INTELLIGENT BUSINESS DECISIONS BY EFLOW PORTAL

Zoltán Baracskai and Viktor Dörfler
Department of Industrial Management and Business Economics
Faculty of Economical and Social Sciences
Budapest University of Technology and Economics
H-1111 Budapest, Műegyetem rkp. 9 T 48.
Hungary
dorfler@imvt.bme.hu

KEYWORDS
Business Decision, Intelligent Portal, Data Mining, Knowledge-Based Expert System, Machine Learning.

ABSTRACT

Bigger and faster changes in business knowledge are expected. Decision maker needs knowledge (hard data and soft information) of various expertises available at deep levels of organizational hierarchy. Experts are forced to life-long learning. It is of crucial importance to use the freshest knowledge but it is even more important to avoid the false knowledge. The keystones of internet-base knowledge increase are the personalization, the freshness and to answer the question "who to learn from". Freshness is provided by the Internet but the other two are to be handled. The eFLOW Intelligent Portal is continuously personalized, provides space for knowledge creation, enables data mining. Its portlets have multiple interconnections and they are also connected to organiza-tional databases to get hard data and to knowledge bases to get soft information. Doctus knowledge-based expert system shell embodies the built-in artificial intelligence.

1. THE KNOWLEDGE ORIENTATION

> *If distress is caused by shortage of data, business rules or experience, eFLOW Intelligent Portal eases the continuous knowledge increase. But, if distress is caused by the human flavor, then another remedy is needed.*

We completed a consulting for a company. Achievement was in the creation and the conduction of a new decision node. After couple of days some leaders questioned a part of the solution. The cognitive dissonance worked. (Performing a boring task for big reward does not need an explanation. For a lot of money it is worth doing it. Although doing the same boring job for small reward needs explanation.) For the new tasks, chief executive has promised more money to newly appointed leaders for the new job. The harrumphing leaders would rather do the old boring work for the small money. This needs to be explained.

For explanation leaders lacked hard data and soft knowledge. They came up with handy data (expenses) and a textbook for higher education with the couple of decades old debate on linear versus divisional structure, tucked in a new wrapper. Clung up on knowledge sanctified by expert, being published in 2001 meant up-to-datedness.

In our modern tumbling world it would be phantasm to expect practicing leaders to test actuality of the publicated data, business rules and experience. In these cases eFLOW Intelligent Portal can assist.

"The web is like my grandmother's loft. I always find something interesting but never what I search for." – said my colleague, at the dusk of the Internet. Today there are new terms like data warehouse, e-learning, intelligent portal and knowledge management. Is the saying still actual?

If we would like to take home a box of matches, we can manage it without a 28 tons truck. It is luxurious to use the web for publishing electronic catalogues, putting on our old curriculums, swap pub-talk with forums or to strain off pet offerings. However nothing is too expensive, if we use interactivity and personalization possibilities for knowledge increase. So the difference between the Internet and the carrier pigeon becomes obvious.

Nevertheless, today's programs with the epithet of intelligence are dull. It is humble to allude to upcoming artificial intelligence. Knowledge based systems with inductive reasoning and genetic algorithms are available.
In future we can expect bigger and faster changes in business knowledge. Fast changes are challenging future experts to life-long learning. The world advances toward the life-long learning model, which gradually replaces the present concentrated learning model (Interactive Week October 9th 2000).

The new keystones for knowledge increase:

- **Personalized** (tailored for body) – Personalized knowledge acquisition means that a "tailor" has to get to know the "body". It is important to get to know the tailor too. For the web mediators it is of crucial importance to observe the one thirsty for knowledge. Plural, in this case does not exist. Instead of concentrating on average mass, we should keep an eye on each person separately. Perpetual learning causes perpetual tailoring. Future requirements will differ from the present ones.

- **Fresh** – During the knowledge increase it is important that mediators mediate and assume the freshest knowledge, before the competitors. False knowledge is more dangerous than ignorance, and the web is a perfect place for phantom pipe dreams armed with fresh dates.

- **Who-to-learn-from** – In knowledge-oriented organizations the conventional relation-ships between generations has radically changed. Expertise is not anymore just in the heads of elder, experienced co-workers, but also in young people too who are open to new technologies and new solutions. This can especially cause problems if co-workers have to learn new things from each other. The web provided learning (does not claim personal presence) neutralizes communicator's personal style; thereby it helps in soften-ing the prejudice towards youth, their values or solutions. Hereby such a learning field evolves where people focus on essential elements. It becomes irrelevant who provides the idea.

