Higher Education Management Dashboards

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***Abstract*- Development and Deployment of a performance management system is a challenge for Romanian universities. The paper presents an architectural framework for a performance management system. We also made an SWOT analysis for implementing a performance management system in Romanian universities.**

I. INTRODUCTION

A performance dashboard is "a multilayer application built on a business intelligence and data integration infrastructure that enables organizations to measure, monitor, and manage business performance more effectively" [5].

Doerfel defined a dashboard as "a group of financial indicators and other operational measures that reflect key elements of an entity's strategic direction used to "navigate" the organization, much in the same way a pilot uses the array of indicators in the cockpit to monitor and navigate an airplane" [3].

From a decision maker's perspective, the dashboards provide a useful way to view data and information. Outcomes displayed include metrics, graphical trend analysis, capacity gauges, geographical maps, percentage share, stoplights and variance comparisons [6] [7].

The main characteristics of a performance dashboard are:

- use visual components (charts, performance bars, gauges, maps, stoplights, etc) to highlight the data and exceptions that require action;
- gathers data from a variety of source systems;
- enables drill-down or drill-through to underlying data sources;
- presents a dynamic, single view of the business with timely data refreshes;
- needs to contain more than pure financial metrics to be effective;
- display key performance indicators in a concise, intuitive format;
- helps monitor individual, business unit and organizational performance and processes for a greater understanding of the business;
- is not always Portal based;
- is easy to use.

The use of dashboards is very broad, for example: hospital bed management, product development management, financial management. Companies can also use dashboards to manage sales, employee and call centre performance by setting metrics and managing those indicators over time through data visualization. Dashboards measure performance at a number of different levels: corporate level, business unit, functional level and process level.

The paper presents some results of the national research project "Integrated Information Solutions for Competitive Management in Romanian Universities".

II. PROBLEM FORMULATION

Romanian universities are going through profound changes. They are facing significant challenges in maintaining their position in the marketplace. Therefore, universities need accurate and timely information about their marketplaces in order to:

- make informed decisions in the short-term;
- plan for the long-term;
- continue to provide educational opportunities that are relevant for students;
- meet compliance reporting requirements;
- continue to attract and retain students.

Most universities operate with an extremely large and complex organizational structure that is segmented into faculties or departments. At this moment management of a university is the same with management of a big company.

Factors such as student admission, teaching load, graduation rates, and research funds, all affect a university's performance. Our universities should be able to capture and report their data on all levels.

Development and Deployment of a performance management system is a challenge for Romanian universities**.** Such a system should provide performance management of the main functional areas of the university: Finance, Research, Student, Teaching and learning, Human Resources.

Fig. 1 presents an architectural framework for a performance management system for universities. Such a system should provide the instruments to support the governance processes, showing the data and analysis necessary for strategic planning and control.

The key components are:

- A data warehouse;
- A reporting layer including ad hoc query and transactional reporting;
- An analytical layer including multidimensional/ OLAP analysis, data mining, text mining, forecasting, predictive modeling, etc;
- A monitoring layer including personalized dashboards and scorecards with key performance indicators;

- University portal.

All transactional and analytical reports come from the single source, the University Data Warehouse. The university data warehouse is fed from various transactional data sources such as Student information system, Human resources, Research, Finance, Academic information system (course management, library services, online education) external sources (other institutions performance data, workforce and employment data, national comparative data, etc). The university data warehouse includes current and historical financial, human resources and student information.

The system is entirely integrated into the university Web portal. The portal brings all of the university information technology applications and services needed by students, administrators, faculty, and staff to one convenient location.

