

A Research on the Use of Business Intelligence and Analytics Applications at Turkish Universities [†]

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Abstract: As a result of the changes in higher education, universities are utilizing business intelligence and analytics applications, which are private-sector practices. This study aimed to determine the extent of the use of business intelligence and analytics applications at Turkish universities. For this purpose, case studies were conducted at 12 Turkish universities that have different characteristics. Case studies were conducted face to face as semi-structured interviews. It was revealed that universities use information systems for their business processes; however, they lack the utilization of business analytics applications, especially predictive and prescriptive analytics.

Keywords: university management; business intelligence; business analytics; university analytics

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1. Introduction

In recent years, the changes in higher education caused changes in managing the universities as well. This is explained as academic capitalism [1,2] in literature, which clarifies how universities transform into businesses and how the private sector practices are used at university managements. Business intelligence and analytics applications are one of these private-sector practices used at universities. Business intelligence expresses an umbrella term that includes all organizational and technical methods and applications in the process of data transformation to information and knowledge [3]. Analytics is a part of this umbrella where the data are analyzed. Business analytics applications are grouped as descriptive, predictive, and prescriptive analytics in literature [4]. Descriptive analytics answers the “what happened?” question through reports, while predictive analytics attempts to predict the future. Predictive analytics presents the best course of action for the situation in the future. Today, most universities, such as Pace University, Purdue University, and Austin Peay State University, utilize business intelligence and analytics applications for their academic and managerial processes. Although many universities utilize business intelligence and analytics application in the world, in our literature review, there were no studies about the use of business intelligence and analytics applications at Turkish universities found. Therefore, as a part of a Ph.D. dissertation, this study aimed to reveal the extent of the use of business intelligence and business analytics applications at Turkish Universities.

2. Methodology

This study aims to explore the use of business intelligence and analytics applications at Turkish universities. To explore the issue and give a detailed understanding, a case study is one of the best approaches in the literature. For this purpose, this study was designed as a case study that consists of multiple holistic cases [5]. In literature, some au-

thors [5–7] discussed that case studies could be conducted with either quantitative or qualitative research methods or both. In this context, semi-structured interviews were conducted in this study as a qualitative research method. The data collected through interviews were analyzed through descriptive analysis.

Since it is possible to use business intelligence and analytics applications with an advanced information system infrastructure, the universities which have improved information technology departments are in the scope of the study. According to the scope of the study, to determine the universities, Damar and Coşkun's [9] study about information technology departments of Turkish State Universities was selected as a reference. However, our study's scope included not only state universities but also private universities, so the private universities in Turkey, which were thought of as having advanced information system infrastructure, were included in the scope. In this scope, the universities were selected by the purposeful sampling method. For the sampling method, the characteristics for the universities were determined as university type (state or private), location (geographical region), year of foundation, which shows that a university has recently established or has a long history.

3. Data Collection and Analysis

According to the explained methodology in the methodology section, universities in Turkey that are in different regions, have diverse characteristics, and have an advanced infrastructure of information systems, were selected for case studies. Although there are 207 universities in Turkey [8], there are not many universities with an advanced infrastructure of information systems, as discussed in Damar and Coşkun's [9] study. So, only 30 universities that met the criteria for the methodology of the study could be selected.

In Turkey, most of the universities are in the Marmara and Central Anatolia regions. Due to that, the selected universities are mostly in these regions. Managers of information system departments are first responsible for any activities about information systems at universities in Turkey. Thus, by sending emails to the information system department managers of the universities, the study's aim, scope, and request to conduct a case study were explained. Twelve universities approved the request. In some case studies, managers of the information system department wanted us to do interviews not only with them but also with the other department managers or team leaders, such as the research center manager or IT Governance group manager. In one case, the vice-chancellor is the head of the IT group at the university. So, we did interviews with the managers who are responsible for information system activities. This situation is supported by the literature for qualitative researches also. Yıldırım and Şimşek [10] emphasized that a researcher can do interviews with new participants when it is necessary during the study.