The question is how to teach learning. Innovative atmosphere and broad world-view should be created on basis of deep knowledge (principles, laws, rules). If the professional slang does not evolve, then the Babel confusion will. According to some the future lies in case studies. It is wrong to start the training with case studies. It is more important to develop sense for judgment, problem-exploration and problem solving. Experience creates firm belief. Evasion of thinking and concept acquirement leads to disclosure of imagination, speculation and inspiration. Human thinking often has to secede from reality in domain of approach and not the problem. Problems have to be treated in reality. In our approach, we are looking for new, original ideas (solutions). Further specialization boost is not a viable way. It's easy to accept the thought that teamwork is the future perspective, but it cannot be done by rounding up the specialists of the conventional professions. Technician training requires overlap within different specialties.

Couple of hypothesis were taken. Essential is the belief that the web-based knowledge in-crease will differ from modern trainings, case studies and long-distance learning.

- In future, the majority of training programs will be based on deep knowledge (problem exploration determined. and solution oriented).

- A "surplus teacher" is needed who can teach the fundamental concepts to knowledge thirsty — the basic terms in "the world of keywords".

- After training we should not collect the standard facts of yesterday, but current data to support our decisions (**data mining**).

- Relationship between data is meaningful (soft knowledge). This knowledge is stored in expert's long-term memory (knowledge bases). In case we need it, we can browse ex-pert studies (**knowledge angling**).

- Benchmarking examines and searches for the leading practice. Basic rule is: "don't copy". It is of crucial importance to understand and then to judge the current situation (**experience fishing**).

2. THE INTELLIGENT PORTAL CONCEPT

Portals are hard to define. It is not our goal in this paper. However we believe that after our presentation it will be easy to distinguish intelligent portals from simple ones. This is important, as in our approach intelligent portals have to be capable of learning so they must have built-in artificial intelligence. eFLOW Intelligent Portal (eFIP) is based on Doctus (http://www.doctus.hu/en) Knowledge-Based Expert System Shell. Doctus uses symbolic artificial intelligence for three types of reasoning: deduction, induction and reduction. For induction Doctus uses a modified ID3 algorithm (Quinlan 1986), which is a type of machine learning in the form of decision trees. Thereby it is capable of learning so it enables learning capability of eFIP.

eFIP is based on four intelligent evaluation processes (Figure 1). A module is dedicated to each of them:

1. The **process management** module is an intelligent project monitoring solution. It com-pares plans to work-in-processes, suggests plan modifications and shows the responsible ones.

2. The **customer management** module starts from the plan of visiting the customers. This is compared to the realized connections with the customers, which lead to the visit suggestions.

3. The **supplier management** module shows the capacity of the suppliers. Comparing this to the required capacity the modification of the contracts or a new contract is suggested.

4. The **human resource management** module lists people with the certain knowledge. This helps the decision maker to select the appropriate person for each position and to foresee the lack of working capacity (people with adequate knowledge) and to decide about trainings and recruitments.

- There is also a zero module "**user**" which is a space for personalization

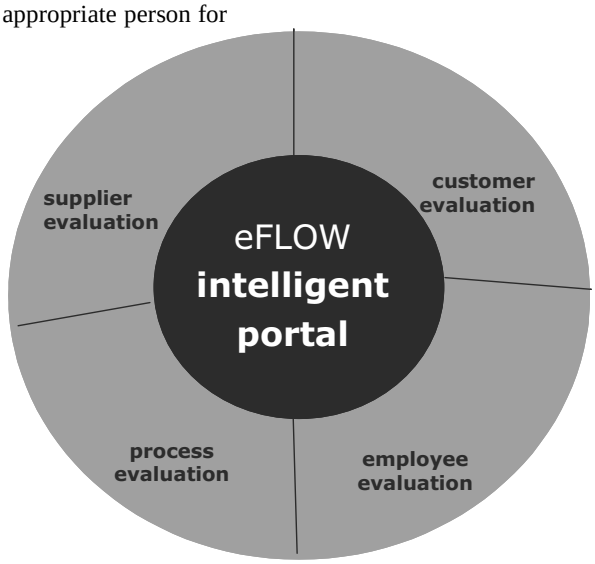

Figure 1: The intelligent evaluation module

Each module has three functions:

1. The **decision** function is based on the deductive reasoning of Doctus knowledge-bases and also retrieves data from management information system. (Actually it starts with deductive reasoning. During the usage Doctus collects the cases and uses them form learning, which is induction. The starting deductive knowledge-base is then updated on the basis of the new experience using reduction. Induction and reduction makes a part of tacit knowledge explicit.) Here the user gets evaluations on processes, customers, suppliers and employees. It also monitors the data changes in MIS and knowledge changes in the knowledge-bases.

