) and to the symbiosis with each national State capitalism.

Therefore, the propagation of standards entails a *net increase in the complexity* at all levels to be managed both for the companies and for the people involved. Once the barrier of distance has fallen, all subjects have to go in search of new suppliers, customers, intermediaries, researchers, and institutions with which to establish relationships on a large scale. This sets the solutions that have been chosen by each in motion and mobilizes the value chains.

Secondly, in order to assess the complexity that companies have to manage throughout the digital transition, it is necessary to take the *new cycle of value* that - as mentioned - is associated with digital-mediated production into account.

The value that markets assign to a business idea or a company is in fact conditioned by a *structural instability* due to the dynamics of competition in the intangible field. The value of knowledge, relationships and products is in fact made unstable by the lack of a protection net which, in the case of material production, was guaranteed by the *cost of reproduction*: a cost that was, as a rule, not too different from the current *cost production*. In order to guarantee the continuity of production, the price of a material product, which is mainly obtained from material assets, cannot, in the long run, fall below its cost of reproduction. However, this condition of long-term stability *is not guaranteed for products and intangible assets,* which - if well coded - have a zero (or almost zero) reproduction cost.

In the presence of a low or zero cost of reproduction, it is inevitable that - over time - the market will be populated by competitors committed to achieving high sales volumes by reducing sales prices. The process can thus go on until the price *drops close to zero*, thus reducing the value that is "achieved" by the producers and transferring the entire surplus to the end user. This downward cycle is observable, in the ongoing transition, whenever the propagation of the standards of success reaches its climax and then triggers the reverse. In digital economy, a new cycle of value of an *exponential type* must be faced (Ismail 2014): business trajectories rise and fall rapidly, determining, at the same time, great successes and great falls.

In the course of the growth of a new successful product, in fact, the price remains high enough to provide the innovator with a large margin for each sold unit, thus generating an added value that grows in proportion to the volume of replicated uses of the coded knowledge. This triggers a process of exponential growth in the volumes, turnover, profits and value of the companies that achieve the greatest multipliers. In the first phase of the competitive dynamic, the transition brings out some "champions" who quickly become dominators of the market and of the used digital interaction networks.

Nevertheless, this initial boom, which is associated with the exponential growth rate of winning competitors, is only the first step in the process of the re-invention of assets that is triggered by the digital transition. In fact, it is inevitable that the standardized product is copied or imitated by other competitors in a short period of time, thus becoming trivialized as its price falls towards the cost of reproduction (zero or almost zero). The cycle of decreasing turnover, profits, and business value that is associated with this second step can also be of an exponential type, that is, it can proceed rapidly and with increasing speed. At the end of the cycle, the value that is generated by innovations is transferred to the users, thus reducing the advantage of producers and of leaders in particular.

In order not to lose the market position they have achieved, competitive leaders are forced to go beyond business models centered on the propagation of standards and search for *new versions of the product* within a logic of continuous renewal. However, it also becomes necessary to find other ways of generating value by moving on to exploiting the potential of variety (second driver) or exploring complexity (third driver).

7. Second trajectory: the re-personalization of the world

As stated above, the propagation of standards is only the first driver of value generation through the growth of complexity associated with the digital transition. Alongside it, new technologies open the door to advanced forms of *post-Fordism* as a result of two fundamental changes in production systems:

1) the digital transition makes *a new flexibility* of machines and procedures available, allowing a sufficient range of variants to be managed (at a low cost and in real time), provided that they can be coded;
2) the digital transition creates and disseminates *enabling capacities,* allowing small producers and demand subjects (industrial users, consumers, communities of sense) to learn complexity and self-organization.

The two transformations add up in changing the relationship between supply and demand at the root. On the one hand, supply consists in learning how convenient it is to generate value according to the personalized needs of demand; on the other hand, demand becomes capable of defending and rewarding one's own differentiated identity by enhancing the history, practical experience, and the trust relationships of each subject This is the new process that shapes the emerging visions of the future.

In every field, the evaluative and operational intelligence of users (and small producers) enables:

- the *self-production of knowledge, goods and services* in fields that previously depended 100% on supply;
- the experimentation and development of new ideas and needs that previously could not find a way to emerge. Today they can make demand *active and enterprising*, even in the search and evaluation of the most suitable offer on the market.

In this case, the growth of complexity passes through the *re-personalization* of the technology applications by using flexibility to

respond to different needs and requirements, case by case. It is this differences that create the added value that is integrated into the price and therefore distributed partly to the producer and partly to the consumer. Therefore, this is to be attributed to a *post-Fordism logic* that introduces many new protagonists and rewards their ability to relate and share.

