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The Information Laws

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INTRODUCTION

Mankind progresses in proportion to its wisdom which has roots in practice, acquired skills, available data & information, concepts and knowledge. To be wise, humankind needs to be informed and knowledgeable, otherwise will not survive own failures. Progress in knowledge was painfully slow as long as the racial memory was transmitted only by oral tradition. With the invention of writing and books the process of knowledge discovery and dissemination has been accelerated. Today, computers and their networks speed up that process far beyond our imagination. In 2000's the Information Wave significantly controls the Agricultural and Industrial Waves through millions of computers. IT supports decision-making based on knowledge-oriented systems such as "data mining" that, for example, discovers knowledge about customers, organizational dynamics, and so forth to achieve competitive advantage.

Information and knowledge become the strategic resource as engineering science was in the Industrial Wave. However, the discovery of human cognition potential must be guided by knowledge *s c i e n c e*, which just emerges. One of signs of any science is its set of scientific data, universal rules, laws, and systems of rules and laws. Hence, this paper offers the first attempt to develop main laws of information that should increase our awareness about the Information Wave which is a new stage of civilization's dynamics that is taking place at the beginning of the III rd Millennium. The paper also provides the framework for the analysis of the human capital from the information perspective. This set of considerations reflects a new emerging approach which I call macro-information ecology.

MACRO-INFORMATION ECOLOGY

Macro-information ecology is based on the premise that the growth rate in the new information (knowledge) discovery is the key determinant of macroeconomic activities in the service-industrial-global economy (so called the new economy). This new emerging school of macroeconomics can be called knowledgism.

Macro-information ecology is the study of information (cognition) as a whole and it is concerned with *aggregates* across nations and markets. Macro-information ecology studies the behaviour of society and economy (nationally and globally) — wide measures, such as:

- the value of human capital,
- the potential efficiency of human capital,
- knowledge output,
- economy output driven by knowledge in a given period, and so forth.
- It also studies measures derived from many individual nations:
  - markets such as the price of human capital or
  - the total structure of employed workers by such categories as production workers, in-person service workers, and information workers.

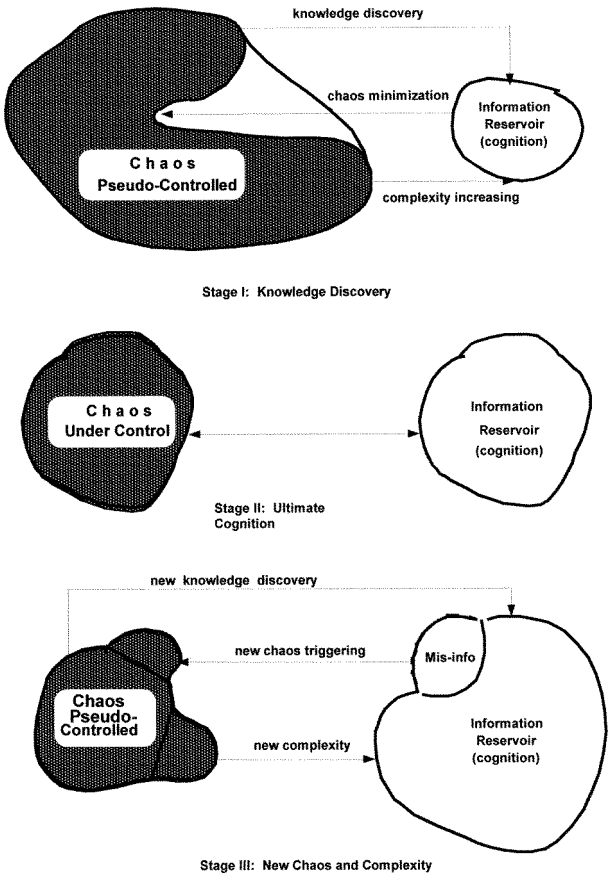
Another interesting facet of this new emerging discipline is the qualitative analysis of civilisation paradigm shifts and the application of civilization tools as a result of increased cognition about us.

