

Analysis of Business Analytics Curricula and Job Demand in Saudi Arabia

Hasan Omar Al-Sakran

Department of Management Information Systems, College of Business Administration, King Saud University,
Riyadh, Saudi Arabia
halsakran@ksu.edu.sa

Abstract: Nowadays the latest trend is incredibly fast increase in volumes of data created by all types of organizations, businesses, and end users. This, in turns, is the cause of understandable desire to find more efficient ways to analyze data and make use of it as part of business operations, which creates huge demand for highly trained professionals in this area. Many universities continue to respond to new business needs and trends for big data and related technologies with innovative academic programs that are related to business analytics. This paper discusses some of the issues and concerns that must be considered while planning and developing Business Analytics program to fit the industries' requirements. The paper presents Business Analytics (BA) curricula based on results of a survey of Business Analytics curricula of academic programs and current industry needs in Saudi Arabia. Graduate students need to be trained not only to handle the huge amount of data but also to present the results in clear and concise form. The objectives of the program are to prepare students for entry to the market with specialty in applying Business Analytics to organizational and managerial needs, expand their business knowledge, link their expertise to growing industries, and to prepare students to develop business strategies using analyzed big data. Graduates of Business Analytics program will use their knowledge of business analytics in their work in business, science, engineering management, healthcare, finance and government. To narrow the big data skills gap with Job Demand in Saudi Arabia we encourage business schools in KSA to add appropriate master program in BA using the proposed curriculum.

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1. Introduction

Recent advances in information and communication technologies have an enormous impact on the world as a whole and the business world in particular in generating massive amounts of data (referred to as "Big Data") within systems and organizations. Data are coming from different sources: business transactions, business interactions, social networks, RFID and sensors; can be created by all types of organizations, businesses, and end users. It comes in both structured and unstructured forms. The amount (volume) of data generated by modern applications is growing at a tremendous rate. Data are being gathered from different sources and stored in different locations and comes in different data types (variety) at high speed (velocity) (Eaton et al., 2012). Moreover, faster computers and new optimization methods have become available to transform this big data into information for better decision making. With continued innovation of digital technologies, the Internet and mobile computing have caused a virtual explosion of data. In 2012, it was estimated that the world's information totaled over two zettabytes and by 2020 is expected to be 35 trillion zettabytes (FIIB MAC, Marketing Analytics, 2013). Such big data required a specific consideration of ways of analyzing, designing, managing,

maintaining, and presenting the resulted information and knowledge to management on all levels where it's going to be used. It also involves using algorithms and formulas to uncover patterns and trends in aggregate big data, and then applying that knowledge to real-world business problems. This involves studying the underlying enabling technologies, which enhance the handling of big data within systems and organizations. McKinsey Global Institute's (<http://www.mckinsey.com/insights>, 2013) estimates that by 2018, there will be a shortage of talent necessary for organizations to take advantage of big data: "the United States alone could face a shortage of 140,000 to 190,000 people with deep analytical skills as well as 1.5 million managers and analysts with the know-how to use the analysis of big data to make effective decisions." Therefore, the development of analytics skills for business and management students has become a necessity.

There has been extensive global interest in big data analytics over the past few years (Rooney, 2012) including popular technology providers, and industry organizations: IBM, Microsoft, SAP, Johnson and Johnson, Bank of America, Oracle, SAS, Teradata, Apple, and others. Yet another indication: the expected future of the Big Data is placed number 7 in Gartner's Top-10 Strategic Technologies for 2012

(<http://www.gartner.com/newsroom/id/1826214>, 2011). In 2013 IBM announced Academic Initiative that proposed extensive academic collaboration with more than 1,000 universities around the world, focusing on Big Data and analytics to prepare students for jobs that will be created to support Big Data by 2015. The company designated more than \$100,000 in awards for Big Data curricula. There are dozens of job listings at MonsterGulf.com with “business analytics” in the title, and hundreds with that term listed as a required job skill (<http://jobsearch.monstergulf.com>, 2014). These jobs are available at different private companies and government agencies. Government agencies can usually extract and analyze big data to more efficiently and effectively deliver services to citizens.