2. The **deputation** function helps the decision maker to depute the routine decisions. The decision maker selects the appropriate subordinate and transfers the knowledge-base to him. Transferring the Doctus knowledge-base to the subordinate does not mean creation of a programmed decision maker. A part of tacit knowledge always remains tacit. The knowledge-base contains only the explicit knowledge of the decision maker. The subordinate also has to pay attention on changes in environment of the decision. When the changes transform the routine decision to original one — called non programmed decision by Simon (Simon 1977) — the subordinate has to give it back to the decision maker.

3. The **business planning** function is an intelligent redesign solution. It updates changes in plan and in work-in-processes as well. It also handles scenarios.

- There is also a zero function "**my page**" where the user has an overview of the selected module.

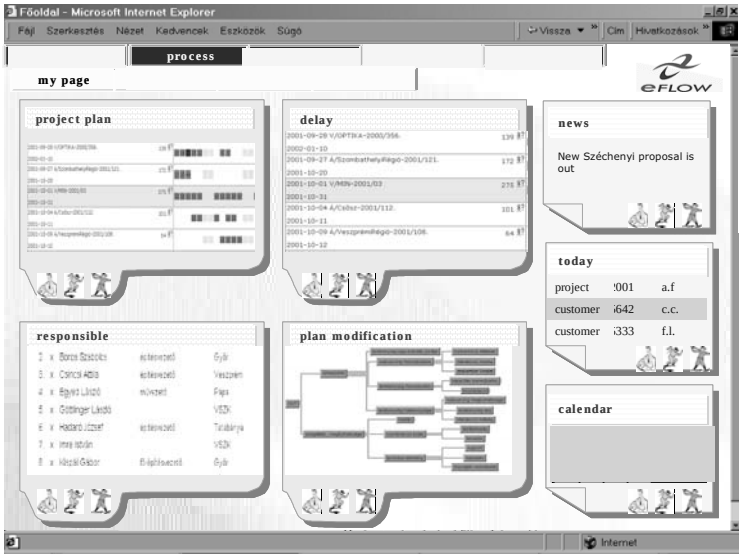

Figure 2: The types of the portlets

We define pages of the portal with one module and one function (including the zero module and the zero function). There are four types of portlets on each page (Figure 2). Their names and their content changes from page to page. The types of the portlets are:

1. The **plan** portlets are used to show the previously defined and constantly updated plans. It indicates the milestones and the requirements associated to them.
2. The **controlling** portlet compares the state-of-the-art to the plans and it indicates the differences.
3. The **responsible** portlet shows who is in charge at the different levels for the processes, customers, suppliers and employees.
4. The **action** portlet is the outcome. It suggests what to do about the differences indicated by controlling portlet, how to catch up with the plan.

- There are also three portlets available at each page (not changing from page to page): The "**news**", the actual things to do "**today**" and the "**calendar**" (Figure 2).

The names of the portlets for the "my page"-s and the logical connections between them are shown on Figure 3.

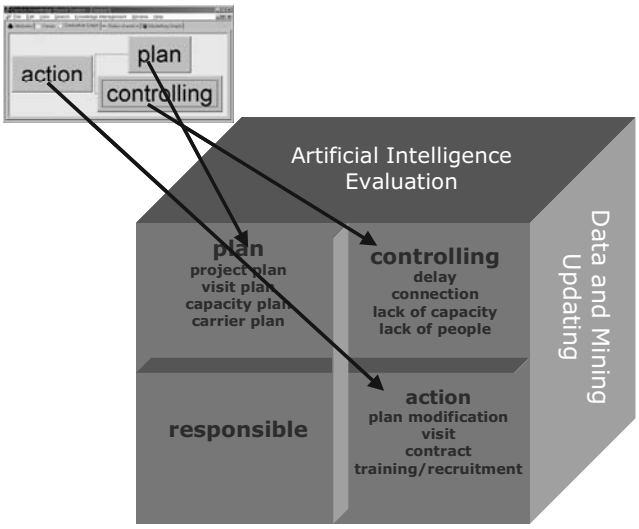

Figure 3: Portlets on "my page"

Each portlet is connected to knowledge-bases and to the organizational databases (Figure 4). It retrieves data from organizational databases, data warehouses, data marts and external databases as well. External

applications can also provide portlets with data and soft information. Doctus knowledge-bases are usually embedded into portlets but portlets can also retrieve soft information from knowledge-bases. Built-in knowledge-bases can be modified by multiple experts, which therefore provides a space for knowledge interchange between them. The knowledge interchange between experts leads to knowledge creation, which is a competitive advantage for the organization (Nonaka, and Takeuchi 1995).