Case studies were conducted face to face as semi-structured interviews at these 12 universities. Only one interview was conducted online through Skype. Table 1 shows information about universities and interviewees.

Table 1. Universities where case studies were conducted.

University	Type	Region	Year of Foundation ¹	Interviewees
UI	State	Marmara	Newest	Vice-Chancellor
UII	State	Marmara	Oldest	Head of IT department
UIII	State	Marmara	Oldest	Head of IT department
UIV	State	Marmara	Oldest	Head of IT department and Administrative staff
UV	State	Marmara	Oldest	Research center manager
UVI	Private	Marmara	Oldest	IT director
UVII	State	Marmara	Newest	Head of IT department
UVIII	State	Eastern Anatolia	Oldest	Research center manager and assistant manager
UIX	State	Central Anatolia	Oldest	Head of IT department and IT Governance group manager
UX	Private	Marmara	Oldest	Head of IT department and 2 Assistant managers
UXI	Private	Central Anatolia	Oldest	Head of IT department
UXII	Private	Marmara	Oldest	Director and Coordinator

¹ According to the university list published by the Council of Higher Education (<https://istatistik.yok.gov.tr/>), if the foundation year was less than 1980 for state universities and less than 2000 for private universities, it was accepted as the oldest. Otherwise, it was accepted as the newest.

Although only 12 universities approved the request, there were the newest, the oldest universities in different regions. Despite most of the universities in Turkey being in the Marmara and Central Anatolia regions, a case study was conducted with a university from Eastern Anatolia as well. Thus, we studied the different cases with characteristics.

Before case studies, an interview form was prepared using the ECAR (EDUCAUSE Center for Analysis and Research) Analytics Maturity Index, TDWI (Transforming Data with Intelligence) Analytics Maturity Model, and OCU (Oficina de Cooperación Universitaria) BI (Business Intelligence) Maturity for semi-structured interviews. Through the interview, data were collected about the questions below:

- Do the universities utilize information systems for managing their business processes?
- What types of information systems are used at universities? (For example, are there integrated systems like ERP used?)
- What kind of reports are used at universities, and in which way are they prepared and presented?
- Are the data stored in university information systems used for detailed analysis, predictive, and prescriptive analytics?

During the data collection process, the “miner role” [11] (p. 5) was adopted, and the authors did not declare their opinions about the case. They only attempted to access the information. This stage took nearly 1.5 h in every case study. The data collection process was started in the 2016–2017 academic year spring semester, continued in the 2017 summer term, and finished the 2017–2018 academic year spring semester. During interviews, notes were taken, and after the interviews, these notes were shared with the interviewees. After sharing the interview notes, the second interviews were conducted with some participants. The second interview was conducted by phone for the participants who were out of Istanbul. The aim was to increase the validity of the study. The collected data were analyzed through descriptive analysis. For the descriptive analysis process, a descriptive analysis framework was created based on the interview form, and the data were processed according to the framework. The themes for descriptive analysis were determined as the use of information systems, reporting activities, and the use of analytics, according to the interview questions. Based on these themes, variables and the values they can take were

determined for comparing the different cases. After the analysis, the results were discussed. In Table 2, the created descriptive analysis framework is presented.

Table 2. Descriptive analysis framework.