To control national output with the development of a global economy, knowledgists stress the need to control the growth of new knowledge discovery. Given the "long and variable lags" of knowledge and information policies and the difficulty in forecasting future economic events (such as recession), knowledgists question the ability of industrial or service-oriented macroeconomics to implement the "correct" economic policy.

The knowledge approach suggests that direct government intervention within the economic system should be guided by the "predicted history of the futures." The knowledge policy is the key to this intervention; in this sense, the knowledge policy is closer to Keynesian interventionists than to "conservative" monetarists.

The supply and demand of information (knowledge) is the most basic model of information ecology (IE). However, prior to this model, we have to examine the stages of the information reservoir development. Figure 1 illustrates this process.

Based on the information reservoir's (IR) dynamics the general information laws will be defined in the following section.



GENERAL INFORMATION LAWS

At the stage of knowledge discovery, the information reservoir (IR) minimizes or tries to "control" the chaos. Every increase in new information also increases a level of complexity of understanding. Based on the analysis of knowledge dynamics provided by Wojciechowski (1989), one can define the following laws of information:

Law I: The complexity of the ecosystem (man, material, information, and nature) is proportional to the level of the existing information reservoir.

The complexity is the state of a system whose components and relationships co-evolve through an enormous number of interconnections, creating dynamic structures either chaotic or orderly. The more information we have at our disposal, the more complex the ecosystem is perceived to be. The more we know, the less we understand. The founders of the Santa Fe Institute, which explores the new science of complexity, investigates such questions as why ancient ecosystems often remained stable for millions of years, only to vanish in a geological instant — and what such events have to do with the sudden collapse of Soviet Communism in the late 1980s.

Law II: Information generates consequences, which it cannot foresee.

One of the forms of information is knowledge, e.g., such as atomic physics. Atomic physics produced rules and techniques that allowed man to build the atomic bomb. The consequence was the tragedy that befell thousands of Japanese who lost their lives or, at the very least, their health in 1945. On the other hand, the Cold War, sustained by the balance of atomic weaponry, was practically bloodless. Should science stop research on atomic physics or gene engineering because consequences can get out of control? Or, being under control, can said research produce positive results, such as the Cold War, which eliminated another Bloody War?

Law III: The precision and certitude of information is proportional to the simplicity of the object of information or inversely proportional to the complexity of the object.

Relatively simple material objects can be described by relatively simple information in natural science. On the other hand, complex social phenomenon requires complex description; this is sometimes contradictory if description is provided by more than one observer. For example, in the 1991 Persian Gulf War, there was a question among the Allied forces about whether to go to Baghdad and seek the surrender of the Iraqi military regime. Almost every observer of this war had his or her own answer (information) to this question.

Law IV: The progress of the Information Wave generates relative ignorance and interdependence among people and globalizes humanity.

The advancement of mediated information requires information skills to access information infrastructure, systems, and services. People without this access are becoming more ignorant than those who can retrieve and apply required information anytime and anywhere in the synchronism of events. The information poor are becoming more dependent on the information rich; the latter are motivated to globally seek more useful information to become even richer. A college professor or a graduate who know end-user computing have more chances to increase their material well-being than those who do know how to apply computers to gather and process important information and are ignorant about possible opportunities for them. Even a well-being business person who is ignorant about information technology may loose its resources or at least not to increase them if he/she does not know how to transform his/her business from *brick 'n mortar* to *brick 'n click* format.

At Stage II — Ultimate cognition, the amount of information is equal to the amount of chaos. From mankind's point of view, the equilibrium in macroecology never happens since the amount of time in which such equilibrium can be attained is infinite; in such disciplines as business management, perhaps, one can achieve short-term equilibrium. Therefore, the next law can be defined:

Law V: The information reservoir has no saturation point.

Since the ecosystem is imperfect and still developing, the information about it has not become definite. What was right in the 19th century is revised in the 20th century, and what is right in the 20th century, perhaps, will be redefined in the 21st century, and so forth. Examples of Newtonian physics critique or postmodernism's challenge of "scientific truth" provide data, which prove this law in the 20th century. Each new discovery not only decreases the chaos; it also increases the confusion about the new directions and, *eo ipso*, requires more information to improve understanding.