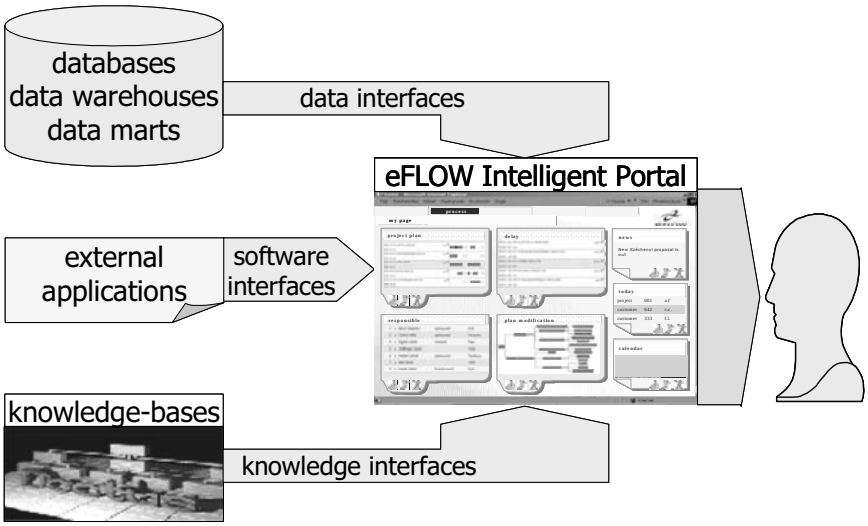

Figure 4: The portal connections

The figure 2 shows the surface of "my page" function of the "process" module, when nothing is selected from any of the portlets. The portlets have multiple interconnections. If we select a project (or a part of it) the other portlets on the page will change. The "responsible" will show the responsible for that project, the "delay" will show the differences between the plan and reality for it and the "plan modification" will give the suggestion for that particular project. If we select a time period from the calendar, the project planned (and those not planned but still running) during that period will appear in "project plan". Delays and responsible will also be accordingly listed. By selecting somebody in the "responsible" portlet, we will see projects, delays and plan modifications for him.

Doctus' knowledge-bases consist of concepts connected with logical „if… then" rules. The concepts are stored in the form of attributes with values (e.g. attribute „delivery" has values „usually late", „not yet known" „usually on time" and „never late". The values are ordered and presented on ordinary scales. In deduction the attributes form a hierarchy called deductive graph. The root is the outcome, the depending attributes are the nodes of the graph and input attributes are the leaves. Rules are to be given for each node of the graph and for the root as well.

On the figure 2 at the bottom of each portlet there are 3 figures. These are three intelligent analyzing options of the knowledge-bases:

"Explain" answers the question how have we come to this outcome. It searches for the rule in the particular node of the deductive graph. The hierarchy of the rules can be followed to the input attributes.

"What if" is the forward chaining. This option follows the consequences of the changes in the knowledge-base. Two kinds of changes are considered: we can change a value of a case for one or more attributes or we can modify a rule. Then new rule is activated for the particular case. If a value is changed, another rule is associated to the case (which was already part of the knowledge-base). If a rule is modified then it has to be activated. This option is the symbolic logic version of the scenarios.

"How to" is the backward chaining. It helps the decision maker to find out how the outcome of a particular case can be changed. It searches for the rules providing the needed outcome. It gives the combinations of input changes for which one of the found rules can be activated for the particular case. The decision maker (or his expert) chooses one of the available value combination changes. As values are presented on ordinary scales in Doctus the most appropriate change cannot be chosen automatically. E.g. someone can increase his knowledge of a foreign language by three grades (values) but he is unable to improve his tallness. Nevertheless concepts have to be presented on ordinary scales. No one can say if the "beautiful" is 3 or 3,2 times better then "nice".

