

TOWARDS OF AN INFORMATION SERVICE TO EDUCATIONAL LEADERSHIPS: BUSINESS INTELLIGENCE AS ANALYTICAL ENGINE OF SERVICE

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INTRODUCTION

- The use of Information Technologies (IT) in educational sector is diverse. However to the undergraduate education (UE) (pedagogical and administrative areas) the IT tools are inadequate and cannot be used to monitoring the education and school performance.
- Generally these public institutions have some difficulties in performing regularly and mandatory performance evaluation, addressing three governance facets. The Institutional and government assessment program covers three domains:
 - Academic results;
 - Educational service provision;
 - Leadership and management.



INTRODUCTION

- Each domain has several topics and indicators. These indicators are normally manually calculated using datasheets. In order to innovate and improve this process, the Business Intelligence (BI) concepts as a service were introduced.
- In this case, BI has as its main goal helping the schools to make smart decisions and obtain new indicators by using data and information collected from various and heterogeneous data sources provided by several information systems.
- This research project aims to study a new element into the technological ecosystem present in the Portuguese educational system.



INTRODUCTION

- The essence of the IT based service explored in the first phase encompasses the development of an Information system architecture able to:
 - Real-time acquisition and storage of schools information;
 - Online processing of information using BI technology;
 - Provide reports and indicators and search facilities to the stakeholders.
- The work presents the first phase of the process, addressing the design of a pervasive BI architecture to ensure the service value and their sustainability making them universal.

PORTUGUESE EDUCATIONAL SYSTEM



- The educational system in Portugal at a non-superior level has two phases, Basic and Secondary learning. Basic is up to 9 years of study, and secondary from 9 to 12 years of study.
- Basic learning covers three consecutive cycles, starting mainly by six years old until 15 years old. At the secondary level, students can choose between general scientific, humanistic, economic, professional or arts courses, generally between 16 and 18 years old.
- Each domain has several topics and indicators (educational, management and financial) collectively used in education.



BUSINESS INTELLIGENCE

- Business Intelligence (BI) can be understood as a method that aims to help companies make smart decisions through data and information collected by various information systems.
- BI systems use the data available in organizations to provide relevant information for decision making. They combine a set of interrogation tools and exploitation of data with tools that allow the generation of reports, to produce information that can be used by the top management of the organizations, in supporting decision-making process.
- Business Intelligence systems are traditionally associated with the use of Data Warehouses (DW) which are considered as being a data repository, more specifically an integrated repository that allows the storage of information relevant to the decision-making.



PROBLEM

- The developed education software still have limitations that subsists until today. In fact, they are non-integrated administrative applications or, in other words, they lack in terms of interoperability.
- This limitation has implications in terms of support the schools governance since directors and executive boards of schools are interested in relationships among data from these software platforms.
- The dissemination of information services, widely accessible through the World Wide Web is bringing new challenges to the educational institutions and their stakeholders.



PROBLEM

- The research project aims studying a new element into the technological ecosystem present in Portuguese educational system.
- By other hand, it is use the educational institutions perform regularly with performance evaluation that will address three facets:
 - To improve their service level and to increase their efficiency;
 - To report their performance to a governance body;
 - To make available to stakeholders information about their performance.