BA will generate a wide range of tangible and intangible business values that can be categorized as transactional (cost savings), informational (fact-based decisions) and strategic (Sircar, 2009). The management style of senior executives and managers of all levels will be shifting away from command and control to a much more anticipatory and facilitating faster and smarter decision making. Other benefits of BA are understanding customers’ behavior (their preferences, purchasing habits), and finding customers’ similarity groups. For example, big data analytics will find where’re Twitter messages or Facebook postings will improve the revenue of an organization.

Categories of analytics: understand what is happening, what will happen, and how to make the best of it (Descriptive, Predictive, and Prescriptive respectively) (<http://www.informs.org/Community/Analytics>, 2013). Descriptive or reporting analytics refers to knowing what is happening in the organization and understanding some underlying trends and causes of such occurrences. Predictive analytics aims to determine what is likely to happen in the future. This analysis is based on statistical techniques as well as other more recently developed techniques that fall under the general category of data mining. The third category is termed prescriptive analytics. Its aim is to examine current trends and likely forecasts and use that information to make decisions. The goal here is to provide a decision or a recommendation for a specific action.

Big data analytics has become an undeniable reality in almost every aspect of today's business with applications for all kinds of businesses: Financial Analytics, Management and Coordination Analytics, Healthcare Analytics, Marketing Analytics, consumer-centric analytics (Customer Analytics), Supply Chain Analytics, etc. BA will be used by business analysts, executives, managers, staff, and customers. Governments expect that analytics of big

data will enhance their capability to provide services to their citizens and talk major national challenges such as healthcare, economy, natural disasters, etc. (Kim et al., 2014).

Consequently, the need has emerged for professionally trained Business Analytics managers, who can help both new and already-existing firms and organizations to seamlessly integrate Business Analytics technologies into their businesses. Few employees can succeed without an adequate background in Business Analytics. Now more than ever business world require skilled Business Analytics professionals practically everywhere.

It will take some time to fill the big data talent gap, so we'll be updating and expanding this curriculum as a service to KSA universities. BA Master's program students will develop an understanding of business; acquire the skills needed to work effectively in a business environment and analytic skills to solve business problems. In addition to the core analytic skills developed, Business Analytics students will gain deep knowledge in areas such as applied statistics and process optimization.

The organization of the remaining of this paper is organized as follows. Literature review and related work is presented in Section 2. Section 3 introduces the research methodology, analysis of universities’ curricula, and survey of Saudi Arabia institutions’ and industries’ needs in relation to business analytics or related fields. Description of the proposed E-business curricula is given in Section 4. Section 5 is the conclusion and recommendations.

2. Related work

Business analytics (BA) requires deep knowledge in the fields of information technology, statistics and management science, data mining and data analysis. Information technology covers the acquiring and parsing, filtering and mining, interpretation and disseminating of big data. Then big data must be carefully analyzed and optimized for maximum efficiency and effectiveness, which are the concerns of statistics and management sciences. The intersection of these areas of study constitutes the field of business analytics. BA is the science of exploring past business performance and translating vast amounts of complex data into clear, manageable information in order to make better timely decisions. It uses data, statistical and quantitative analysis, predictive modeling and optimization techniques to make businesses work better, improve existing business processes and strategically design new processes. Analytics has become a part of every major business decision making process today (Eckerson, 2012). BA includes people, techniques, applications and technologies that turn data into the

driving force in business decision making and business activities.

BA curricula can be divided into three categories: Data Science, Data Mining and Analytics Techniques, and Big Data Technology.

Data Science category: This category represents courses specifically related to collection, analysis, design, visualization, and interpretation of data within a business environment with emphasis on issues such as understanding the importance of ethical and legal considerations that emerge within the world of big data, analytics, security, privacy, and real-time streaming data.

Data Mining And Analytics Techniques category: This category encompasses issues specifically related to understanding and application of data mining techniques, and quantitative modeling techniques, to include statistical analysis (Why is this happening?), predictive modeling (What will happen next?), forecasting (What if these trends continue?), optimization (What's the best that can happen?), and real time predictive analytics, to the solution of business problems.

