

# Study on Web Intelligence in Higher Education: A Review on Business Intelligence Techniques, Frameworks and Usage

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**Abstract:** *Web Intelligent Systems usage in higher education is growing from the last few years. As an investment proof in this scheme of research, there has been vast amount of articles, papers and dissertations. The paper discusses benefits, frameworks, different proposals. To overcome all the disadvantages from normalized database systems. WIS- web intelligent system is proposed. This evaluates vast amount of data having much incoherence's, much time which is analysed. The ability of combining large amounts of data and getting students insight for whole of the lifecycle study will lead to an decision making process which is improved which supports strategic aims consequently. The research follows approaches case studies, approaches using qualitative, content analysis. Literature survey of business intelligence shows that it has positive impact on the process of decision making and it supports many areas of operation in educational institution. Empirical researches give the conclusion of positive perception of managers toward business implementation which is possible and which gives benefits that we gain from it.*

**Keywords:** *Web Intelligence; Higher education; Business Intelligence; Key Performance Indicator; Frameworks.*

## I. INTRODUCTION

Many Organizations which are successful would be using their data for getting insights about their operations and also internal and external services in the environment.

BI is a tool which we use for analyzing and visualizing the information which is derived and data knowledge for supporting companies for performance improvement and relationship management of customers. BI can be applied effectively for higher education Institutions. They have to follow the trend which is for using the information which is powerful. In the aim of getting data analysis of students in a better way and also demands of market. More specifically to understand students' academic behavior through BI, preferences, retention, graduation rates and insights on student's

demographics information, all these information would contribute for the decision making process improvement.

The constant changes in the environment of business will make the operations of organization as more complex thus managers faces problems of understanding business process which are comprehensive. Information and knowledge are the critical components of success. The organization valuable asset is the data. We should know what is happening in the internal and external environments and should set the stage for the accomplishment of strategic objectives. But the huge volume data which is increasing will make the understanding and analysis much complex and the solution which is cost effective to deal with. So it's good to employ a system of business intelligence. The great benefits of BI are the effect it has on the process of decision making. It gives the capacity for better decision making in real time and data of quality which is visualized and presented in a manner which is comprehensive. The improvement in data analysis will lead to the enhancing decision making process and institution of education is following the trends of BI and adopting the BI as a way for managing the students and academics related data effectively.

BI has many advantages but it has to overcome all issues which are related to the implementation greater than 50% of BI projects is failing to satisfy the stakeholder's expectation. The main factors which determine that the implementation of BI which will succeed or not are support of organization is Organization process, technology. The organizations ability for adjusting to a new analysis method of data should be accepted by people and its contributors to the strategy of business. More organization types should be studied for defining the success factors which are universal which are related to BI that research will study how we can use BI in education industry and how the phase of implementing will lead to the success factors and also the benefits that an educational institution will get above the forecasting and the process of decision making. The aim is to study the practice of BI and its applications in the institutes of education for understanding how it effects the process of decision making.

Decision making is the major issues in each organization for meeting the targets of performance indicator of business and for improving the processes of business. Generally, Organization's top management has limited the data accessibility of organization most of the time, data will be locked and is not fully accessible for the management. Data accessibility lacking will cause the top management for making decisions with little reference or none to data which is appropriate.

BI is a process of monitoring, analyzing the data which is to be transformed to knowledge and information for activity of decision making and for achieving level of business organization. BI can be simply defined as discovery of information and analysis to make it available for decision making people at most organization levels for easier accessing and understanding with that. BI will be able for providing information which is accurate with tools which are appropriate for analysis of data.

BI system is a major solution in many organizations for decision making from last few decades as that will handle vast amounts of raw data for more accessing useful, clear, visualizing the information which is valuable by making use of tool which is appropriate. BI also allows users for digging and for extracting the information which is valuable for decision making which is effective. Thus, BI is an ICT tool which allows users for leveraging the good use of its data used for aggregating and summarizing the information. BI also supports operational and strategic decision making and the assessment of rule in a business environment which is dynamic.