Stage III — When the capacity of the information reservoir should exceed the capacity of chaos, new chaos and complexity is created by misinformation, which begins to penetrate the IR. It is only an assumption since, according to Law V, such a situation should not happen.

MACRO-INFORMATION ECOLOGY MODEL

The macro-ecology of the information equilibrium model (Figure 2) indicates that civilization, most of the time, operates in darkness. The mathematical model of the information reservoir is as follows:

Stage I: $I < E$

where: I = Information Reservoir capacity
E = Entropy, a measure of chaos
D = Darkness (or net entropy E-I)

The macroecology goal is $D_t \to 0$ and the task is to determine the elasticity of the increased entropy or information and how a user or organization responds to changes (+, -) caused either by the increase of information reservoir or by its "enemy" — entropy.

$$D(E_t) = f(I_{Mt}, C_t) \quad \text{or} \quad D(I_t) = f(E_t, C_t)$$

where: I_{M} = Misinformation
C = Complexity

The elasticity of information is a measure of the sensitivity or responsiveness of the information value demanded to create changes in price, revenue, unemployment, and in other factors of the Information Wave. Information elasticity will be one of the major indexes of the emerging Information Wave.

Macro-information ecology is also interested in the creation of **human capital** as a medium of knowledge generation and application. Particularly, a relation between human capital and economic development is a strategic inquiry of IE.

The mechanism of the material civilization in modern capitalistic theory was built on the rule that market growth triggers the specialization of human capital and the growth of its income as well as its level of living. In the Information Wave, the situation is different. The new motoric forces of economy can express the following law of the human capital.

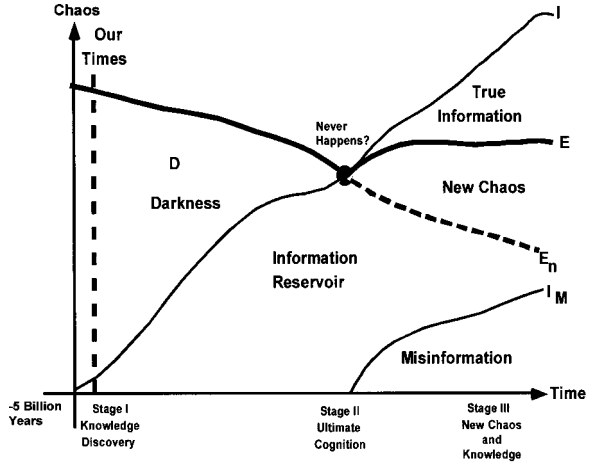


Figure 2 Macroecology of Information

INFORMATION LAW OF HUMAN CAPITAL

Law VI: The human capital's growth in knowledge generates specialization and productivity and sustains the growth of income.

As Kevin Murphy [1] noticed that the old sequence in economic development in the Industrial Wave:

- (old) material sequence**: market growth - specialization - more income** transforms in the Information Wave into a new sequence in economic development:
- (new) early information sequence: **knowledge growth - specialization - more income**

The new sequence is true as long as the specialization of human capital sustains the increase of productivity in the material sector or in the information sector. The necessary co-ordination of specialists, particularly those in the information sector, may consume the new "speed" of knowledge and not only contribute to the economic growth, but misguide it.

The most important question, however, is whether or not we should apply new knowledge to promote economic development by growth or whether we should just apply that knowledge's message, which says that zero growth is wiser and the only appropriate policy to achieve a sustainable society and economy.

There is a ruthless trend that is occurring in the American human capitalist system in the 1990s. It is implemented in the name of restructuring and trimming corporate "fat" as a "surplus" of human capital. American human capital is being downsized and atomized; as the Scottish farmers were torn away from their soil, millions of Americans are being evicted from the working worlds that have sustained them, the jobs that gave them not only wages, health care, and pensions, but also a context, a sense of self-worth, a kind of identity. Work was the tribe: there were IBM reps, Sera's men, GM workers, and Anheuser-Busch people. There are still, of course, but their world has changed.

