

# Conceptual Model for Decision Support System Based Business Intelligence OLAP Tool for Universities in Context of E-Learning

Adeel Javed , Maqbool Uddin Shaikh , Baber Majid Bhatti

*Abstract*—By the virtue of E-learning, students with different profiles, academic backgrounds, and professional experiences and from diverse geographic locations can enroll in various academic programs and professional courses. In order to be able to ascertain the efficacy of a course, learning from past experiences, adapting to the market demands, finding out the best-time-to-offer and need of a course, the university must be equipped with a Business Intelligence tool, capable of OLAP based data warehouse and data mining (trends analysis and forecasting) capability. Before a course is offered, the university must analyze the job market versus interests, performances and trends of the students. After taking such measures, the university will be able to offer the appropriate course for students, at the right time. This is precisely inline with the practice currently being adopted by the competitive market, in which the companies analyze and foresee the right product for the market. Similarly, after having the Business Intelligence tool, the university will be able to better shape-up the product, i.e., courses as well as students. The tool will be helpful in mining different trends, which may include that of students prone to plagiarism or that of intelligent students needing grooming in certain areas in order to perform better. Also weak areas where faculty needs to concentrate more. This paper proposes such a business intelligence tool, justifies its usefulness and identifies major source systems. It also talks about how the university will become proactive, based on the prevailing trends while being able to forecast the prospective career for the students.

*Index Terms*—Business Intelligence, Business process management, Data mining, OLAP, Personal work area (PWA).

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## 1. INTRODUCTION

“Nowadays, information overload hinders the discovery of business intelligence on the World Wide Web. Existing business intelligence tools suffer from a lack of analysis and visualization capabilities and traditional result list display by search engines often overwhelms business analysts with irrelevant information” [1].

Business means to gain and to progress in any field so when we talk about universities the same concept applies there. The better selling of their product will result in a successful business. Further more if the university is making its business in E-learning then it is more critical to make the marketing strategy for the offering of its product like courses, students, faculty and resources [2].

This paper clarifies the theoretical framework for the business tool to foresee the trends vs. interest analysis, cost vs. benefit analysis and supply vs. chain analysis in the field of E-learning based OLAP based data warehouse and data mining concepts.

Further more the identification of the major source systems will help universities a lot in designing policies, curriculum and schedules for the optimal output in selling their courses in E-learning.

The objective which is targeted in this paper is related with policies, matters regarding courses and student intake as well as assuring better career. This all depends upon our new idea of business intelligent tool which decides about course, duration, price, suitable time, geographic location, course needs and its target market and how to approach them. With the help of this BI tool the university will certainly be able to increase its business at a tremendous rate along with better output and prospective careers of its students. With this BI tool universities with E-learning will achieve its goal of the appropriate courses for students at the right time.

## 2. RELATED WORK

The typical applications of OLAP are in business reporting for sales, marketing, management reporting, business process management (BPM), budgeting and

forecasting, financial reporting and similar areas.

Such a BI tool capable of OLAP based Data Warehouse and Data mining capability is being used in some of the industry in sales, BPM and financial institutes but in universities of the developing world this is a new concept.

In industry such a tool can help in analyzing the trends in the market like the graphs of regional sales along with the weak points and their reasons. Also the competitive edge of the competitors has and in which sense our firm is lacking behind. This tool uses source systems to determine business logic and different trends that were prevailing in the past and which could be in the future.

In universities of the developing world some sort of information for decision making is organized manually but there is no proper automated BI tool which can be used for the future analysis. When there is time to offer a course a major issue is how to approach the potential right customer, that comes with niche marketing and even more with personalized marketing by using various sources and that is where a major part on which BI tool works depend upon source systems.

### 3. CURRENT METHODOLOGIES IN E-LEARNING IN UNIVERSITIES

#### 3.1 Courses

Virtually the university is providing knowledge beyond the boundaries any where in the world by E-learning. When any course is offered it has certain pre defined policies which is the same for every course regardless of its importance, need, suitable time, price and target market.