GOAL

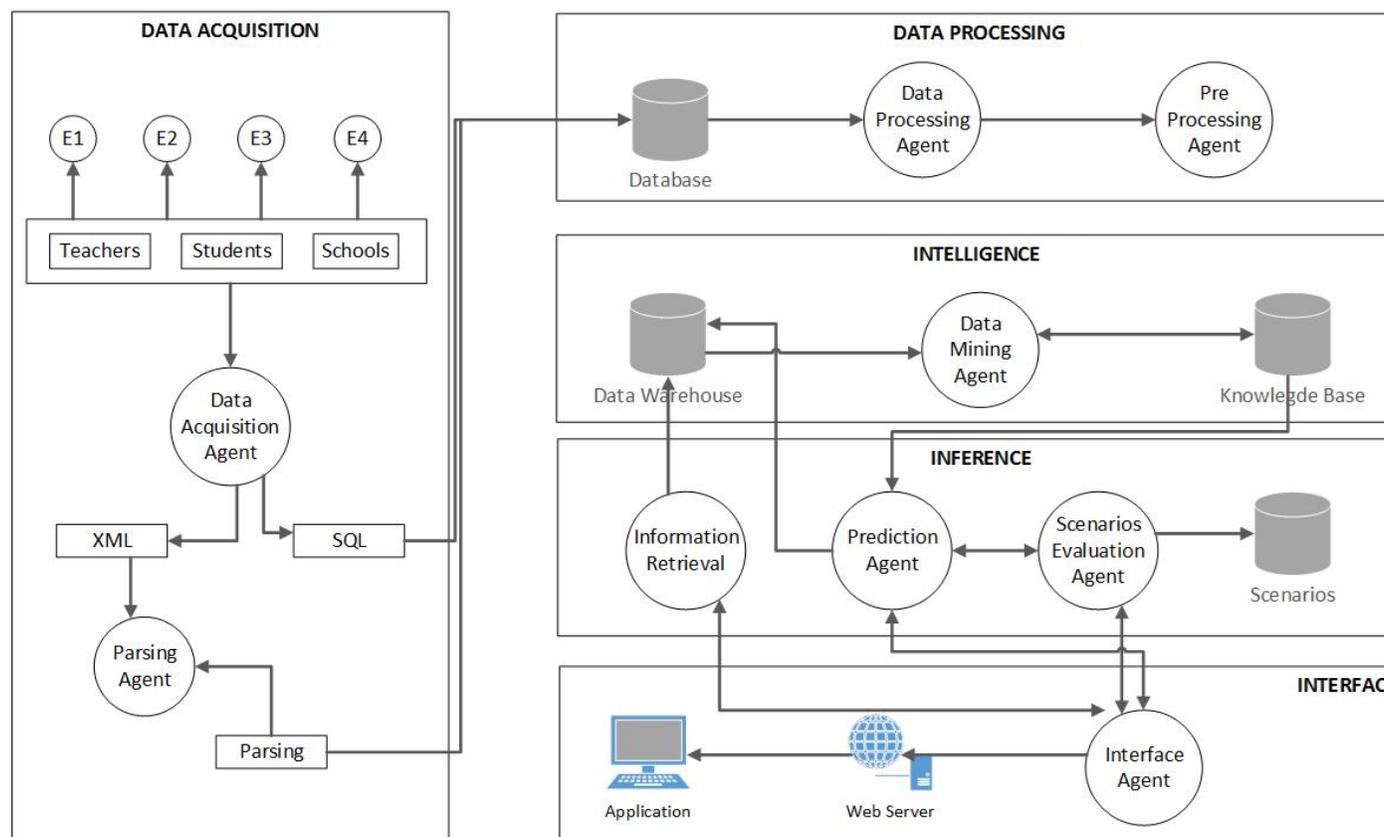
Design the process and the pervasive architecture to answer to the problem

Provide a Business Intelligence solution able to monitoring the schools and student data in real-time.

Helping the schools to make their decisions quick and in real-time



ARCHITECTURE





ARCHITECTURE

- This architecture is composed by several semi-autonomous agents in charge to:
 - automate the data collection;
 - processing and transforming the data;
 - presenting the results in real-time.
- Conceptually, the system can be decomposed in five subsystems:
 - Data Acquisition,
 - Data Processing,
 - Intelligence,
 - Inference,
 - Interface.