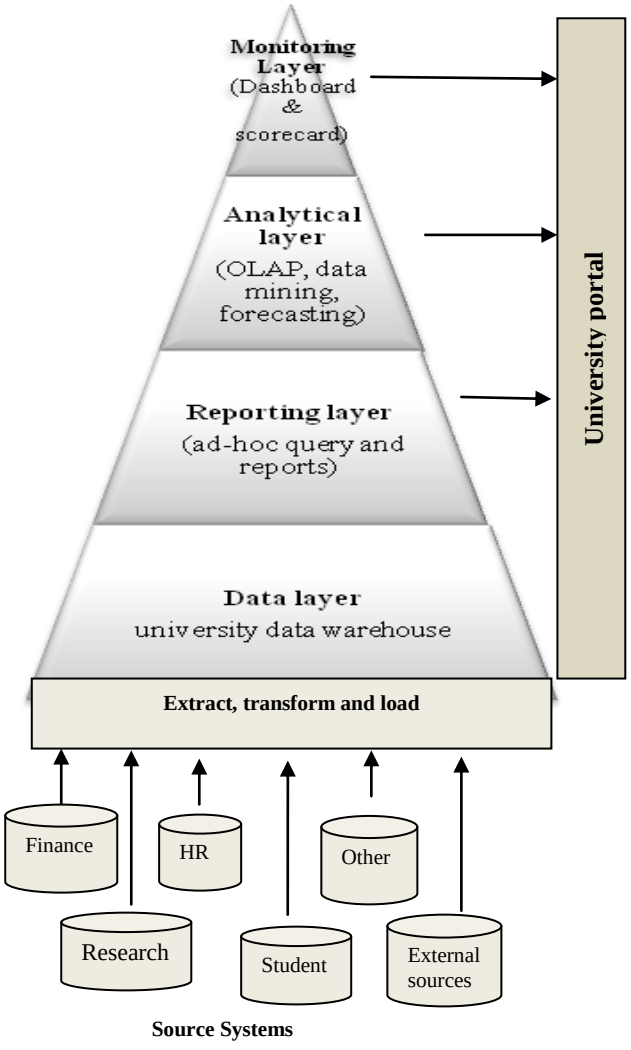

Figure 1. An architectural framework for a Performance Management System for universities

Users can monitor their department/faculty performance by using Scorecards and/or Dashboards.

The dashboards used in conjunction with the campus data warehouse and query tools allow university managers to easily display a variety of analysis and trends.

We made an SWOT analysis for implementing a performance management system in Romanian universities (table 1).

TABLE 1. SWOT analysis

S (STRENGHTS)	**W (WEAKNESSES)**
Communicate performance across all levels of the University Business decisions are analyzed at the appropriate level of detail Dashboards allow you to focus on key indicators and drill down for further analysis Make decisions in a quick and timely manner Single platform for decision making. Users are able to monitor and measure their performance within one single system	Expensive Complex technology infrastructure Lack of open source
O (Opportunities)	**T (Threats)**
Platform for continuous improvement of performance	Issues of integration with the existing applications Unclear goals Inaccessible data/lack of data/collecting the wrong data Long development process Academic resistance in the plannin implementation of this project Authentification and authorization capabilities of the system

III. DASHBOARDS FOR UNIVERSITIES

Performance Dashboards are a key component of a performance management system. Identifying and monitoring key performance metrics is as crucial for the university administration. The basic function of performance metrics is to assist in determining how well a particular university or department/faculty has achieved its respective goals. The performance indicators must be related to the objectives and strategies in universities and therefore this performance information must be presented to managers in a concise, intuitive format to support the university management processes.

University can use dashboards to manage student, staff, department and research performance by setting metrics and managing those indicators over time through data visualization.

The performance dashboards for university management should be classified into the following fundamental groups (fig. 2):

- Student, Teaching & Learning dashboards
- Faculty dashboards
- Finance dashboards
- Research dashboards
- Staff &workplace satisfaction dashboards
- University Business Processes & Operations dashboards