Big Data Technology category: This category refers to technical courses that require no business knowledge, such as Cloud Computing, Mobile Analytics, Database Management Systems for Big Data, NoSQL Databases, Hadoop Open Source that supports intensive processing of large datasets across distributed systems, Data Telecommunications and Mobile Technologies, and Software Interfaces Design.

There's a big data talent gap between the growing number of jobs that require data analytics skills and the available candidates who can fill these positions (Rowe, 2013). Continued exponential growth of data is headed in one direction, so it's clear that the required skill for big data analytics is a long-term problem. Big data and BA present unique challenges and opportunities for Information Systems programs at business schools (Chiang et al., 2012), and organizations face a growing need for skilled workers with the right quantitative and business skills (Briggs, 2013). Forrester, a global research and advisory firm, estimates that less than five percent of available enterprises' data effectively utilized, mainly due to the lack of necessary analytical skills needed to handle big data (Hopkins, 2011). But what should be done to tackle this problem?

Business and academia must work together to clearly define the knowledge and skills needed to handle big data across the organization. Every profession, whether business or technical, will be impacted by big data and analytics.

New curricula are needed to meet the needs of industry (Vaidhyanathan, 2010). Colleges and universities worldwide are now trying to fill the gap with advanced degree programs which purpose is to produce graduates who can perform a data analytics, provide useful information and communicate it to business leaders and clients. With the rapid expansion of big data, business and IT colleges of many universities around the world responded to demand of changing curriculum different ways. Some integrated business analytics with traditional courses; where others created a Master Degree programs in Business Analytics or Master Degree programs with a concentration in Business Analytics. Number of universities supplemented their MBA programs with a track in business analytics or adopted a program providing a certificate in business analytics. BA can be considered one of the best ways to teach evidence-based management principles and practices (Charlier et al., 2011) in the MBA program. Others redesign the analytics data courses (Kennedy, 2014). In observation of this demand Yang and Liu (Yang and Liu) developed series hands-on labs on business analytics with real business data and business relevance. Others propose to supplement higher education programs with business analytics related courses to facilitate moving towards data driven design and real-time decision making approaches within an existing education system (Siemens and Baker, 2012). Students at higher education sectors should not only have access to data but also acquire the ability to contextualize and interpret the data (Chiang et al., 2012; Vatrappu et al., 2012; MacNeill et al., 2014).

Several elite schools have started master programs related to big data analytics (For example, Harvard, Columbia, University of California, University of Illinois at Urbana-Champaign, etc.). Many accredited universities around the world are seeking to design a new or modify their existing curricula to ensure that their future graduates will be equipped with necessary skills and knowledge. In the last few years and currently hundreds of universities are offering fairly new masters programs in Business Analytics (<http://analytics.ncsu.edu>, 2014). A listing of some of well-known universities offering new masters programs in business analytics or related fields specifically targeting the big data analytics mainly sponsored by schools of business is given in Table 1. All of these programs are adapted to candidates who already have undergraduate degrees in IT, BA, Engineering, and most favor professionals with work experience with big data.

Table 1. Universities Offering New Masters Programs in Business Analytics or Related Fields

