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The Evolution of Cost Control Systems: a Cultural Phenomenon.

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INTRODUCTION.

This paper only aims at stimulating research and debate, starting from two ideas:

- historically, cost control systems have undergone major changes by integrating an increasing level of instability;
- the same pattern of evolution can be found in other areas.

Evolutions seem to have gone through four stages:

1. **A static period.** Individuals think in terms of a stable environment in which there is only one truth. Problems are solved through an analytical approach.
2. **A period of static** balance. Although there is some movement, unchanging laws prevail. The environment is a deterministic one in which the future is modelled on the past. The only systems that can be conceived are closed , dependent ones.
3. **A period of dynamic balance.** Some change is introduced in the laws regulating trends. The environment may thus be transformed and tentatively brought under control. Systems tend to become open-ended and adaptable.
4. **A period when the probabilistic order of confusion prevails**. Although the movement has become widespread, it cannot be foreseen in detail. However, major events are somehow predictable according to statistical laws. Overall transformations remain undetermined. Systems improve and become more effective by constant updating and upgrading.

Those four stages have been observed in five different fields:

- cost control systems in organisations
- the history of economic theory
- natural sciences
- information technology
- philosophy.

This evolution of course did not affect the five fields in the same manner or at the same pace. It is however important to note that the stages are identical whatever the field i.e. that changes in thinking patterns shifted from one stage to another.

SECTION I : Analyzing mechanisms.

The study of a new discipline or of a new problem generally starts with a restrictive definition of its field and the elaboration of a method designed to identify and classify its components (the analytical method). The search for some order as well as for "natural truths" seems to be, at this stage, its essential goals. After the "obscurantism" of the Middle Ages, Descartes rejects metaphysical doubt. His *cogito ergo sum* is a response as much as a rejection that leads him to adopt methodical doubt. In the first part of the *Discours de la méthode* , he announces this need for certainty and truth: " I enjoyed chiefly mathematics because of the certainty and plain truth of its reasoning but I was not yet aware of its real purpose; thus thinking that it could be used only for mechanical arts, I wondered that it had not been put to a loftier use in spite of its firm and reliable grounds. The search for "natural truths" which resorts to a mathematical and analytical method leading to a mechanistic conception of life then seems to be a characteristic feature of the early days of any new discipline - at least as soon as it begins to be recognised as a science.

1. Cost control systems.

At the beginning of the industrial revolution, empirical cost control systems were no longer adequate, as a result of the emergence of factories. It brought about two new problems: the first one is a problem of scale, the other a problem of production which is in the process of becoming "multi -product". The cost department method, dividing a firm in business units, or full cost method meets such needs in a way which is in keeping with the approach prevailing at the time i.e. the first stage. As it considers organisations as aggregates of entities viewed as gear works or mechanisms (mechanistic aspect), and as it ensures a safe and continuous flow of information in the departments, this method seems to be absolutely exact, which gives those who devised and used it a false sense of security and reliability. In France, the sanction of this method by law [tax law; the I947, 1957 and to a large extent the I982 *Plan comptable* (chart of accounts and accounting standards); accounting procedures imposed on firms tendering for public contracts] supports such a strong belief. The adoption of the term " real cost " in standard use as well as in law (Article 38 *quinquies* of the *Code général des impôts* or French Tax Code) clearly shows the illusion of certainty entailed by the application of a highly mechanical and arithmetical technique.

2. The history of economic theory.

The same approach was used in the early days of economic science. Quesnay's economic matrix and the cost department method have at least three characteristic features in common:

- the approach used which is arithmetic and analytical; economic life is reduced to a flow chart. Quesnay himself describes it in *Philosophie rurale ou économie générale et politique de l'agriculture* : " The economic chart is the first arithmetic rule[4] invented in order to impose accurate, precise reckoning to elementary science and to the permanent execution of God's decree ' Thou shalt win thy bread by the sweat of thy brow ' . Such a circulation, like any other, has its own rules (…), the anatomy of which we shall study. "
- the certainty which this sort of method gives to its inventors ("accurate reckoning" with Quesnay; "real cost" with the cost departments)
- the conception of the economic system and of the production of value. According to Quesnay, only land generates value. His matrix thus makes a distinction between "productive" and "unproductive" classes, just like the difference between production and service departments or support activities.