BI involves the main task which involves the activities and processes for analyzing, refining and managing vast amount of information which is related to business environment and for providing the decision making the easier access for processing information. BI facilitates the vision which is strategic by analyzing the rates of graduate's employability. Analyze strategic planning and education quality comparative results b+ across various units are within university and also across universities. BI also provides HEI's good prospect by giving only the information which is possible which is related to the university performance that top management of university can use.

## II. LITERATURE SURVEY

Miskon et al [28] proposed an approach which is of method of four stages for identifying and extracting the articles which are related, coding and to analyze and reporting the findings which is literature based. The method of first stage is to identify and extract.

There were many BI frameworks proposed BI framework for university [1]. This paper gives a component and a framework which is dedicated for the management of university as a guide for implementing the solution of BI in the institution of thesis.

Ladder of business intelligence [17] here, they have proposed framework of LOBI. It is one type of framework which focus by the analysis of people in

detail, technology and process. It focuses on core business process analyzing which has the high impact on performance of business. LOBI framework gives the plan and architecture which is on the basis of objective of business.

BI derives data mining[3] proposed business intelligence data mining which is a framework of four layers which involves layer of knowledge, layer of E-service, layer of method and layer of data which is constructed by the approach process which is top down. This is a combination of data mining which is method driven and data mining which is method driven for filling for the gap knowledge of BI in various method of Data mining and E-Commerce.

Software as a service (SAAS) BI framework [4] is, a unified framework of five layer with every components which are provided as service. This also delivers BI's data integration of multiple source and analytics of data as a solution which is comprehensive for meeting the organization needs.

Framework of BI [20] which is a framework of three layer which is a basic structure which separate logic, data for accessing the component development in interaction which is tight both from application side and from supplier.

There were eight components which are identified as follows which has people, process, key business process, BI technologies, information infrastructure, university strategy, key performance indicator, university value and mission. An HEI organization requires a framework that defines each component for delivering the strategic plan and vision by implementing in the organizations [1].

University mission and vision is the main description of desired outcomes of university and future direction of university. It is a component which is complementary and purposes which are core by giving direction of university for orientation which is long term. According to Cates et al [2] the concept of LOBI framework agree that will apply business mission and vision as the main component for the direction of company for the years which are upcoming. University strategy is a university pan which is detailed to achieve goal and also success in any situation stage.

University Performance model will make use of indicator of key performance as a metric for evaluating the factors that will be needed by the university process is the series of activities which are related which are designed for gathering the input and converting to a result which is desired.

BI technologies is the another component of this framework. This component of framework which is preferred dashboard will be one of the tool of visualization which is for display and to deliver the business intelligence which is core dashboard will visualize a dataset which is multidimensional from the linked chat combination.

The BI technologies capacities for accessing in a performance view which is holistic will give advantage and benefit for developing the requirement of reports [9]. Business service layer in a SAAS component of framework of BI and service of reporting is a business service layer sub component. Reporting service would be dealing with technology of visualization as well as to provide a report of web-based with given tools and of reporting.

Educational institution would be operating in a environment which is high competitive where external factor changes will be having the inspect which is significant on the performance of organization. The larger volume of data will continue for increasing with the time and also need to know the data of yours will be a future significant one. BI applications vary based on the department of admission, academic, management and marketing [10]. The analysis which concerns data will be relating to the retention, admission, students' performance is known as academic analytics [11].

The application examples which are included in area are admission for application rate improvement, special tutoring area, student admission, faculty evaluation, curriculum improvement, helping students for preparing the plans of study, to help students analyzing the carrier option and academic options to decide where to open the further universities which courses people will be able to study at its best in an environment of e-learning, Recommendations of learning.

Based on the academic data analysis, institutes of education could have an insight view which is on students by students' academic performance analysis and performance. Here by improving the outcomes of academic rate of retention and rate of satisfaction. In addition, System of course management would also emerged and it gives information to professors on performance of each student individually in each and every courses of academic which would lead to the strength and weakness identification. Based on all the information institutions could develop programs of tutorial in order to support the students for improving and contributing for academic performance rate enhancement of the institution [12] [13].