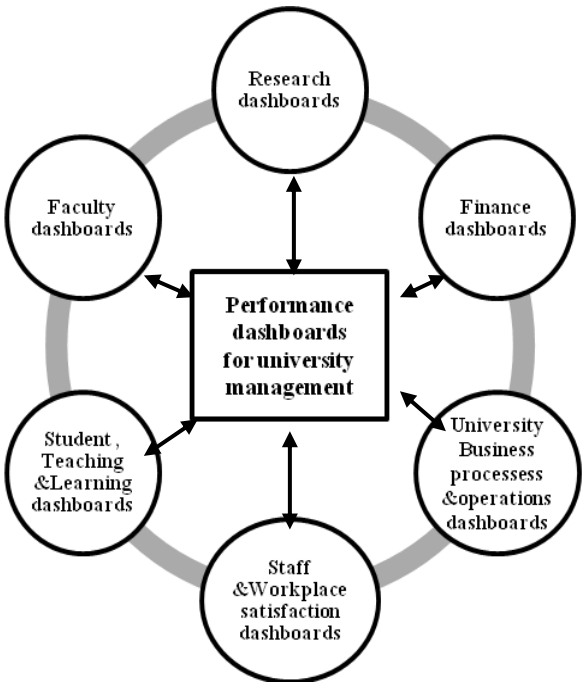

Figure. 2. Performance dashboards for university management

University can use dashboards to manage student performance by setting performance metrics and managing those indicators over time. The main performance metrics pertaining to students and their performance can be:

- Enrollment (undergraduate enrolment, graduate enrollment, total enrolment, graduate headcount, % of international students, % of female/male students, etc);
- First year retention rate;
- Number of degrees and Ph.D. awarded;
- Student Outcomes (graduation rates; %employed, % going to master, Number of degrees awarded, etc);
- % of students living on-campus, etc.

The faculty is often the main determinant in the quality of the university as well as pivotal in deciding which direction the university is heading.

A Faculty Dashboard can be an invaluable tool for faculty and their staff to stay on top. The main performance metrics pertaining to faculty performance can be:

- Ph.D. holders;
- Involvement in research projects;
- Student-Faculty ratio;
- Average faculty salary by rank, %female/male;
- Number of fellowships;
- Number of courses offered, etc.

The indicators described above are a mandatory part of any higher education performance dashboard, but can be modified by universities according to their particular needs.

Research is of great significance to universities. Research is a core business of universities and, as universities become more business like in the current competitive environment, there is pressure to manage research activities more effectively. Since universities receive research grants from the state and the business world, university authorities are keen on monitoring the outcome of research.

The current information system for research management has been developed with Excel tool. There are no drill-down. It is time-consuming, it is static and compared to the dashboard technology it does not look appealing anymore.

In order to design a dashboard for research management, we used various methods for information gathering:

- Gathering online information from website of CNCSIS (National Council of Scientific Research in Higher Education). We identified key performance indicators for university research activity. We gathered information about quality indicator for university research performance-IC6 [13].
- Gathering online information from Research department site of Academy of Economic Studies. We studied the research activity report for 2009. We used the report as a starting point for dashboard design [12].

IC6 quality indicator for university research performance includes the following key performance indicators [12] [13]:

- Ability to attract funds for research activity:
  - Fund-raising initiative in national and international research;
  - Projects won in national and international competitions;
  - Funds attracted by research projects/contracts, consulting/technical services from national and international competitions.
- The ability of universities to prepare highly qualified human resource for research:
  - University involvement in highly qualified human resource training for research;
  - Effective training of human resource for research;
- Relevance and visibility of research results :
  - Papers published in internationally recognized journals;
  - Papers published in CNCSIS recognized journals;
  - Books published in national CNCSIS recognized publishers and prestigious international publishers.
- The ability of universities to design/develop products, innovative technologies for business.
- Institutional capacity to conduct and support scientific research activities and transfer research results on socio-economic environment.

A dashboard is shown in fig. 3. The dashboards display only two indicators: number of research projects and total value of projects. The dashboard could answer business questions such as: what are the university's research incomes? This question should be answered using different dimensions such as: research project, time, etc. Dynamically, you can change year, you can change project category (for example PNII competition -2007),

you can select a type of project (for example Human Resources T.D.), you can select all years, you can change the display from a bar chart or line chart to a summarized table (fig. 4, fig. 5).

You can select a project category (for example PNII competition-2007) and you can view all project types of this category (for example Human resources-T.D, Partnerships, Ideas-PCE, etc).