3. Natural sciences.

[4] Not underlined in the original.

Linnaeus (1707- 1778) is often considered as the founder of the natural sciences. His unique contribution is based on a very precise description of species resulting in a classification, making it possible to discover "the sovereign world of Nature" .

" A description should specify all the natural characteristics[5] of a plant; it should list all of its external parts; it should describe every organ in terms of number, shape, proportion and position ; it should be divided into as many separate paragraphs as there are distinct parts and be neither too long nor too short "[6] It all sounds like a course on how to analyse firms in terms of departments. It is also redolent of the Cartesian approach: "divided into as many separate paragraphs..." But like in the other aspects of this mechanistic stage, the time factor is ignored, the analysis freezes the objects it focuses on. Linnaeus belongs to the school of fixism which assumed that natural species did not change.

4. Information technology.

The automaton vogue may be interpreted as a resort to mechanics in order to analyse and understand phenomena such as life and the circulation of information.

There were numerous such attempts from the 16th to the 18th century with Leonardo da Vinci, Descartes (who devised a female automaton named Francine), Pascal (who invented the arithmetic machine[7])... But it is above all Vaucanson who explored the possibilities of mechanics as a means of observing life. He endeavoured to "reproduce means with a view to obtaining the experimental intelligence of a biological mechanism. Vaucanson's automatons will strive (sometimes deceitfully) to simulate the main functions of living creatures: movement, the production of sound (the flute player), digestion (the duck), the circulation of blood.

In the same way as firms are reduced to aggregates of mechanically articulated departments, animals or men are reduced to machines integrating a series of autonomous functions. The dualistic conception is obvious: on the one hand, there is the body or the material world studied by science and regulated mechanically; on the other hand, the mind or soul. But those fields always remain separate.

5. Philosophy.

The body-soul dualism is quite obvious in Descartes' and Pascal's works.

Descartes: " So that this ego, that is the soul which makes me what I am, is entirely distinct from my body and the former is even easier to know than the latter..." (*DIscours de la méthode* , third part).
Pascal: " Difference between a mind for geometry and a subtle mind (*Pensées,* section I).

Once they have distinguished between these two fields, the two philosophers define an analytical method which makes it possible to determine certainties related to whatever does not concern the soul. With Descartes, the four principles of the method are characteristic : they allow to " distinguish what is true from what is false ". Pascal gives the analytical method the force of a postulate: " I deem it impossible to know the parts without knowing the whole, in the same way as it is impossible to know the whole without separately knowing the parts " (*Pensées*, section II).

This philosophical approach seems to be of a mechanistic nature which can also be found in the

[5] Not underlined in the original.
[6] *Philosophia Botanica*, 1751.
[7] This machine was named « Pascaline » and may be seen (admired !) at the Musée des Arts et Métiers in Paris.

cost department method.

Section 2 : Static balance.

In this second stage, phrases like "natural sciences" are progressively replaced by "universal laws", thus reflecting a significant change.

The concept of law is apparent in virtually all disciplines: in economics (Jean-Baptiste Say's law of markets), in philosophy (Montesquieu's *De l'esprit des lois*). As defined by Montesquieu, laws are considered as "the necessary relations stemming from the nature of things". The very mention of law induces the notion of relation. The entities observed are no longer absolutely autonomous; they are, as will be seen later, approached as being relatively determined by their environment. The concept of system emerges (Auguste Comte) but it is dependent, relations and movements are rigid and deviations from "necessary relations" are perceived as immaterial and incidental.

Rationality or positivism seem to be extensions of the mechanistic analysis of the first stage. But rationality essentially represents a sort of law i.e. a constant relation, a natural balance from which men and nature cannot escape.