ARCHITECTURE

- Data acquisition refers to the reception of the data by the entities. All part of the requirements is framed in this subsystem. After everything relating to processing of data and their validation, are forming part of the processing of the data.
- Below is the construction of forecasting models, the data are entered into the subsystem intelligence.
- Then there is the inference subsystem, which is responsible for the creation of the DW and the obtaining of all necessary data.
- Finally, there is the interface subsystem. This is responsible for the interaction with the user, i.e., this is what sets the user interface.



ARCHITECTURE AGENTS

- This is an agent based system architecture, composed by several semi-autonomous agents in charge for the functionalities inherent to the system. Formally, the system is defined as a tuple:

$$\Xi = \langle \mathbf{C}_{\text{EDUCBI}}, \Delta_{\text{EDUCBI}}, \mathbf{a}_{\text{da}}, \mathbf{a}_{\text{p}}, \mathbf{a}_{\text{dp}}, \mathbf{a}_{\text{pp}}, \mathbf{a}_{\text{dm}}, \mathbf{a}_{\text{ir}}, \mathbf{a}_{\text{pd}}, \mathbf{a}_{\text{sc}}, \mathbf{a}_{\text{int}} \rangle$$

where:

- $\mathbf{C}_{\text{EDUCBI}}$ is the context and corresponds to a logical theory of the Model,
- Δ_{EDUCBI} is the set of bridge rules defining the interaction among the systems' components (the agents) and the BI platform;
- \mathbf{a}_{da} to \mathbf{a}_{int} are the system's agents.



ARCHITECTURE | BI - REQUIREMENTS

Interoperability

- The great goal is to ensure the interoperability of the existing communication in the various types of information.
- This makes available a set of new information in the field of education through the collection of data from multiple data sources.
- To this end it is necessary to follow a set of rules, standards and syntaxes for this to be carried out properly;

Adaptability

- The system has the ability to automatically optimize the models with new data when it is needed.
- This information is obtained from their evaluation results;

Real-Time

- Through the use of intelligent data and data transformation processes in real-time, this system is capable of delivering new knowledge in the moment of it is needed.



ARCHITECTURE | BI - REQUIREMENTS

Decision Models

- The achievement of the best solutions depend heavily on the decision models and scenarios created.
- The decisions that are applied on prediction models can help the schools to choose the better solution on the decision making

Optimization

- The models are optimized over time.

Accuracy

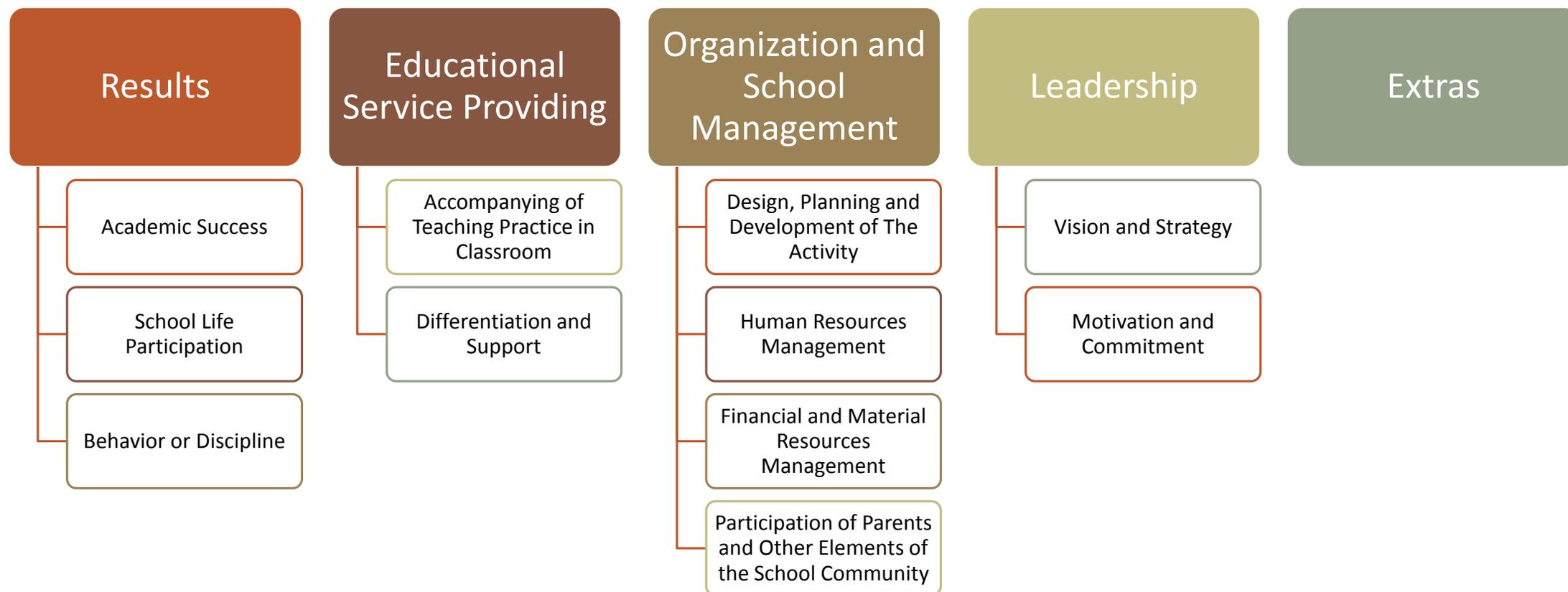
- The data available need to be accurate and reliable;
- The system need to have an autonomous mechanism to a pre-validation of the data.