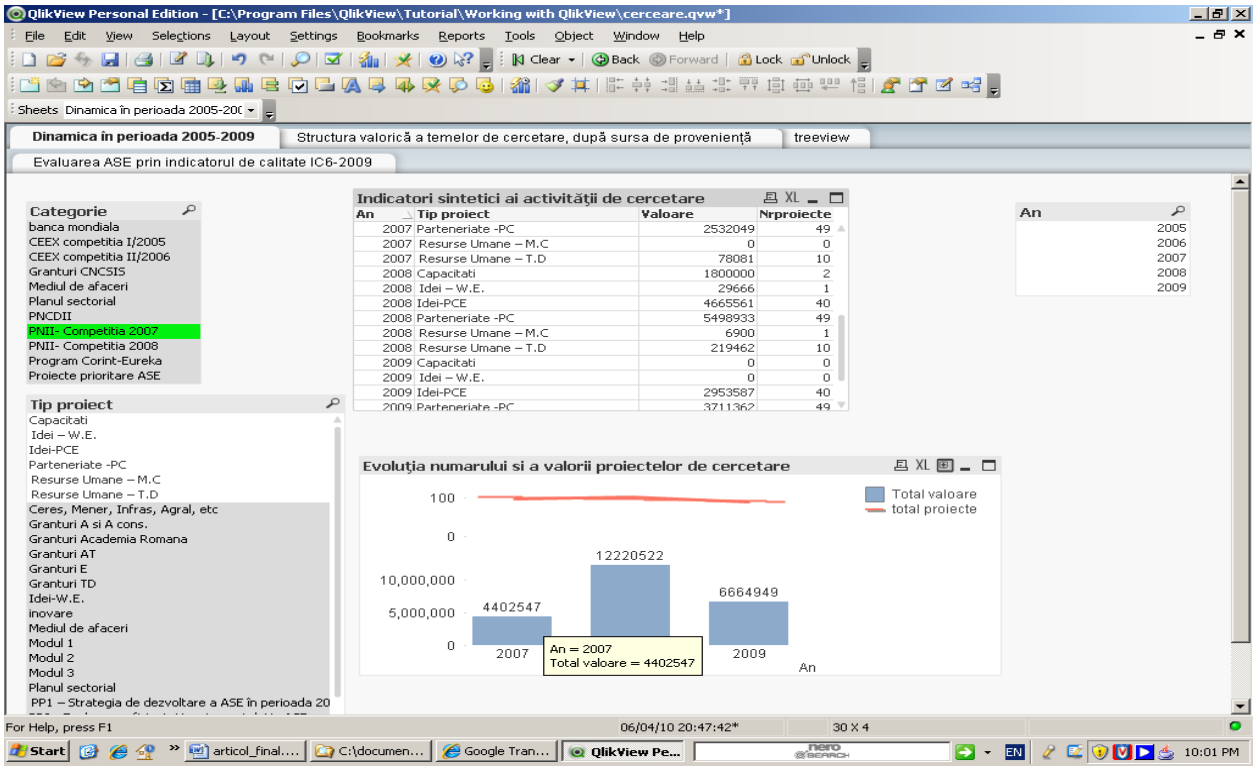

Figure 3. Example 1 of Dashboard

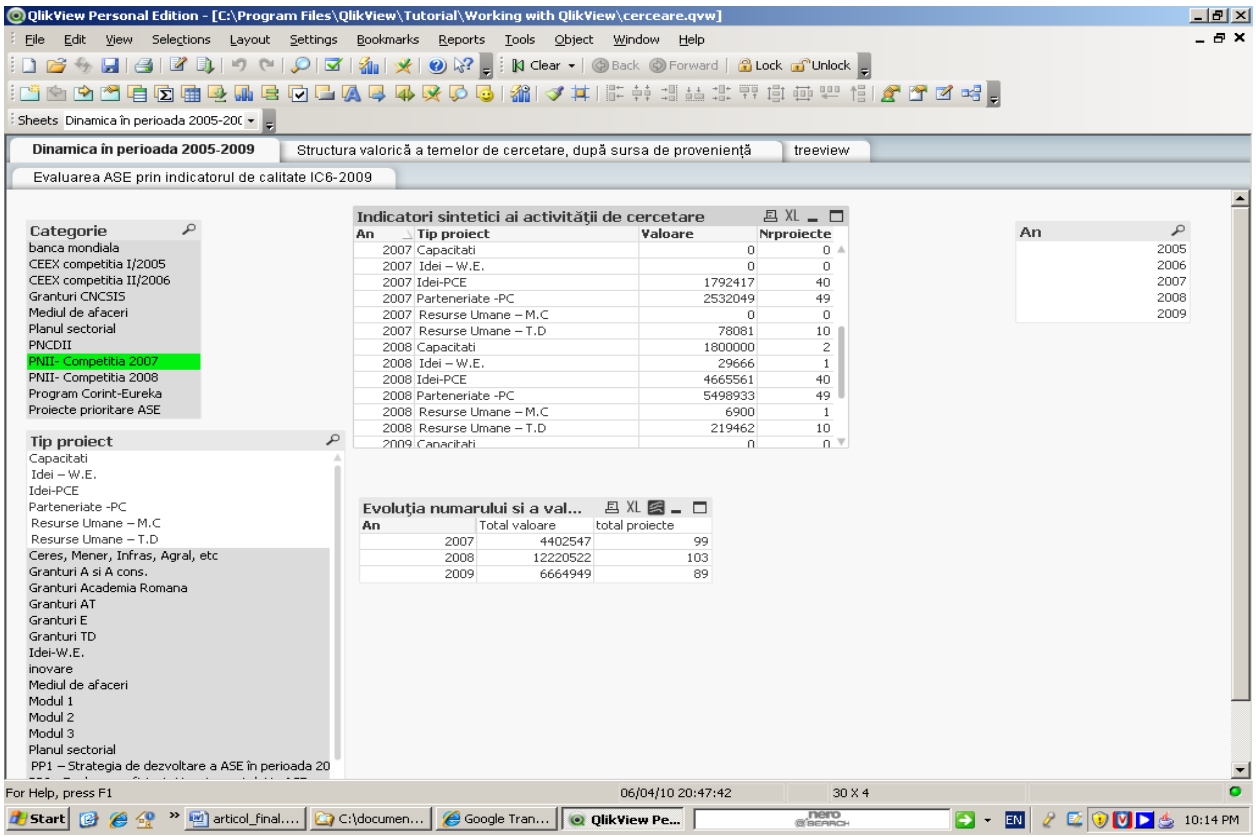

Figure 4. Example 2 of Dashboard

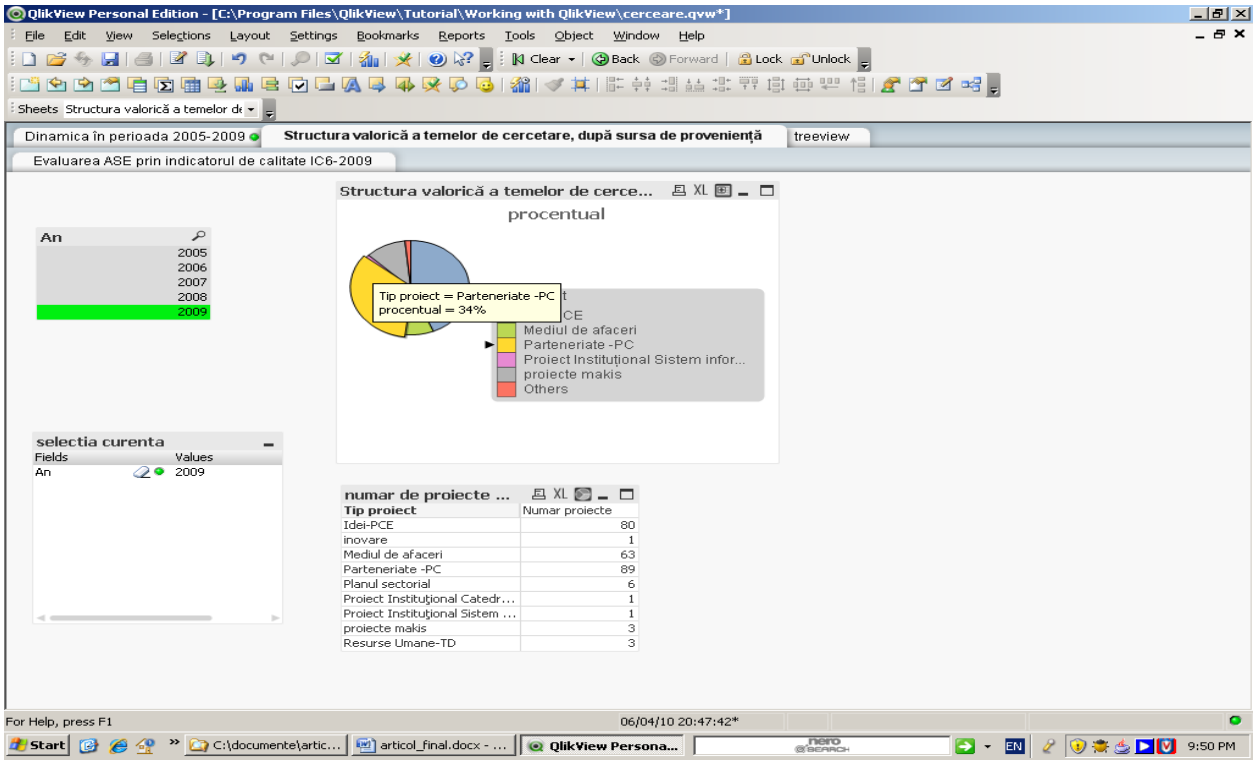

Figure 5. Example 3 of Dashboard

We used a multidimensional data model to evaluate university research activity. The dimensions of model are: Time, Publications, Research Projects and University. There are three hierarchies: Publications (Books, Conference papers, Articles), University (University, Faculty and Department) and Research Projects (Category, Type) (fig. 6).

The measures of the multidimensional data model can be:

- number of academic staff per department and year;
- number of research projects won per project type, department and year;
- number of Ph.D. students per department and year;
- number of Ph.D. holders per department and year;
- number of Ph.D. theses completed per department and year;
- total value of research projects per project type, department and year;