1. Cost control systems.

The cost volume profit analysis is a characteristic feature of this stage: it measures the effects of any change in business volume (due to the environment) on the firm. In fact, such a profit analysis has two main functions:

- first, to calculate global and stable costs by eliminating the effects of variations in business volume. This is indeed one of the guiding principles of that period: beyond variations which are considered as unusual or exceptional, what is aimed at is the "necessary relation" (i.e. a stable one) that corresponds to the notion of full cost which is thus re-established as a "universal law".
- second, to measure i.e. to identify the effects of the environment upon the firm (the volume differential). This means that, although such an influence is recognised, the firm should avoid passing it on.

Moreover, the cost volume profit analysis is based on the assumption of a series of balances (a succession of normal volumes of business) which refuses and rejects the notions of continuous evolution and the firm-environment interaction.

2. History of economic theory.

The "classical" advocates of an automatic economic balance illustrate this stage in the history of economic theory. J.B. Say stated this belief quite clearly: "the very development of a new product immediately[8] creates opportunities for other products"[9]. He typically denied the effect of time, of lags.

Ricardo will later accept a potential imbalance which he considers as an accidental, short-lived phenomenon: "the outbreak of a war (...) generally causes a deep depression in business (...). Fixed capital remains idle (...) and some workers are left unemployed. The depression may last for sometime."[10]

[8] Not underlined in the original.
[9] *Traité d'économie politique*, third edition, 1817, volume 2, p. 142.
[10] Not underlined in the original.

Such a balance is universal. It applies not only to one nation but to the relations between nations (Ricardo's concept of automatic equilibrium in the balance of accounts) and between social classes: according to Ricardo, " understanding the laws which determine that distribution (between social classes) is the major challenge for economists".

3. Natural sciences.

Cuvier's early work in palaeontology led natural scientists to take into account the time factor. However, Cuvier and his contemporaries rejected transformationism or evolutionism. According to Cuvier, no trace of evolution can be found; yet he claimed that life on Earth was subjected to four major revolutions (*Discours sur les révolutions du globe*).

D'Orbigny later claimed 27 successive creations. Thus a fixist theory (i.e. based on a static balance) still prevailed.

4. Information technology.

When Watt developed his steam machine, he met with the need for a control system. He thus invented the fly ball governor. The system receives an information (speed), transforms and interprets it (upward or downward movement of the balls) and relays a command (safety valve).

What is involved is no longer an information which is rigidly transmitted (as with clockworks and automatons). The notion of a system, of a control is now endorsed but it is only supposed to maintain a static balance. The fly ball governor measures the imbalance while setting fixed limits upon it. Such a system is a closed one.

5. Philosophy.

Although Montesquieu and A. Comte are a century apart, they both illustrate the philosophical doctrines which are typical of this period.

On the one hand, the concept of universal and natural laws is consistent with the notion of balance or equilibrium. According to Montesquieu, "laws in general result from human reason, as they govern all the peoples on Earth."[11] According to A. Comte, "The truly positive approach chiefly consists in observing in order to predict[12], in studying what exists so as to infer what will exist as a result of the universal dogma of invariable natural laws"[13].

On the other hand, these laws are relative. According to Montesquieu "They must be quite specific to the nation for which they are made. They must be adapted to the physical conditions of the country."[14] According to A. Comte "The two types of relations[15] equally account for phenomena; they equally help in predicting them, although the laws of harmony seem to be primarily designed to explain and the laws of succession to predict"[16].

The principle of reason (rationality), of stable relations, of balance can thus be found in different disciplines which use the same approach.

However, such a balance is static or, more exactly, it rejects imbalance or movement while

[11] De l'esprit des lois, Part 1, 1.
[12] Not underlined in the original.
[13] Discours sur l'esprit positif.
[14] Op. cit.
[15] (Static) existence and (dynamic) movement.
[16] Op. cit.

assuming a succession of balances which are considered as revolutions (Cuvier). In mathematical terms, one might say that time is a discontinuous function.

