

Innovating the information – a modern approach to improve the knowledge based systems

By Prof. Eng. Ph.D. Victor GREU

Abstract

The paper presents an approach for the evolution consequences, in complex and knowledge based systems, as the main human activity fields and Earth ecosystem.

The progress, apogee and decline stages of evolutions and circumstances are analyzed and compared, aiming to show the importance of information and knowledge innovations for the progress or survival.

The complex relations between data, information and knowledge in the knowledge based society are also revealed, in order to identify the ways which the information and communications technology and generally the science and technology could provide innovations to help mankind in the permanent struggle with the time.

The complex problems of data overflows and supercomputing, in many scientific and technical areas, are also analyzed, as related to the information, knowledge and management necessary innovations.

Keywords: *knowledge based society, information and communications technology, green technology, biotechnology, exadata, cloud computing.*

JEL: L 86, O3

1. A true and simple story from today to tomorrow

In our days, a citizen bought some modules of metallic tiles (steel plates) for the construction of 2 balcony roofs.

Following the producer's **information**, the remaining cut (non rectangular) parts *could not be useful (reused)* in the project, because of the curved surfaces of the tiles.

Trying to *optimize the material at every cutting step*, the citizen finally got the 2 projected roofs and a lot of remaining parts of steel plates, including a complete module.

Then the citizen thought to use the remaining parts in order to double (under it) one of the 2 roofs (which was more exposed to the wind), as an aerodynamic protection.

After an optimization effort, the citizen had the surprise to obtain a doubled improved roof and the complete re-use of wasted (remained) material (about 1/3 of grand total).

How that was possible?

By **innovating the actual information!**

Here both emblematic terms (innovating; information) suppose also the appropriate actions to obtain the progress.

The results: performance optimized project, optimal use of materials from economical and ecological point of view.

As we will further show, adapted at a large scale, a such approach is one of the ways to the knowledge based society, when using *green industry*.

2. The Earth apogee and decline show that we need innovation more than ever

Progress or apogee

The distance from apogee to decline is not always so big as we are expecting, especially when we think at a diversity of processes about the Earth and mankind.

Of course it is very difficult to chose some examples to illustrate the actual humankind (and Earth) *apogee*.

We may try with the human genom decoding, the smart phones, the space robots after the Man on Moon, the Large Hadron Collider (Geneve) or the recent experiment with the possible surpass of light speed and many many more.

Notice that, for accuracy, generally we should distinguish (although we above did not so), among the diversity of actual “tops”, those which satisfy the condition to be a true apogee (a state closed to an upper limit), not only a present level best (a stage of *progress*).

The last observation is crucial for understanding the essential, opportunity and pertinence of our analyze about the Earth and mankind evolution.

Considering both horizontal and vertical diversity of the evolution processes, we see that the average estimations show high levels in most fields of human activity, so it is correct to appreciate that the most processes are evolving towards an apogee, but not all of them.

Here we have to mention at least some prominent classes of exception, as the rate of health care efficiency versus the economical and technological progress, the social progress and last (but far from least) the ecological balance of the Earth with humankind activity (the best example being the climate changes).

So we may say that there are many tops and some lacks.

But it is very possible that an average person hearing all this “tops” to ask:

What about Us?

Although we have mentioned the health and the social progress as prominent “lacks” I think this question is the best way to open the other side of the picture.

Slowing down or decline

In spite of the above, sometimes from progress to decline could be a short way, especially if we consider that, in many fields, when the rising is slowing down, usually the estimations are presented as a start to “decline”. The best example for this case is, as in the actual World crisis, the economical increase of the states.

Another class of decline, very significant in the technology field for example, is expected when the evolution is approaching visible limits.

It is sure that there is more to know every day, in order to have a knowledge based system (society), on Earth and outside (perhaps more than we actually know, in all areas), but we sometimes forget that the most important (and difficult) progress must aim the human being herself, from health to spirit and eventually her existence and progress on Earth.

At this point it is interesting to observe that, in almost entire mankind history, from little to big actions, people said that “all we do is for the mankind well”.

Unfortunately, much of the done led us to the actual challenges and possible Earth decline.

The logical conclusion from this point will be to rethink all these “well intended” actions, but in an refined integrated conception.

A good start, in a such complex and complicate process, it will be to analyze the main decline fields (activities), or at least some prominent of them as examples that could indicate the principles of improving them.

Data or information, which is in crisis?

Not only because the information is the topic, but because it is a knowledge generator, we must put it first.

The last years I used to tell to my students about the near perspective of the World to collect data about every m^3 of the Earth, for military and civilian purposes.

I also have mentioned that 11-th of September 2001 proved, among other, the limits of the states (including USA) to optimally manage (store, select, analyze, share and use for decision) the huge amount of information they have now. But in the future?

I have thought that the future ask for heavy intellectual efforts to create new philosophies, theories, concepts and algorithms in order to optimize the management of the complex sets of data, at diverse levels, aiming the Earth progress or at least stop its probable decline.

Exadata

On the other hand, now the scientists [1] have the goal to create the complete map of human brain circuitry (about 1 000 000 mm^3), but 1 mm^3 will request about 1 petabyte (1000 terabytes), so eventually about 1000 exabytes.

The expectations for Internet traffic in a couple of years count also exabytes and are exponentially growing.

Thus we are going to an “exadata” age.

This is the confirmation that we need a new “science” to manage all the sciences and all the human activity data in order to get the needed results in ways that, among other benefits, reduce the amount of processed and memorized data.

One could say that a way would be to partially return from digital to analog processing in the scientific experiments and generally in all processes associated with the human activity (including the Universe research). Less probable to be so.