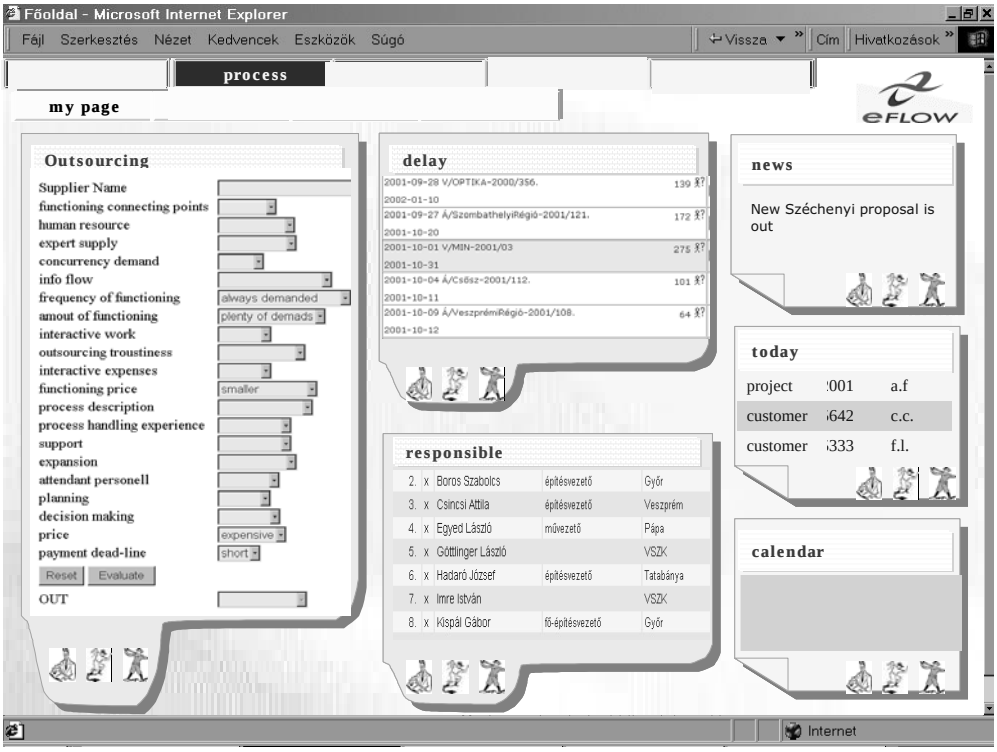

Figure 5: Data mining in the portal

3. THE DATA MINING CONCEPT

In some action portlets Doctus is used as data mining tool. To find interesting rules (Padmanabhan. and Tuzhilin 1999) a new approach is developed. The knowledge-base is built for the decision maker. It contains soft information only. But some of the soft information can be tracked back to the soft relations between hard data from MIS. To transfer data (numbers) to soft information (concepts) Doctus uses a clustering algorithm. This kind of evaluation is shown on figure 5. The previously filled fields retrieve data from MIS. The decision maker fills the rest. Then Doctus performs the reasoning. This approach to the data mining uses symbolic logic, as we believe, that results of statistics or neural networks are hard to interpret (Davenport and Prusak 1998).

4. BENEFITS

To exploit the advantages of the intelligent portal the leader has to be experienced decision maker. We can support only the decision maker, who can accept that routine decisions can be made using less information (fewer attributes). They will have the following benefits:

- personalized information
  - get to know the thinking of the decision maker
  - get to know the habit of the decision maker
- fresh information
  - produced today
  - needed today
  - can be delegated today
- pay for what is needed
  - free access to the knowledge (not without paying for it)
  - free increase of the knowledge
  - free distribution of the knowledge (not without paying for it)

Intelligent portals will be useful only to organizations where creation and division of labor is present and needles for “plan-accomplishers” without empowerment. The organizations will have the following benefits:

- smart data mining
  - which data was used?
  - what was it good for?
- smart knowledge angling
  - which relation was used?
  - who knows the relations if no data is available?
  - what kind of new knowledge can be assembled?

- smart experience fishing
  - which experience was used?
  - who knows the leading experience?
  - what can we use from the leading experience?

25 years ago we made our first program for business support. Our chief told us to make pro-gram for the processes that we know well and to wheedle the customer. Then we were able to pro-gram wage accounting. We did it. Now we are able to select data for the decision maker. Now we make intelligent portals.

REFERENCES

Davenport, T. H. and L. Prusak, 1998. *Working Knowledge*. Harvard Business School Press, Boston.

Nonaka, I. and H. Takeuchi. 1995. *The Knowledge-Creating Company*. Oxford University Press, New York.

Padmanabhan, B. and A. Tuzhilin. 1999. "Unexpectedness as a Measure of Interestingness in Knowledge Discovery". In *Decision Support Systems* Vol. 27 Issue 3, pp. 303-318.

Quinlan, J. R. 1986. "The Induction of Decision Trees". In *Machine Learning* Vol. 1 No. 1, pp. 81-106.

Simon, H. A. 1977. *The New Science of Management Decision*. Prentice-Hall, New Jersey.