SECTION 3 : Dynamic balance.

By dynamic balance, we mean the ability to take into account a transformation of the object itself. It no longer refers to mere oscillations around an equilibrium point, a fixed one by definition. The object described evolves in a predictable direction, following a logical, scientifically established pattern. Time, which cannot be separated from movement, becomes an important variable whereas it played no role in a purely static and analytical description of the components of the object. It only played a very minor role in our description of static balance. But here time is a simplified notion insofar as the infinite variety of basic movements is totally ignored. Only the major stages of a genuine transformation are taken into account. The period as a whole is more significant than the succession of moments.

Lastly, the environment affects the transformation of the object. Systems are now open, adaptive and finalised - since a model now exists.

1. Cost control systems: standard costs as expressions of industrial relations.

Let us remind the reader that standards stem from taylorism. The original meaning of the word is yardstick, model, type. They are a means for people holding organisational power to pattern a mode of production on what they consider an ideal model. Management is now considered as a full-fledged science, which means that two major changes are widely recognised:

a. The production function is no longer a fixed entity since technology and the labour force may result in new combinations of production factors;
b. The production function (productivity rates and working conditions, mechanisation etc.) no longer depends upon a global balance imposed on all members of a given industry. It is subjected, in every firm, to a bargaining process which ultimately translates into production standards.

As soon as it is integrated in a management control system, a standard ceases to be an average performance or an average of performances. It represents corporate objectives and changes in standards are a key management indicator used in order to update and upgrade production. Thus, standards help both support and identify new patterns in production as well as in the technological and social environment. Contrary to that approach, the cost department method and the cost-volume-profit analysis were implicitly based on a single and stable production function.

Lastly, time here plays a much more important role than in the previous methods as it is split into a cycle based on forecasting -reading-discrepancy measurement.

2. History of economic theory.

In contrast with the classical theory which views imbalances only as anomalies which are promptly corrected by invisible market forces, a long-lasting disequilibrium is at the core of the dynamic marxist approach. Such an automatic restoration leaves room for cumulative processes enabling a reassessment of the economic system. From then on, alternative theories of under-consumption, Tugan-Baranovsky's theory on the inadequate volume of savings and especially Keynes' theory according to which free-market economies cannot emerge from deep recessions without resorting to public investment i.e. unless major changes affect the very nature of such economies. Time becomes a significant variable in cases like the investment multiplier model.

Simultaneously, economic theory -which has so far been confined to *homo oeconomicus*- begin to focus on the behaviour of "real" individuals, thus taking a social dimension.

Finally, we can hardly resist the temptation of equating Marx's "the socially needed working time" with a sort of Taylor's standard time.

3. Natural sciences.

According to Lamarck, the transmission of acquired characters and natural selection allow a progressive adaptation of species to their environment. His adaptive theories are opposed to the fixist ones expounded by his contemporaries (especially Cuvier). Lamarck heralds Darwin's theory of evolution.

The main characteristics of dynamic balance can indeed be found in his approach: the concept of evolution, the notions of period (the succession of the generations) and of a connection between the object (the species) and its environment[17]. Chance and disorder are conspicuously absent in Lamarck's theory. Such elements can only be observed later in natural sciences.

4. Information technology.

Machines are capable of working in adaptive ways depending on changes in the environment. The clock works in a totally independent way and Watt's fly ball governor can interact only with the steam machine on a single fixed principle whereas the numerical control machine is capable of working more "intelligently" since it can interact with its environment. It can identify external changes and adapt to them. It operates in an open system.

Time plays a major role as the machine can anticipate changes i.e. make a number of forecasts thanks to a model, then match them with actual data and finally base new forecasts for the next period on any variation that may be observed.

Teleological machines (e.g. numerical control machines) are no longer meant to maintain a balance. They rather aim at a specific goal while adapting to changes in the environment.