The problem is that if a course in demand is being offered, it is offered at the same price at which the most unwanted course is being offered. Also the price in villages and the price in industrial areas are the same; the time is not evaluated for undergraduate and graduate students. Also the job market is never analyzed and a future analysis is never done. All these factors result in degrading the worth of expensive courses along with lowering the repute of the University. By these policy drawbacks universities are not making business according to their potential.

#### 3.2 Target Market

Universities usually target their target market by newspapers, websites, brochures, agents and sometimes by TV networks. Same is what University offering E-learning is adopting to approach target market. But they have never analyzed the performance of their students and the ultimate results of their offered courses in term of jobs hunted by alumni.

The problem is that every course is not for every student, they must be offered courses in accordance to their capabilities and the record of such individual's

information and future behavior of individual can be analyzed by the proposed solution. This personalized marketing will surely increase the output level. This tool will co-relate the characteristics of that student and analyze that these sorts of students have usually that particular behavior in some particular time period of course. This will help the University for taking proactive steps for successfully carrying out E-learning programs. Currently there is no database about the performance of past students in the market which can help in eradicating the drawbacks and weaknesses among courses and faculty. But in some universities of developing countries there is a manual system in the form of job placement cell which helps students to get jobs on the basis of their performances but this does not provide an accurate measure of authenticity of courses, resources and mechanisms of the university.

#### 3.3 Faculty and resources

Faculty, labs, recorded lectures, material and books are very precious resources for University in order to provide E-learning for distant students. What the university currently adopting is, is the use of all these resources according to its availability.

The problem is that they are not co-relating these resources with the selection of course, policy matters, conditions in the market and performance of alumni. They need to look at the aspects of how many students have got the job and on what basis and what are the reasons for not getting a job because that might be due to the inefficient courses offered, teaching mechanisms, curriculum and so on.

Our proposed BI Tool will draw trend lines based on all the past experiences and current analysis to examine the reasons for drawbacks and suggest the solutions that could be like Faculty development programs.

### 4. PROPOSED BI TOOL BASED UPON OLAP

“Over the past few years, many universities worldwide have begun delivering some of their courses on-line and new ones have emerged that offer only Internet-based courses. Many policy makers and managers question whether on-line learning is cost effective and wonder whether it is a direction they should pursue” [5].

This paper proposes such a business intelligence tool, justifies its usefulness and identifies major source systems. It also talks about how the university will become proactive, based on the prevailing trends along with career forecast for students.

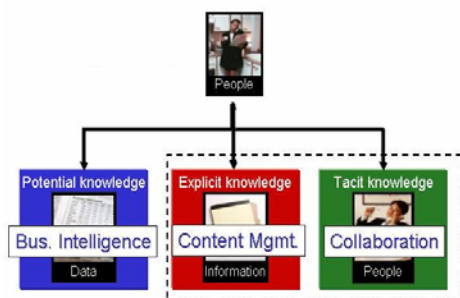


Figure 1: Knowledge distribution

#### 4.1 Source Systems

There are following important decision making dimensions which would play a vital role in enabling our proposed solution to work and the source systems involved are highlighted which would generate the necessary information.

BI may facilitate the connections in the new-form organization, bringing real-time information to centralized repositories and support analytics that can be exploited at every horizontal and vertical level within and outside the firm [3,4]. BI tool do all this with the help of knowledge distribution structure as in figure 1.[6]

##### 4.1.1 Market Demand Analysis

To offer a course, market demand analysis is necessary which can be done by having a database of online jobsites by setting up some office or job placement cells in the university to keep a record of all the jobs and their job descriptions. The University must also have an alumni office to keep records of alumni data to keep in touch with market trends. Another source system could be collaboration system with local industry for which university Public Relation (PR) department and job placement cell play a vital role, this will help in analyzing the exact percentage match between what is being taught and what are the Job Descriptions (JDs) of jobs in the market are. So (i) jobsites, (ii) alumni offices and (iii) collaborations could be important source systems which will help the university to match their supply with market demand and to reorder their courses according to current and future demands in the market.