It is obvious that this new science will innovate the information and communications technology (ICT) processes, but it mainly must innovate every activity that provide data, aiming to obtain new information (final data, results and decisions) by different methods, eventually reducing the volume of processed data.

It is also clear that reducing the data volume is only a part, a simpler one, of the complicate goal to optimize the data processing and use, at all levels, according to an integrated, knowledge based, management system.

To optimize this knowledge based system, the most difficult part is to create a flexible but effective set of new principles, criteria and algorithms for the management of processes and circumstances.

All these new theoretical instruments would add in fact *innovative (new) essential information* for every field of activity, thus the data crisis is only the top of iceberg, but behind is an *information crisis*, which in fact leads to **a knowledge crisis and then to the real challenges (apogees/limitations or even declines in the corresponding fields or circumstances)**.

The creation difficulty will increase as the level of the system in the global (World) hierarchy is higher.

The temptation is to use the power of ICT to solve this problems, but this way the paradigm usually remain the same (still, ICT could be a part within the solution as an *expert system*).

It appears that we have just arrived in a vicious circle.

The exit from such a circle is to change our thinking reference.

So, the solution is to ***innovate the information*** that generates the knowledge.

3. Innovations from nano to exa

Naturally, the next questions are where, when and how to innovate?

Difficult questions, but we don't expect exact answers, we only try to get some tips on these complicate matter.

Again we remember how long is the way through theory, but short by examples.

From simple to complicate, from narrow to wide areas, lets see some prominent challenges of our days, where ***apogee or decline ask for innovation***.

Continuing the huge data case, it is interesting to count some relevant areas, in the scientific and technical fields where innovation must compensate the data overflow: simulations of complex processes (as nuclear fission/fusion, climate/weather changes and forecast etc.), real time processing, Internet and other [5], [2].

It is important to note that most of these processes need innovations not only for storage, analysis, filtering and dissemination of data overflows (exadata), but also new supercomputers (computing power/speed).

The case of higher speeds is crucial because the whole world (not only ICT) depends on it, so when the nano limits of the CMOS transistors will (relatively soon) be reached, some revolutionary (perhaps biological) innovations will be requested [2].

Close to this case is the materials fading and again semiconductors have a global impact. Notice that some of these semiconductors (for example GaAs) not only are on fading, but the whole industry is relying on some single producers and this situation rises serious strategical and security problems [3].

Among other benefits, virtualization and cloud computing will provide a considerable reduction in hard devices (materials) and power consumption.

The story goes on with the "apogee" of the ICT world, the Internet, where the huge amount of users (now over 2 billions) will be crowded by the exponential growing of the number of connected devices, as a logical consequence of the information society road to knowledge based society (KBS).

The Internet innovation is aiming new architectures which should better respond to these challenges. Among these new solutions, the most promising are those inspired from the biological world and those based on information centric approaches [2].

Last, but the most important, the Earth ecological balance rise the most complex and difficult problems.

The mankind versus Earth balance is on decline, mainly by the ecological changes (and all consequences) and the materials fading.

Notice that material fading include not only industrial ones, but the food, water and even the air and here are requested the most complex and difficult innovations, as we already have mentioned. Water decline, for example will also affect the available energy (power), as the fossil sources of energy are any way on fading and the nuclear power has its (material) limits and risks.

Those innovations are generally included in what is called “green industry” [4], but we have to innovate everything on our everyday life, as a “green life”. Here we should include water and food consuming new attitudes and more (like the social relations and learning the innovations from the nature and its history).

Notice that all in biotechnology sphere must be used with much care, because the nature already made, in millions of years, its innovations and we have chances to spoil them and on the other hand, especially in the human areas, all is very complex and difficult to understand and change.

Maybe the most important challenges is about to innovate the information and knowledge sharing and use, as a KBS main feature. Notice that an important part of world population is far from been connected at information and knowledge progress, but the real innovation here must include more than ICT use (education and social improvements must be first).

4. The permanent dilemma is apogee or decline

Finally we may count again the tops and the “shadows” in order to see if we are at the apogee or decline.

My opinion is that we are somewhere in the middle, for the only reason that our metric (for such a complex and complicate assemblage of processes and circumstances) is not only relative (or rather holistic), but variable in time as our life philosophy is changing. It is obvious that this opinion too is the result of a certain philosophy.

On the other hand, as in many random processes, when we have no certain information, we have to chose to think on a historical base (integrating the last steps).

So, we have to consider that our evolution is not at the middle (between and apogee and decline), but rather close to decline, because we have to consider first the traditional principles, criteria and values (from the mankind recent history).

The analyze could continue, but it is reasonable to conclude that, for an optimistic thinking (as mankind have done in the difficult moments), we must apply one more time our proposed paradigm: “innovating the information”.

That is we have to reconsider, as a compromise that adapts the classic principles, criteria and values to the actual conditions and give to the Earth and mankind the chance to be somewhere after the middle and to learn how to “innovate” the knowledges in order to slow down the evolution to a global decline.

REFERENCES

- [1] Paul McFedries, *The coming data deluge*, IEEE Spectrum, feb.2011.
- [2] S. Balasubramaniam, K.Leibnitz, P. Lio, D. Botvich, *Biological principles for future Internet Architecture Design*, IEEE Communications Magazine, July 2011, vol.49.
- [3] Richard Stevenson, *Crystal method*, IEEE Spectrum, jan.2010.
- [4] Imran Asraf, Federico Bocardi, lester Ho, *Sleep mode techniques for small cells deployments*, IEEE Communications Magazine, aug.2011, vol.49.
- [5] M. Wehner, L. Olikar, J. Shalf, *A real cluod computer*, IEEE Spectrum, oct.2009.