Theme	Variable	Values	Description
Use of information systems	Utilizing information-systems	Yes	- When any information system is utilized for any function
		No	- When any information system is not utilized for any function
Use of information systems	Using an integrated system	Yes	- When there is an integration between systems
		No	- When there is not any integration with any system
		Partially	- When only some of the systems are integrated
		In-house developed	- When all systems are developed in-house
Use of information systems	System type	Commercial	- When all systems are commercial
		Both	- When commercial and in-house systems are used together
Reporting Activities	Having a reporting platform	Yes	- When having a separate reporting platform
		No	- When there is not a separate reporting platform
		Partially	- When there is a special reporting platform (For example, a read-only copy of the main system)
Using Analytics	Using descriptive analytics	Yes	- When using descriptive analytics for all functions
		No	- When descriptive analytics is not used for any function
		Partially	- When using descriptive analytics for some functions
		Planning	- When descriptive analytics is not using but planning to use
Using Analytics	Using predictive analytics	Yes	- When using descriptive analytics for all functions
		No	- When descriptive analytics is not used for any function
		Partially	- When using descriptive analytics for some functions
Using Analytics	Using prescriptive analytics	Planning	- When descriptive analytics is not using but planning to use
		Yes	- When using descriptive analytics for all functions
		No	- When descriptive analytics is not used for any function
		Partially	- When using descriptive analytics for some functions
Using Analytics		Planning	- When descriptive analytics is not using but planning to use

4. Results

According to the descriptive analysis, the use of business intelligence and analytics applications at Turkish universities was determined, as shown in Table 3. Based on the descriptive analysis themes, the following findings were obtained:

In universities, information systems are used in business process management, and generally, the systems are fully or partially integrated. At state universities, generally, in-house developed software systems are used. The universities which use only commercial software are all private universities, except one state university. The state university UIII, which uses commercial software, has different systems for different functions, and there is no integration between these systems. Besides this case, in some state universities, commercial software is also used for some functions near the in-house developed systems. In

the three of the private universities which use only commercial software, SAP higher education solution is used. In these private universities, except for UXII, the SAP system is used with its business intelligence module. In UXII, the SAP system establishment had not been completed during the case study.

In universities, generally, there are not any other reporting platforms. Statistical reports, such as Excel sheets on the information systems' reporting modules, are used. There are only three universities (UIV, UX, UXI) that have a separate reporting platform, and two of these universities are private universities that have the SAP system. Due to the SAP systems' business intelligence module, in the universities which use the SAP system, there are separate reporting platforms. There is one state university only, UIV, which has a separate reporting platform. In UIV, a business intelligence tool, IBM Cognos, is used, which gets data from the university's in-house-developed integrated university information system. The reports created through IBM Cognos are dynamic and presented as dashboards. Besides UIV, in UI, the reporting module of the information system is run on the read-only copy of the system. At UI, the reports are run on another system, but not like the other universities; hence, the evaluation made was that the reporting platform is used partially. In the universities where static reports are used, if a new report is needed, a request is sent to the IT department. The new report is created by developers and added to the system's reporting module. However, in the universities which have a reporting platform, all reports are available due to the dynamic infrastructure. In other universities, descriptive analytics is used as static reports for academic, administrative, and managerial functions due to the use of the information systems' reporting modules. In addition, prescriptive analytics is not used in any university. In UX only, it was revealed that prescriptive analytics is planned to be used for academic functions. Like prescriptive analytics, predictive analytics is also not used in most universities. Only in a few universities for a few administrative and managerial functions, such as finance or IT, is predictive analytics used based on the information system's module.

Table 3. Comparison of universities where case studies were conducted.

University	Type	Utilizing IS	Integrated System	System Type	Reporting Platform	Using Descriptive Analytics for Functions		Using Predictive Analytics for Functions		Using Prescriptive Analytics for Functions	
						Academic	Administrative and Managerial	Academic	Administrative and Managerial	Academic	Administrative and Managerial
UI	State	Yes	Yes	In-house	Partially	Yes	Yes	No	No	No	No
UII	State	Yes	No	In-house	No	Yes	Yes	No	No	No	No
UIII	State	Yes	No	Commercial	No	Yes	Yes	No	No	No	No
UIV	State	Yes	Yes	In-house	Yes	Yes	Yes	Planning	Planning	Planning	Planning
UV	State	Yes	Partially	In-house	No	Yes	Yes	No	No	No	No
UVI	Private	Yes	Yes	Commercial Commercial	No	Yes	Yes	Planning	Planning	Planning	Planning
UVII	State	Yes	Yes	and In-house	No	Yes	Yes	No	No	No	No
UVIII	State	Yes	Yes	In-house Commercial	No	Yes	Yes	Planning	Partially	No	Planning
UIX	State	Yes	Partially	and In-house	No	Yes	Yes	Planning	No	No	No
UX	Private	Yes	Yes	Commercial	Yes	Yes	Yes	Planning	Partially	Planning	No
UXI	Private	Yes	Yes	Commercial Commercial	Yes	Yes	Yes	Partially	Partially	No	No
UXII	Private	Yes	Partially	and In-house	No	Yes	Yes	No	Partially	No	No