##### 4.1.2 Situation of current students

For improvement of students and polishing them for the competition they will face in a market, one of the important source systems could be the university's student database which will take input from individual performances in each course, evaluation by each instructor, past performances, performances in the past universities or institutes, behavior, aptitude, interests,

financial background, psychological attitudes (after conducting psychological tests to judge individual characteristics), vulnerabilities in the student's personality and much more. By the help of this source system our BI tool will help us to accurately forecast the future behavior of individuals and enable university administration to take proactive steps to make use of individual capabilities in a positive sense for the betterment of the student's career and repute of the university.

##### 4.1.3 Capability, availability and activities of Faculty

A Capable faculty is an important asset of a university so a faculty database is a very important source system which will take input from evaluations, seminars, records, publications, achievements, trainings attended and much more. This source system will help our tool to better foresee the feasible plan in accordance with the trend line drawn through all these factors involved in this source system.

Another source system regarding availability of faculty could be faculty schedule plan, because a qualified faculty at the right time can increase the output in a remarkable manner.

E-learning is such a wide concept where there are no limitations and restrictions involved so the personal planning of faculty members could be another important source system which will be playing a vital role in achieving objectives of BI tool.

##### 4.1.4 Prospective student's forecast

This business intelligence tool will also help university authorities about the prospective student's forecast for their smooth execution of E-learning program. The need of course, time, price and duration matters a lot in the intake of potential students. The important source system involved here could be registration databases of the university and other colleges and universities, university need here a small office setup to collaborate with departments of other universities to get email addresses, mobile numbers to contact personally about the newly made offers. After the student has enrolled from diverse geographic locations, there is the need to forecast about the student according to source systems defined in section 4.1.2 in order to maintain every students profile and treat with special strategy. Proposed system will use all these source systems and can answer all adhoc and routine queries in order to magnify the data mining effect for future forecasting.

##### 4.1.5 Pricing of a course

Pricing each course on a single rate is not a good deal, some courses are very hot in demand so they must be charged more than those which are of less

demand. The pricing further more depends upon the geographic areas like same courses in the metropolitan cities should cost more than those in small cities or a village. Also pricing should depend upon timing, if courses are offered at some special time of a year it must have more prices than from routine. So the source systems involved for designing pricing schemes could be jobsites, online journals, websites of universities and this information can be obtained from (i) Remuneration offered in the market (ii) Demand against specific job opportunities and domain (iii) availability of courses in the competitive market with their ranking and pricing. For this it is necessary to be in touch with the competitive market as well to exactly look where we stand and where our offers cost us. The BI Tool uses these source systems for analysis and answers all queries for better planning.

#### 4.1.6 Duration and pre-requisites of a course

By the virtue of E-learning it is now very easy to spread education beyond boundaries, but an important question is that should everyone be treated the same, the BI tool will answer NO. The reason is that if a person has qualified a certain test and has already studied some of the courses then the student must be given exemption in some courses or it can be said that duration for that student should reduce. Also while designing course pre-requisites should be decided in some suitable way which would not burden students as well as the university. Another scenario could be that highly in demand short courses need only certification of just 2 or 3 weeks of training for professionals, then offering that course for a long duration will not have any positive effect, rather it will reduce its worth like Project Management (PM) short courses are of just 2 weeks and if E-learning mechanisms treat this course like other short courses then courses along with the university will lose reputation and business as well. For this source systems there can be websites of both academic institutes and industrial websites as well. A regular database should also be maintained. All this will enable proposed BI tool to answer queries in large run future forecasting and better planning.

#### 4.1.7 Time to offer a course

Another very critical issue while designing E-learning courses is the time on which a course should be offered. Like offering financial audit courses a few months before the closing of the financial year will result in tremendous raising of the graph and short courses for undergraduate students should be offered few months before the undergraduate admission starts. The source system which will keep record of this sort of information is admission cell and academic councils. The key point is that the OLAP based tool will use database of admission cell and automatically highlight the time period to offer a particular course.