Many sectors can benefit from great opportunities for growth by learning to manage the complexity that is associated with the re-personalization of the products and services that are offered. In the fields of fashion, furniture, mobility, food, tourism, e-commerce, etc. the flexibility of the offer, supported by digital automatisms, can become a formidable lever for the creation of additional value. In all these fields, supply chains are lengthening and diversifying, by leveraging on a *fast logistics* that work *on demand*, responding to the division of labor that emerges in the various supply chains from time to time. Alongside the algorithms that control movements and distribute tasks, it becomes necessary to employ many people (the so-called *riders*) who manage the delivery processes throughout the territory: in fact, streets and towns design an environment that is hardly or not codable. However, the added value created for users - thanks to on-demand production - is enough to compensate for the higher logistic costs.

Customized production generates value by adhering to the specificities of each user and interacting with his or her ideas and sensitivity. The result is that the admitted variance increases, to the extent that it can be encoded or codable. The communication and decision-making processes, mediated by digital automatisms, thus create interdependence between supply and demand, and require a *trust basis* to develop in order to share the rules of relationship and valuable meanings.

But even in this case, the value of the services that are provided to the customer and that of the companies operating in this business are unstable: the interaction codes can in fact be copied or imitated, and therefore tend - in the absence of novelties - to be replicated, with decreasing prices, as the variety that is supplied to single customers becomes an obvious, trivialized service over time.

8. Third trajectory: the exploration of novelties and possibilities

As the horizon marked by the first two drivers (propagation of standards and re-personalization) widens, both producers and consumers discover how big and attractive the hitherto unexplored but full of previously unimaginable promises of value and growth world of the possible can be. On the other hand, real-time access to a very wide range of cognitive standards and low-cost materials, together with the use of flexible solutions, make the shaping and experimenting of new ideas easier and faster.

With the support of digital automatisms and human creativity, the world of production and consumption enter that area of complexity in which uncertainty grows significantly, both in a *positive* sense (the promises of a possible future) and *negative* (the threats of inadequacy and failure). The rational calculation of advantages and disadvantages is no longer enough

to guide the basic strategic choices of people and firms. To move forward in a sphere of action that is still not very predictable, it is necessary to leverage the initiative of those who believe in their capabilities and have plans or dreams for a possible future.

In this manner, the *subjectivity of people and companies* is rediscovered, thus positioning their power of ideation and practical experimentation at the center of the scene. It is also possible to discover the decisive contribution that *sense communities* can make to these activities: a sense community is a group of people (and companies) who trustfully accept to work together on a shared project, thus giving value to the meaning that each person assigns to his or her own activity.

Furthermore, the conception and research of novelty, alongside the practical experimentation of the solutions that are found, is a task that employs a lot of *qualified work* and stimulates the development of a *new type of activities*, at the service of the quality of life, of curiosity in discovering the world, of sharing meaning, of the search for healthy and interesting ways of living.

But even in this case, there are many obstacles to overcome in view of the construction of the new paradigm. In fact, throughout the processes of exploring novelty, not everyone is in the same conditions. The people who are embedded in the pre-existing system will prefer to resist novelty, perceiving it as threatening. Others will prefer to stay "by the window", waiting to see what emerges day by day.

A *minority* will probably be the ones to believe in a certain vision of the possible future and choose to take the three necessary steps to try to make it happen:

- *sharing a project* with others, in order to have the minimum scale required for the conception and experimentation of new ideas;
- *investing the personal or corporate resources* that are required by the innovation process while assuming the necessary risks;
- *creating a network of relationships* with partners on a trust basis, in order to collaborate and allow an equitable sharing of profits or losses resulting from the realization of the shared project. This is the condition for making the sharing of ideas and activities in the supply chain sustainable over time.

Digital transition, as can be understood from these critical aspects, is an uphill path: it must, in fact, deal not only with the progressive growth of the levels of complexity to be managed, but also with the *increased risk* that is associated with the investments that are necessary to innovate in conditions of high uncertainty by exploring the possible future. In order to prevent the growth of risk to block investments in the most interesting fields of innovation, there is only one possible remedy: *sharing* the most demanding *projects* to be carried out, the *investments* that are required and the *risks* that need to be faced.

It is by no means an easy program for Italian capitalism, which is based on personal or familiar forms of *widespread entrepreneurship*. However, it remains a necessary program in the endeavor to avoid losing ground in the path of evolution towards the new digital paradigm.

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