Additionally, Professor could use tools of BI like data mining in order to decide the students in a group of performance so can identify each and every characteristics and to adjust the process of learning which depends on that [13]

The management system of student's relationship could facilitate the applications and also provides the attention which is personalized for every student by developing a contact with those related to the performance of academic. The system could notify the professors, students when some criteria is met like the classes absences of exam results that leads to the student's failure [14]. Further in the e-learning programs era offer by institute of education, professors will have reports which are summarized related to the online behavior of students. Through the BI use, professors

would have the information which is analyzed about academic performance of students' progress and also measuring the efficiency of course online structures.

By monitoring online the student's behavior would allow all professors for taking actions for preventing students who are at fail level of risk and would also making decisions which would lead to the overall performance [15]

The data of academic could provide view on which programs are preferred by students the demands of market what type of courses they will choose when they had options whether to introduce a course which is new or a new program for meeting the demand of market which type of course they will choose when they had options whether to introduce a course which is new or a new program for meeting the demands of market which type of changes should be applied on path of academics whether to drop or add courses and whether is it efficient or possible for offering a course or program online [16].

Admission is one of the main department of institute of education as this is the intermediate between the new students and educational institution. Through BI, managers would identify and also evaluate many indicators of key performance, cost of acquisition, numbers, and performance of academics, lifetime value, retention rate, and web metrics and for adjusting the operations on the basis of findings.

Lifetime value of students will determine the educational institution value would be gained through the student's entire relationship from the application or registration of students for their graduation. Combining all the members by getting with various dimensions could be useful for making predictions and therefore enabling the information which is more accurate for the process of decision making [17].

Acquisition cost of students will decide the money amount an institution of education would spend for acquiring a student. This information is helpful for educational institution for making the resource forecasting that it could need while getting new students like advertising and agents costs. Through the acquisition cost of student, department of admission could make the decisions to acquire students which would offer a value of higher level for institutes of education during the students lifecycle than the cost of theirs. In addition with this, students can get prevent from the cost of high and facilitating ways which are efficient for acquiring students in various circumstances. That information could get tracked from evaluation of agent partners cost on terms of students number, students' academic performance, students payments that they bring to the institute of education and programs they mainly promoted and popular programs for students.

The academic performance of students would give information about GPA of students per country and per program and also making comparisons with the average GPA of educational institution which is on the basis of objectives which are strategic and for investing the efforts

of admission on students those will help to achieve the aim.

Student's retention refers to students who will enroll for two semesters at least. This query could measure the educational institution ability for retaining those students' characteristics which would drop put on order to adjust the resources and offering support to students for convincing them for retaining until students graduation.

Furthermore, through retention of student's admission will identify the enrolled students those students who get into an educational institution but leave out before they get graduated and students transfer; those who will leave the institute of education for transferring to another [18].

Enrollment management refers to the educational institution of department of admission ability for admitting, identifying and retaining the students which are established. These are models of predictions for identifying the potential students characteristics, which are historical data based thus can know from where we can expect students and what would they demand probably. These models would be beneficial for the budgets as the office of admission would know where to effectively spend the money.

Further, work of admission in a close way with the department of market in order to recruit new students. Admissions will generate students characteristics from BI tools and marketing tools could operate on the basis of guidelines which is got from admissions.

Metrics of web will be referring to the marketing efficiency which is online. That is the social media, website, search engine, ads of Google and many other forms of online advertisement. Based on all these metrics institutes of education could have the data on how marketing of online will attract the students and can compare with other means of performance expenses through the web.

Data analysis for concluding the web metrics value will lead an institute of education for making decisions that are useful for it such as new market expansion.

WI in higher education [19] paper suggests a process which creates WI system that is useful in higher education. WI solutions which are being implemented in many areas are Open Mind is a open source tool which will transform the data that is from different level of sources in the web which will be data of relevant for process of decision making. WebMind is a tool for searching data within the web. That tool will be executing the process that will be similar for ETL process for enabling the data to get process in many tools for analyzing. Verint WI platform are the tools which will be collecting the data from various sources like news, blogs, reports, websites. Deep web and other for discovering relationship between those Hiwire systems these kinds of construction systems facilitates the varied set of implementation.