- number of patents awarded per department and year;
- number of publications per publication type, department and year, etc.

We specified the "granularity" (level of detail) for each measure.

The dashboards are developed using a free BI tool-Qlikview. The multidimensional data model is implemented in Oracle database using a constellation schema.

Benefits of using dashboards for research management include:

- visual presentation of performance indicators;
- ability to identify and correct negative trends;
- ability to generate detailed reports showing new trends;
- ability to make more informed decisions based on business intelligence.

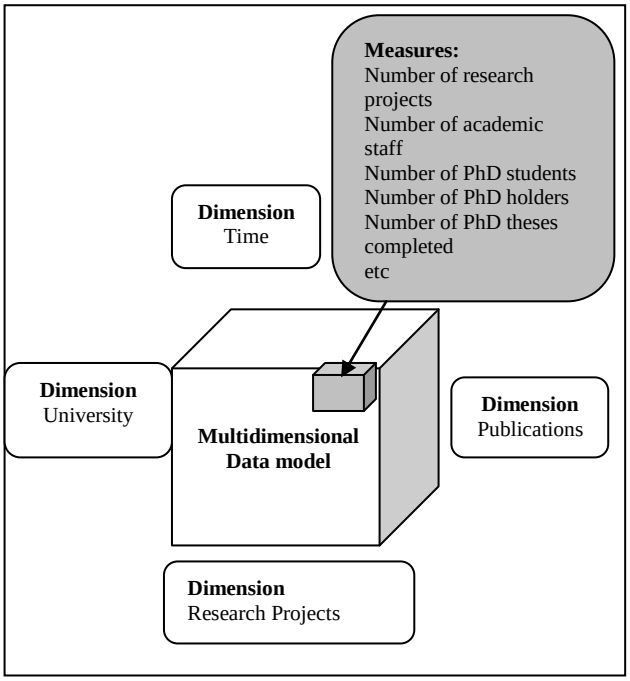

Figure 6. A multidimensional data model for higher education research performance management

CONCLUSION

The main goal of Romanian universities is improvement of quality of educational, scientific and management process to become integrated in European space of universities. For adapting the Romanian universities to European standards, it is necessary that decisions must be determined by quality information, fresh and accessible in real time and also on an analysis of this information. Truly valuable information is often obtained by aggregating data in new ways. Dashboards have been demonstrated to be effective tools for displaying data for decision makers. In the coming years the dashboards will become essential in our universities. But the infrastructure of the data warehouse, security, portal and query system must be in place prior to developing performance dashboards for university management. In the next two years the international research project "SIMUR" will develop and implement an integrated information system for our university. This research project will use the results of the national research project. The integrated information system will allow the development of performance dashboards for university management.

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