5. Philosophy.

As materialism -closer links between mind and matter- gains wider acceptance, the stage is set for evolution. The immutability of Montesquieu's laws is challenged as they merely express social relations at a given time and place. Such relations only reflect production roles as defined by the Marxist theory. The dialectical relation thus established between mind and matter may be compared with the one between forecasts and actual events.

SECTION 4 : The probabilistic order of disorder.

The determinism implied by what we referred to as "dynamic balance" is now replaced by an approach involving in the study of objects not only the major changes that determine the successive stages of an evolution but all the elementary and erratic movements of life itself. From then on, it becomes impossible to trace the logical sequence of innumerable events which have no historical significance when considered separately.

[17] Lamarck is the founder of biology (theory of life) which relies on the very nations of dynamic balance and adaptive system.

As no explanation can be provided, each movement is ascribed to accidents. This attitude is offset only by the hope that scientific observation will eventually discover the statistical laws which determine such accidents. Elementary time sequences no longer involve any global rationality.

Lastly, movements are only considered as related to the ones taking place in the environment which effects a "natural" selection.

I . Cost control systems: management by objective, a self-adjusting system.

"The M.B.O. and the management control approach is a systemic one allowing facts to be controlled by men and men to be controlled by facts"[18], to substitute self-control management to management by dominance.[19]

Scientific management offering a global, ideal model is abandoned. Reality is no longer simplified. Variety and confusion are instead recognised as sources of wealth. The evolution of the environment can no longer be predicted and controlled but the complexity of the organisation makes the environment adaptable to any change.

The corporate model is no longer that of a smoothly operating mechanism but that of complex living organisms for which survival is only the guiding principle. As a consequence, the system of internal transfer price ensuring a fiscal optimum or a planned redistribution of overall profits among the various cells of the organisation is now replaced by systematic competition through the generalisation of negotiated prices. Such confusion which may be first considered as a huge waste actually effects a ruthless competition (plant closures, divestment of subsidiaries etc.) ensuring optimum efficiency and maximised short-term profitability.

However, the lack of an explanatory and predictive model results in short-sighted management as means tend to be mistaken for ends (instrumental rationality).

2. History of economic theory.

The failure of macro-economic models leads to the search for more punctual solutions, in other terms, to focus on grass blades for lack of a global grasp of the organised structure of the lawn.

Thus were born industrial economics, mesoeconomics or mesoanalysis and the concept of "limited rationality" contributed by H. A. Simon.

The paradoxical nature of such a situation clearly appears in all economic systems, either in the former eastern bloc where attempts have been made for the twenty last years to reintroduce the notion of profit in order to solve the problems posed by central planning, or in western economies where self-restraint export agreements are negotiated sector by sector, so as to avert protectionism or in France where nationalised firms are allowed to retain managerial autonomy.

Confusion is only avoided through the belief that specific improvements within the framework of a stimulative system meant to channel energies will ultimately meet the general interest, whereas global coercive models "based on a fairly univocal concept of causality"[20] have failed.

[18] Laufer and Paradeise, "Le prince bureaucrate", Flammarion, 1982.
[19] P. F. Drucker, "The practice of management", Heineman, London, I 955, p. 162.
[20] Marchesnay Michel, Où en est la mésoanalyse?", in Economie Industrielle-Problématique et méthodologie, Economica, 1983, p. 18.

3. Natural Sciences.

Although this study which is focused on management has placed natural sciences in third position, they have become a model for other sciences. They have generated the notions of selection, adaptation then self -organisation and creation through chance.

Lamarck's transformism was based on the assumption of the transmission of acquired characters, for which evidence is still missing.

Darwin instead postulated evolutionary changes in species which was to be later borne out by genetics. The latter introduced chance or hazard while the mechanistic approach only recognised necessity. Some genes express their potentialities, others do not, unpredictably -at least in the present state of scientific knowledge. The only integrating principle remains the survival of the fittest. Therefore, "if there is not such a thing as transmission of acquired characters at the level of the individual, the end result is the same, indirectly and statistically, where populations are concerned, owing to changes in gene frequency."[21]

Determinism or voluntarism (i.e. a global, ideal model which is aimed at) lose their explanatory value in the evolution of species. Instead, the relations with the environment become omnipresent and the notion of ecosystem, self-organising or self-adjusting system emerges.

