A Project Management Perspective – utilization of artificial intelligence techniques

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For a number of years a lot of research has been dedicated towards efficient operation of project management and tools enabling execution of undertaken tasks. Management programs require more than just a performance process, but it goes one step further – it requires a "learning process". This expectation has been found as possible to be achieved only lately through the utilization of artificial intelligence techniques. It has to be explained however, that this is only a threshold of what this tool might finally achieve.

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For many years grave concern has been expressed about the quality of buildings and efficiency of the processes leading to the final outlook of our built environment. A lot of research has been focused on procurement options, cost, time and value. Until present, very little attention has been given to the central issue of the design and construction process – information and decision-making, both forming a basis for efficient project management.

With the growth of computer industry, increase in the knowledge and existence of more and more sophisticated software, the potential for managing the "flow of information" has at last become a reality. Yet, the knowledge and the skills required by project managers are diverse, as the representatives of this profession are first expected to be highly skilled in the specialty area in which they work – architecture, construction etc., and second – in budgeting, scheduling, and human and resource allocation. Beyond this, project managers should have insight into risk management, contract management and posses a wide scope of business skills.

It has to be accepted that even the smartest and most energetic project managers will fail if they are not provided the support needed to carry out a job effectively. Program management requires more than just a performing process; it requires a "learning process". Utilization of the value management process, to complement the project management duties. Hence more and more, project managers are required to look beyond the set boundaries of strict project delivery.

It seems that neither professionals, nor existing project management software are well prepared to provide the expected full scope of services. Computer tools are used to achieve something they were not designed to do. In the beginning, project management software was designed to help medium term planning of single, complex, usually heavy engineering projects e. g. bridges, power stations. Basic aim covered the demand of

resources over the next few months. The main issue was to maximize the efficiency of the team workers on a single project. There was no need to consider cross project conflicts, optimalization of project's resources as well as a host of elements which have appeared only within the last ten years of industrial development. Presently, most project teams need help with short term planning on many similar, relatively simple, but overlapping projects where individuals also work part time on physically non-existing projects. A vast majority of the project management software users belong to this latter group. Managers of such projects have tried to adapt the available project management software tools.

Presently, most projects planning software spans the next few weeks only. While most projects have a much shorter overall duration than within the last decade, the project manager's role is concerned with the long term capacity of the building's lifetime, as well as specific plans for the next week or two. At the same time project managers deal with individual people, who posses many skills that may be used to meet the requirements of many projects. Histograms are not anymore a useful form when showing only how many hours per day a person needs to work – they already know their working hours. Much more interest should be placed on the fact – as to what they should be doing during those hours.

Only utilization of a complete program covering the management of building's lifecycle will ensure that any decision made in response to change in business environment will be implemented and analyzed based on a multi-action management process. This aim is the basic human drive to reshape existing tools into more efficient ones. Hence, the search to construct artificial intelligence possessing the "creative passion" and "adaptation abilities" which always have been characteristic to human resources only. Contemporary research has allowed to distinguish following paths of future development: neural networks, fuzzy logic and evolutional programming.

Artificial network is based on the biological archetype, where a neuron consists of a nucleus, a number of dendrites (entrance points) and a single axon (exit point). Neurons are connected by the axon-dendrite links. Each neuron transforms its internal information as a set of electric impulses and emits the external signals – as a chemical reaction.

Mathematic description of the artificial neuron has been formed as early as 1943 (McCulloch, Pitts). From the technical point of view, artificial neuron is similar to the biological one – it exists as an active or "sleeping" unit. Information is received and transformed by the means of existing weights of observations. Such "weighted" signals are added, showing the total neuron's activity. Artificial neuron consists of a summation block and a motivation block. The simplest neuron network is a feed forward one (Widrow, 1960) – single, multiplayer, recurrent or cellular network. It is characterized by a very important feature – ability to learn from external teachers and adapt existing weight values. In consecutive learning cycles, network adjusts the "weights", so that the answers will be closely related to the teaching standards. Alternatively, it is also possible to give additional "negative" and "positive" standard, allowing the network to choose the right solution. Multilayer networks are taught through the back-propagation method (1974), where nonexistence of a positive answer allows the return to the lower layers for further research.

A self organizing method enables isolation of the most active neurons which earn the "right" to a further teaching process.

Artificial neural network has certain features similar to a human brain – it can learn and associate events. Even though, contemporary mathematical model is highly complicated and simulating tools have to be high class computers,

research can be conducted on simpler models which usually limit the number of input impulse data to no more than 12 elements. The main difference between neural network and other algorithms is the ability to generalize, and use this parameter towards the newly absorbed data. Hence, presently this tool may be used to define a certain range of possible answers rather than specific answers. This model has been used in various research works in Poland, lately while establishing the level of technical wear of the residential buildings' substances (utilization of 9 data parameters). Within management area, those algorithms maybe used for:

Feasibility studies, including financial prognoses and level of risk involved

Selection of staff (particular skills and qualifications versus requirements for the position)

Achievement of the general external building form (volume, shape, level of possible utilization of the natural energy resources, influence of the new development on the existing environment")

Hence, fuzzy logic and its practical use through application of fuzzy controllers is an answer as how to define through computer techniques, information of abstract or imprecise issues. Such commands as: "please switch on the lights when twilight arrives".

Evolutional programming – genetic algorithms are used – as within the environmental surroundings – for the natural selection processes. Their beginning dates back to biology research (Barricelli 1957, Fraser 1960), analyzing genetic processes by the means of computer software. It was only in 1970, that they were used in a system recognizing human silhouettes (previously unsolved by traditional programs). Genetic algorithms try to find the best solutions (cross-over process) generating newer generations coded into structures (code combinations).

It may be assumed that this artificial intelligence may be used as support tool for verification of solutions such as – location of the building, choice of building materials, choice of building functions, and one maybe – the average aesthetic influence of the new structure.

Dynamic development of computer technologies has already lately given a start to a number of tools helping with the research on artificial intelligence – such tools as Evolver or Flex allow for the optimization of certain problems with the use of genetic algorithms (Windows 3x. environment, Excell version 3 – for the neural network, and MATLAB environment where the genetic algorithms are concerned.

Basically, the scope of use – both for the neural network as well as genetic algorithms may be defined as following:

Prediction – the network is used to predict the final outcome

Classification and recognition – ability to recognize a certain group of information within existing set, and to classify new standards in accordance with categories established earlier

Data linkage – linkage of facts extracted from introduced data

Data analysis – connection between elements within data inputs

Data filtration – filtration to reduce unimportant information within each set

Optimalisation – optimal solution chosen for each type of data.

It should be stressed that this is only the very beginning of the described type of artificial intelligence, as yet it is too early to predict if its merits will be sufficient to create a well developed tool to be used by project managers. Judging from the existing state of knowledge, it should be hoped so, that one day project managers will be able to support their knowledge and instinct with computer software.

References:

Scientific work
1. Kierunki badań nad sztuczną inteligencją. http://piotr.cz.pl
2. Artificial intelligence – neuron network. http://republika.pl
3. Decisive systems. A. Skowron, N. Hung Son. Faculty of Applied Mathematics. http://alfa.mimuw.edu.pl
4. Architectonic design and management D. Ryńska (1997)