| University Name | Degree | Established |
|-----------------------------------|---|-------------|
| DePaul University | M.S. in Predictive Analytics | 2010 |
| University of Tennessee | M.S. in Business Analytics | 2010 |
| Carnegie Mellon | M.S. in Business Intelligence & Data Analytics | 2011 |
| Louisiana State University | M.S. in Analytics | 2011 |
| University of Cincinnati | M.S. in Business Analytics | 2011 |
| Drexel University | M.S. in Business Analytics | 2012 |
| New York University | M.S. in Business Analytics | 2012 |
| Northwestern University | M.S. in Analytics | 2012 |
| The Stevens Institute | M.S. in Business Intelligence and Analytics | 2012 |
| University of Michigan - Dearborn | M.S. in Business Analytics | 2012 |
| New York University | M.S. in Data Science | 2013 |
| Michigan State University | M.S. in Business Analytics | 2013 |
| Fordham University | M.S. in Business Analytics | 2013 |
| Rensselaer Polytechnic Institute | M.S. in Business Analytics | 2013 |
| Arizona State University | M.S. in Business Analytics | 2013 |
| University of Maryland | M.S. in Data Analytics | 2013 |
| Canada's York University | M.S. in Business Analytics | 2013 |
| George Washington University | M.S. in Business Analytics | 2013 |
| University of San Francisco | M.S. in Analytics | 2013 |
| City University of New York | M.S. in Data Analytics | 2013 |
| University of Connecticut | M.S. in Business Analytics & Project Management | 2013 |
| Texas A&M University | M.S. in Analytics | 2013 |
| George Mason University | M.S. in Data Analytics Engineering | 2014 |
| University of Chicago | M.S. in Analytics | 2014 |
| Bowling Green State University | M.S. in Analytics | 2014 |
| Saint Louis University | M.S. in Applied Analytics | 2014 |
| University of Minnesota | M.S. in Business Analytics | 2014 |
| Southern Methodist University | M.S. in Business Analytics | 2014 |
| University of Denver | M.S. in Business Analytics | 2014 |
| University of Virginia | M.S. in Data Science | 2014 |

3. Research Methodology

In this section we investigate Business Analytics or related academic curricula and market demand in Saudi Arabia. Our study assesses industry demand for Business Analytics professionals and the skills needed for specific Business Analytics career.

The study provides a summary of the survey and interviews conducted with the Business Analytics professionals and IT managers

The study intends to answer the following significant questions:

- What technical and managerial business analytics jobs are currently in demand in Saudi Arabian organizations?
- Do graduate students have adequate knowledge and skills to meet the business analytics jobs specifications?

- What current business analytics curricula or related business analytics courses are being offered in Saudi Arabia universities?

The survey consists of 16 in-depth questions designed to provide a useful benchmark for Saudi organizations seeking to understand the current state of their Big Data, the BA skills of graduates, required technical BA skills, though answering critical questions such as:

- Volume of data in an organization;
- Is big data growing out of control;
- Role of the real time data-driven decision making and growth the business value of an organization;
- Degree of adoption of business analytics in an organization;
- Difficulty of finding professionals with BA skills;
- Skills of the current graduates with regard to BA.

3.1 The Current State of Business Analytics in Academia of Saudi Arabia

Based on the content analysis, we identified a total of 13 courses, which were classified into the 3 categories (Data Science, Big Data Technology, and Data Mining and Analytics Techniques) as shown in Table 2. The investigation of the curricula at both graduate and undergraduate levels across different colleges (business, IT, science, and engineering) showed that none of Saudi universities has a major or a minor program in Business Analytics or related fields. The Web sites of these universities were analyzed to determine their offerings of BA courses.

The results listed in Table 2 showing that only a few courses are offered in this area. Some universities have been developing new business intelligence courses. The list of these courses includes Business Intelligence, Data Mining, Business Decision Modeling, and Human Computer Interaction and Interface Design) in both BS and MS programs.

Table 2. Universities Offering Courses in Business Analytics.

| Business Analytics Course | Number of universities |
|---|------------------------|
| Introduction to Business Data Analytics | 3 |
| Business Big Data Management | 0 |
| Business Decision Modeling And Optimization | 1 |
| Financial Modeling and Analytics | 1 |
| Data Mining for Knowledge Discovery | 3 |
| Enterprise Information Architecture | 2 |
| Technology for Business Analytics, Platforms and Applications | 0 |
| Big Data Security | 0 |
| Predictive Analytics | 0 |
| Analytics Programming | 0 |
| Ethics issues of Business Analytics | 0 |
| Human Computer Interaction and Interface Design | 5 |

Based on the analysis of course offerings, most investigated programs are placing a strong emphasis on technology courses (networking, Web development, programming tools, etc.) and traditional business courses for which there is little market demand in the business analytics area.