4. Information technology.

The advent of telematic networks is final proof of the fact that the concept of order is somewhat abandoned in this field, as each individual user becomes relatively autonomous. The designers of the system only try to manage overload probabilities, much along the same lines as the French "Bison Futé" system monitors road traffic. The system is self-regulated inasmuch as it includes a queuing program without imposing any constraints on the user i.e. the environment.

Ashby's homeostat is another example of self regulation: "it is a machine which includes highly autonomous electric circuits and which is capable of restoring its own balance when subjected to external stimuli".[22]

5. Philosophy.

This fourth stage is also characterised by a questioning of existing classifications and categories. Cost control systems thus start encroaching upon the theory of organisations, economics and management come into contact with each other, generating industrial economics, genetics increasingly draws upon physics and chemistry, philosophy progressively loses some of its identity with the compelling recognition of human sciences, psychology and sociology in particular.

"Yes, there are still some philosophers left. But philosophers no longer have faith in philosophy -or much less often if they ever have. While still calling it philosophy, many of them are dealing with something else."[23] They therefore abandon the global vision of man and of the world to observe specific phenomena. Philosophers try to become "fieldmen". In order to meet such a goal, they will borrow the statistical tools belonging to sciences which no longer claim to be exact. They will succeed in "rationally" accounting for some types of behaviour when faced with specific situations but they will never be capable of developing a global model of man. Such a notion seems so alien to our culture that it becomes almost absurd. "Modern science established itself by renouncing

[21] Henri Atlan, "Entre le cristal et la fumée -Essai sur l'organisation du viyant", Seuil, 1979, p. 183.
[22] Encyclopaedia Universalis, volume 5, p. 257.
[23] Ibid.

essence."[24]

Conclusion.

While extending their capacity to take into account increasingly complex movements, cost control systems succeeded in adapting to less simplistic representations of organisations and in penetrating all of their mechanisms. This is how it was possible to evolve from merely operating separate workshops to co-ordinating the extensive operations of large industrial and financial groups.

However, cost control systems could not gain much ground until their own nature had eventually changed and until increased interaction between specific disciplines had been widely accepted. Initially designed strictly as accounting systems (industrial accounting), they now comprise management control, personnel management (hierarchical structures, motivation of the workforce, job definition) as well as organisation and they extend to information systems.

For accounting professors, our research may lead to a complete reassessment of the approach to teaching. Should we not recognise more clearly that two separate fields actually exist:

- accounting law requiring a legal more than a management background and
- a cost control system which might well be the common denominator to a number of disciplines pertaining to management but more generally to human sciences and which should not be viewed as a technique.

[24] Ibid. p. 972.

SUMMARY TABLE

Field ➡ ⬇ Stages	Cost control system	History of economic theory	Natural sciences	Information processing	Philosophy
Analysis of mechanism: • no movement • existence of a single truth	Cost department method or full cost	QUESNAY's economic chart	Botany, anatomy (LINNAEUS)	Clockworks, DA Vinci's automatons, VAUCANSON	DESCARTES
Static balance: • deviations from an equilibrium point possible • existence of natural laws • dependent systems	Cost-volume-profit analysis	Classical theories (J.B. SAY, D. RICARDO)	Palaeontology (CUVIER)	WATT's flyball governor	MONTES-QUIEU and A. COMTE
Dynamic balance: • existence of a global trend toward changes • adaptive systems	Standard costs	Theories of imbalances: MARX, KEYNES	LAMARCK's transformism	Teleological machines (e.g. numerical control machines)	Emergence of materialism in philosophy
Probabilistic order of disorder: • taking into account all elementary movements • self-adjusting systems	Management by objectives	Industrial economics, mesoanalysis	Darwinism and genetics	Telematic networks	Philosophy loses its identity and human sciences specialise : psychology, sociology, etc.

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