Web mining is the automatic crawling and relevant information extraction which is from the activities,

artifacts and patterns which are hidden that is found in WI users. There are three main categories like web content mining, web structure mining, web usage mining.

Web usage mining is of four main steps like data collection where relevant data of users will be collected from different sources. Data collection is where treating of inconsistencies according to their nature is done. Pattern discovery where finding patterns from different application techniques of DM, Machine learning and others is done. Pattern analysis is the process of finding the knowledge from the initially discovered patterns. Patterns which are irrelevant are eliminated.

In the study the data will get generate from the application usage "IoEduc" which is of 153 or more number of students was undergone treating and analysis. The database of data is in the format of MYSQL and that is called as "webitclo\_main" The database user table consists of assessment login, user login uc presence studentspwumtable-information about the student etc. As a methodology, design science research [DSR] is used that consists of creating activity set, designing, developing and deploying the data warehousing.

The process developed consists of three stages like data source, data preparation and data visualization. In data source receiving the data from "IoEduc" application, Data preparation where information gets prepared for analyzing. In the last step we can get the total number of users who accessed the application and number of the students who are distinct, number of vision, full time or part time students and retention rates which are displayed in the form of graphs.

### III. CONCLUSION

Universities are seeking constantly the managerial and technical approaches for better use of information and data to be available studentspwumtable-information about the student; because of the data amount which is increased is being collected and is distributed from source of external and internal. Emerging ICT advancements have been enabled most universities for developing means which are innovative for collecting the data which might not possible before. Sometimes, this will lead to the data exploration and challenges which are unprecedented in the making of effective and strategic use of the data which is available. Furthermore, a framework of BI will also facilitate the University for structuring the process to improve the solution and helping to implement the BI strategy of university in a more cost effective way. Eventually, Projects of BI would be most successful, less of cost and delivers high value to the BI users of university. Hence, that BI framework which is initial could be used as a guideline as that will give good definition for vision which is strategic in environment of HEI's. Furthermore, the BI framework explained in initial would be able being four main drivers of business like plane, process, people, performance which are able to help the management of university that deploy solution of BI.



Sl no	Paper	Methods Discussed
1	Usage of Business Intelligence techniques in Education[19]	Discusses about WI mining, web usage mining stages, student retention, student success, framework , web intelligent system using application IoEduc
2	Ladder of business intelligence [17]	LOBI - one type of framework which focus the analysis of people in detail, technology and process, high impact on performance of business
3	BI derives data mining[3]	A framework of four layers which involves layer of knowledge, layer of E-service, layer of method and layer of data, useful in of Data mining and E-Commerce
4	Software as a service (SAAS) BI framework [4]	Delivers a method of BI's data integration of multiple source and analytics of data as a solution which is comprehensive for meeting the organization needs
5	Framework of BI [20]	A framework of three layer which is a basic structure which separate logic, data for accessing the component development in interaction which is tight both from application side and from supplier
6	WI in higher education [19]	Discusses various tools like Open Mind, Web Mind, paper suggests a process which create WI system that is useful in higher education and discusses different techniques
7	How to define retention: A New Look at an Old Problem[18]	Discusses about student's retention of student's admission will identify the enrolled students those students who leave out before they get graduated and students transfer
8	Customer Lifetime Value (CLV) Defined[17]	Discusses about Lifetime value of students which will determine the educational institution value would be gained through the student's entire relationship from the application or registration of students for their graduation
9	Using Business Intelligence to Change Student Lives[16]	Discusses about The data of academic that could provide view on which programs are preferred by students the demands of market what type of courses they will choose when they had options
10	Business intelligence in e-learning [15]	Case study on the Iran university of science and technology dataset- discusses online monitoring of the student's behavior and a plan to increase performance of students
11	Business intelligence in higher education [14]	Enhancing the teaching-learning process with a SRM system-discusses The management system of student's relationship.
12	Academic Analytics and Data Mining in Higher Education.[13]	Discusses about making use of data mining for deciding students' performance and identifying characteristics of students.

Table 1. Summary of papers discussed

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