Safety and Security

- All data should be safely stored in the database. There is a security protocol that makes it can be accessed anywhere by only whom have access privileges.



BI INDICATORS





DISCUSSION AND RESULTS

- As main result it was proposed a universal and innovative architecture able to support a pervasive real-time BI solution able to produce new knowledge by means of Data Mining and data analysis.
- This architecture is divided in five subsystems: Data Acquisition, Data Processing, Intelligence, Inference and Interface.
- The subsystem tasks are performed automatically without human intervention through the use of intelligent agents.
- The architecture developed presents as main features: real-time, interoperability, online-learning, intelligent agents, adaptability, optimization, universality and pervasiveness.



CONCLUSION

- This work proved the viability of developing a universal information service able to receive and process any type of data sources collected from different schools in order to create analytical engine ready to be accessed anywhere and anytime by the UE stakeholders.
- The main gains in using this approach can be summarized as:
 - The data acquisition and the results are made and available in real-time;
 - All the real values are considered - no missing values;
 - The data is displayed in a new way – real-time charts to compare trends;
 - Less errors with the previsions;
 - The results are available anywhere and anytime.



CONCLUSION

- The architecture proposed is able to support an Educational BI solution aiming to help the decision making process through a continuous monitoring task.
- This architecture allows a real-time calculation of the indicators according the most recent schools results, allows a quick and better comprehension of the school and student conditions and can create new knowledge by inducing data mining models.
- Being this solution based in the interoperability and information as a service concepts, this can promotes a new research domain in this education area by combining Information System and Education.



FUTURE WORK

- Future work include:
 - Improve the Data Warehouse model;
 - Introduce the school indicators;
 - Conclude the development of the Business Intelligent Platform;
 - Implement this solution in one group of schools already interested in the process;
 - Deploy the developed solution in multiple Portuguese's schools;
 - Expand this concept to other countries with similar education concerns.



ACKNOWLEDGEMENTS

This work is supported by FEDER through Operational Program for Competitiveness Factors – COMPETE and by national funds through FCT – Fundação para a Ciência e Tecnologia in the scope of the project: FCOMP-01-0124-FEDER-022674.

PROJETO ESTRATÉGICO DO CENTRO ALGORIMI - Ref.: FCOMP-01-0124-FEDER-022674



THANK YOU!

QUESTIONS?

PLEASE SEND THE QUESTIONS TO
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