The early Information Wave, controlled only by corporate profit, deconstructed the work force of America and other developed countries. In a time of surreal transition, America is working without a social contract or with one, which has been deeply violated.

In the industrial civilization, Americans practised long-term marriages, careers through apprenticeship, promotions, success, and retirement; getting fired was a disgrace. That epoch has passed. America has now entered the age of the contingent or temporary worker, of the consultant or subcontractor, of just-in-time human capital — fluid, flexible, and, worst of all, disposable. Is this really the future?

If the Information Wave is to work without knowledge and information policies, the work force of the future will constantly have to sell its skills and invent new relationships with employers, who must themselves change and adapt constantly in order to survive in a ruthless global market.

This is the new metaphysics of work. Companies are portable, workers are throwaway. The rise of the Information Wave means a shift, in less than 20 years, from the overbuilt systems of large, slow-moving economic units to an array of small, widely-dispersed networked economic centers. In the early stages of the Information Wave, highways are becoming electronic: even Wall Street has no reason to be in Manhattan anymore. Companies become virtual, based on a networked concept and their dematerialization, and strangely conscienceless. In 1988, contingent workers were about a quarter of the labor force; by 2000, they are expected to make up half of it.

The Industrial Revolution was inevitable, even as the Luddites howled and broke the machines. There are some solid economic reasons for a current restructuring of the American work force (for example low productivity due to over staffed companies), but the human capital costs are enormous. Profound betrayal of the American dynamic itself (work hard, obey the rules, succeed) runs through this process like a computer virus.

There may be an analogy that applies to this betrayal in the way that the U.S. fought the war in Vietnam. Robert McNamara's Pentagon became intoxicated by computer efficiency and pseudo-precision and began sending soldiers off to war alone instead of in cohesive units — the confused young soldiers, like temporary workers, were dispatched to a 365-day jungle job and then sent home alone. Thus vanished *esprit de corps*, team spirit, and the intangibles that are indispensable to winning. An economy that becomes addicted to treating its workers like interchangeable, disposable grunts may find itself with as little success as America found in Vietnam (McWhirter 1993).

The uncontrolled development of the Information Wave may lead to another economic sequence:

- further information sequence: **knowledge growth - specialization - collapse of economy (?)**

This sequence produces an economy that is too specialized and productive, requiring a small work force without the means to create a demand for economic output. In current practice, robots and computers do not pay taxes.

Information ecology has to include a human dimension of the Information Wave in its inquiry. Better knowledge should provide a better level of living, not inspire self-destruction and limit

progress to technology alone. Technology is not neutral; the new knowledge should define telematic technology as a tool of honorable and sustainable living. This is possible if we consider the Electronic Global Village as a tool of information and knowledge creation and distribution (bottom-up and top-down), and as a globally interconnected aware tribe.

The steered Information Wave should offer the following sequence of events:

- expected information sequence: **knowledge growth - solutions - sustainable economy**

If "human capital" becomes wise enough, this sequence should probably be implemented in the 21st century. Otherwise, population and ecological bombs (about 2050) will return us to the beginning stages of the history of mankind.

HUMAN CAPITAL DEVELOPMENT

Human capital in the 21st century will become the most important economic resource. This is a medium, which generates and applies knowledge. Its architecture of "organs" is depicted on Figure 3.

In post-modern notation, the architecture contains the left brain and right brain attributes, which determine the value of human capital. Human capital develops in three stages:

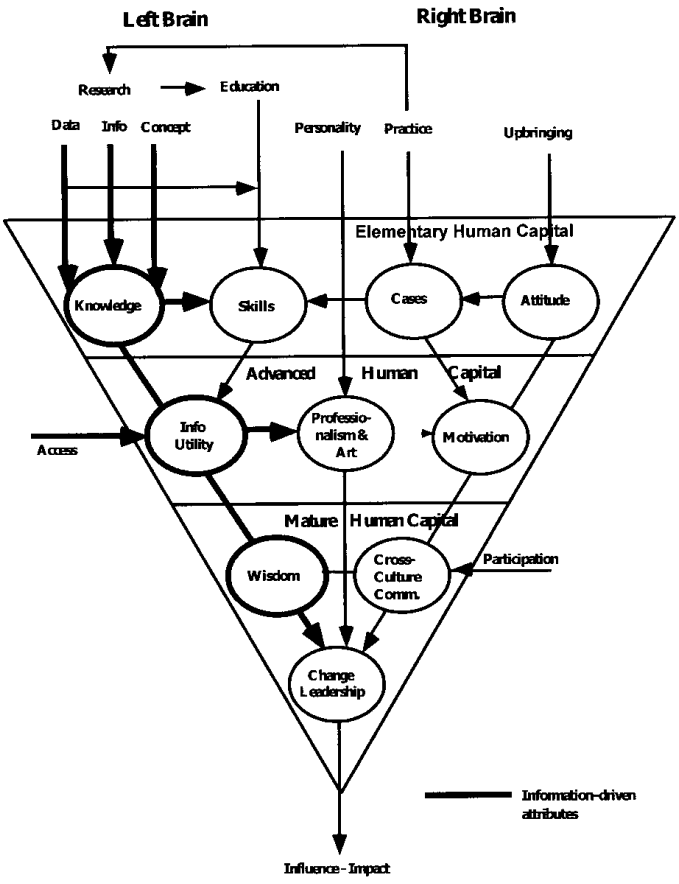


Figure 3 Human Capital in Developmental Stages

Stage I:Elementary Human Capital:
Knowledge, Skills, Cases, Attitude

Stage II: Advanced Human Capital:
Info Utility Access, Professionalism and Artistry, Motivation

Stage III: Mature Human Capital:
Wisdom, Cross-culture communication, Change, Leadership

Only four attributes are information-driven: knowledge, skills, information utility access, and wisdom. This means that the development of human capital cannot be limited only to issues of information. The process of socialization plays a very important role in the estimation of human capital values; this process is culture-driven.

The measurement of human capital value can be done through the estimation of the value space of work force (macroecology) or through a given person (microecology). Figure 4 illustrates the value space of human capital.

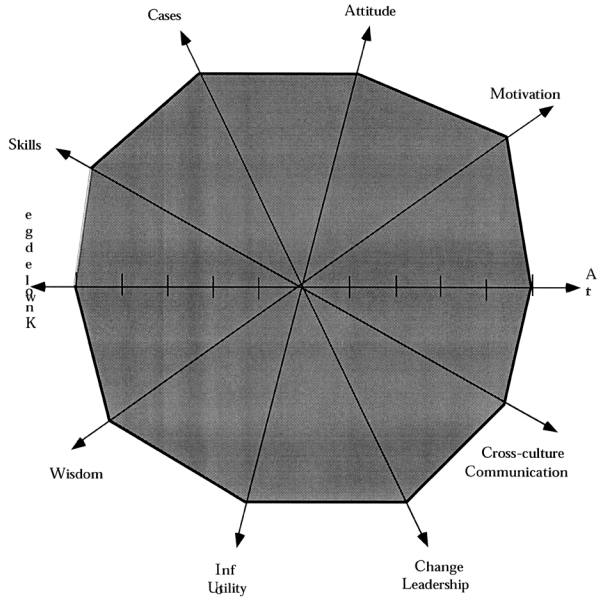


Figure 4 The Value Space of Human Capital

Each attribute (A) can be measured on the five-point scale. A sum total of all attribute points provides a value of given human capital (V). This is a comparative unit of human capital value. It can be applied in comparisons of economies, organizations, or persons. It can also be applied in the analysis of human capital efficiency potential.

CONCLUSION

Macro-information ecology is just emerging, along with the development of Information Wave practice, and research should turn their attention into the application of the information laws and their further discovery and corrections in the analysis and design of values and tools of the Information Wave and civilization in general.

NOTE

[1] During his public lecture at Western Michigan University, (13-12-1992).

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