5. Conclusions and Discussion

Research results show that only a few universities use descriptive analytics efficiently, such as dashboards; however, they are used for academic functions. So, although some Turkish universities use descriptive analytics applications, it is not a holistic usage that covers all academic, administrative, and managerial functions. They use of descriptive analytics was mostly as static reports. Furthermore, according to the case studies, no university uses prescriptive analytics applications. Further, only a few universities use predictive analytics. However, this is limited to a few administrative and managerial functions. This research result overlaps with studies in the literature. In a study conducted by EDUCAUSE, higher education is defined as data-rich but information-poor [12]. Universities use information systems efficiently for their functions, such as human resources, library, student affairs, and data collection, but they cannot use the collected data for analytics applications [13]. Our research results also supported this situation in the literature. Thus, Turkish universities look like other universities in terms of the use of business intelligence and analytics applications. From this point of view, it could be said that Turkish universities also use information systems for their academic, administrative, and managerial functions effectively, but they lack using analytics applications.

The use of business intelligence and analytics applications also points to analytics maturity. In terms of analytics maturity issues, Turkish universities can be evaluated as analytically impaired, which is the first level of the analytical maturity model of Davenport and Harris [2]. Although there are some attempts at analytics at some Turkish universities, they do not have a holistic view that encompasses academic, administrative, and managerial functions. As the research results showed, in a few universities, predictive analytics is used with limited functions. Prescriptive analytics is not used at any university, and descriptive analytics is mostly used as static reports. Only a few universities in the scope of the research have some effective analytical attempts. So, when all Turkish universities are considered, it can be said that, in general, Turkish universities are analytically impaired. This conclusion supports the inference of Guitart and Conesa that says, “many universities do not use business intelligence systems” [14]. According to the analytical maturity model of Davenport and Harris, the second and third levels are localized analytical and analytical companies. Guitart and Conesa say that there could be some universities at these levels, but it is hard to think that a university exists above the third level [14]. Above the third level, there are analytical companies and analytical competitors levels where analytics are important and primary drivers of an organization. At that point, Guitart and Conesa address another issue that although universities have researchers publishing high-quality papers about analytics and have professionals with analytical skills, they cannot analyze their data to improve their operational and academic functions [14]. In our research, after we conducted case studies at universities, we also did a Turkish literature review about analytics, and found that Turkish universities also have researchers who have papers or dissertations on analytics. For example, Hakyemez designed a decision support system for universities [15], Yüksek studied business intelligence and analytics application for universities [16], Yücel developed a data mining software for analyzing student data and which makes suggestions to students about course selection [17]. So, although Turkish universities and researchers have studies on analytics applications for universities, they are generally analytical impaired concerning the use of business analytics applications. Thus, it shows that Turkish universities support the issue addressed by Guitart and Conesa [14]. According to our research conclusion, the analysis of the reasons universities are analytically impaired although having analytical skills is a suggestion for future research. Furthermore, the determination of the analytical maturity of Turkish Universities is another suggestion for future research. This study can guide future research about the analytical maturity of Turkish Universities. The research results also show the big picture of Turkish universities in terms of using business intelligence and

analytics. So, studies about the details of the big picture might be useful for practitioners also.

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