## 5. JUSTIFICATION

The tool will be helpful in mining different trends, which may include that of students prone to plagiarism or that of intelligent students needing grooming in certain areas in order to perform better or that of weak areas where faculty needs to concentrate more. The justification is the better result which would raise the profit level and repute along with the student better career.

### 5.1 Planning Courses

In order to offer the course the identified source systems and proposed BI Tool capable of OLAP based data warehouse and data mining capability will enable officers to decide when, how, which, to whom and at which price to offer the course e.g. offering MBA at the same rate on which MA-Urdu is being offered would not be justified to the resources of the university and this course must be charged more than other masters courses. Also courses for overseas students should cost more than for local students.

Duration of courses is another important issue e.g. 4 years Bachelors in Computer Science (BSCS) programs are being offered throughout the country in all universities but in some universities its duration is 3 years which will result in disqualifying from recommendation of Higher Education Commission (HEC), which will result in reducing the worth of university and students as well. Also short courses must be offered in accordance with the duration prevailing market e.g. certification of SAP professional is about 2 to 3 weeks with heavy price but if this course is offered for the duration of 6 months, it will create negative impact on the course design and standards being followed.

Offering courses at the right time not only reduces the cost but also increases profitability. Offering full-fledged graduation programs just in autumn when students gets their HSSC(Higher Secondary School Certificate) or A Level exams will be more beneficial than at any other time of year because the number of enrollments counts a lot in the successful offering of a program.

### 5.2 Planning Students

Targeting the right persons is a very important aspect which the proposed tool will help a lot in. Targeting the right person like customized advertisements on the websites, or in the PWA (personal work area) of email accounts depending upon the interests filled by account holder in their profiles, emails and phone calls to cell numbers of potential customers will increase the productivity and profitability along with the accurate targeted market. This could be also done by giving seminars in other

universities but the BI Tool will suggest patterns of seminars because seminar information is not fully automated.

### 5.3 Planning Faculty

Planning about faculty is as planning about the core resource of any organization. Faculty may be visiting, on contract and permanent. So they need to be evaluated regularly by students and special evaluation teams. The purpose of doing this is to improve the faculty in their weak areas and to improve their skills according to today's environment e.g. as E-learning is not very highly interactive, we need very skilled faculty and much trained people to answer all those potential questions which could arise in one's mind. The other important example is that from scheduling point of view the tool will provide the schedule of faculty for the busy and free timing to adjust the university requirements.

The proposed solution will gather all the information from identified source systems and generate all the graphs and trends for forecasting as shown in the graph below. The generated graphs will then show that BI tool has highlighted trends and weaknesses for development; it will work like as the proposed graph in figure 2.

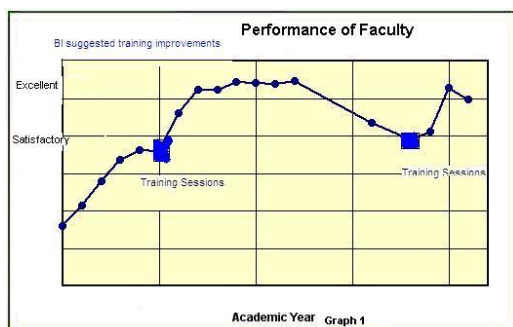


Figure 2: Proposed Performance graph

### 6. CONCLUSION AND FUTURE WORK

Given the complexity of the data warehousing system and the cross-departmental implications of the project, it is easy to see why the proper selection of business intelligence tools and personnel is very important [7]. The business intelligence tool which is capable of OLAP based data warehouse and data mining capabilities will

result in the automated and accurate answer of adhoc and routine queries towards the policy making attributes. Also if the source systems are more efficient and robust, better is the forecasting and trend analysis. The proposed tool will help in analyzing the market and will suggest a better approach towards offering courses, targeting students and enhancing the skills of faculty in the process of E-learning.

Further more, in future, more areas can be included like planning about hardware including construction of buildings, laboratories, research centers and planning strategies adopted by the BI tool about courses, students and faculty will be refined.

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