3.2. Saudi Arabia Market needs

In order to understand what is required from graduates by industries in Saudi Arabia, a study was conducted to determine perceptions regarding IT and critical business areas of knowledge and skills

needed. The study based on a questionnaire and interviews. The questionnaire was completed by 267 people: 125 IT managers, 88 business managers, and 54 IT/ management professionals. We conducted interviews that included of 10 open-ended questions related to what IT management described as being an important need for future Business Analytics professionals. Our interviews were conducted with IT/management professionals such as Senior Project Analysts, Quality Assurance Analysts, Project Managers, ERP managers, etc. The professionals were from 20 businesses, 12 medium-to-large businesses, and 8 non-profit organizations. So far, we completed 20 interviews that provided insight into where organizations see the future of Business Analytics.

Survey respondents included IT managers 46%, business managers 32%, and 22% IT/management collaboration. 74% of the respondents have Big Data concerns. Analytic capabilities in Saudi organizations are still challenging, but regardless of that, all respondents are looking forward for Big Data to have a major impact on making real time, smarter, better, and faster business decisions. Big Data in different domains are being considered, but most commonly mentioned domains where organizations are using analytics of big data are market analysis, service data, and risk management are shown in Figure1.

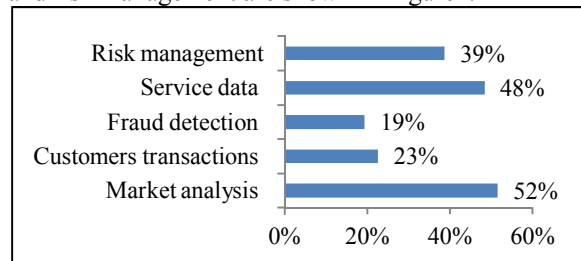


Figure 1. Most Important Knowledge Domains of BA



Figure 2. Tangible benefits of business analytics of Big Data.

Tangible benefits of using Big Data more often cited by respondents are fact-based decision-making, reduced risk and improved customer experience [Figure 2]. Survey respondents indicated that one of the most challenging factors that contributed to the effective utilizing Big Data is finding people with the right skills needed to leverage Big Data. More than half believe (53+10%) that it is a difficult or impossible task [Figure 3].

Another challenge is finding professionals who understand the sources of data and capable of analyzing it and who can recognize and leverage the business opportunities and threats from big data. Only 8% of respondents indicated that it's relatively easy to find skilled human resources.

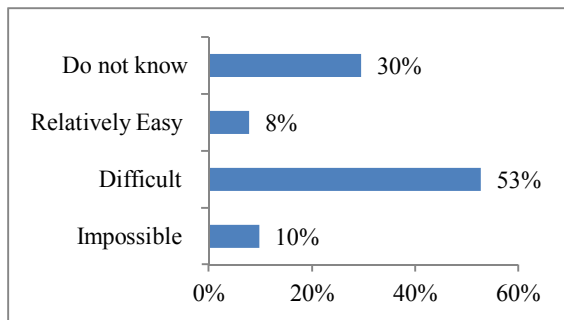


Figure 3. Difficulty finding professionals with analytical skills.

As of now, the candidates for big data analytics jobs lack too many analytics skills as well as deep knowledge of technical tools as shown in Figure 4 and Figure 5 respectively.

The Saudi market is in desperate need for individuals with deep knowledge of dealing with the complexities of big data in the business and organizational context. The demand for expertise in business analytics is growing in many different applications, including consulting, retail, financial services, consumer behavior, marketing, healthcare delivery, healthcare fraud, social network analysis, fraud and crime detection, supply chain, cyber security, libraries and network security.

Most of the organizations are not satisfied with the knowledge and skills of university graduates. Very common complaint is of difficulty to find people with required analytics skills. Graduates are lacking skills required by current business environments. Industry feedback suggests that focus should not only concentrate on specific analytics techniques but also on understanding of the business context. Everything is suggesting that lack of qualified professionals is due to the difference between requirements of industry and academic curricula.

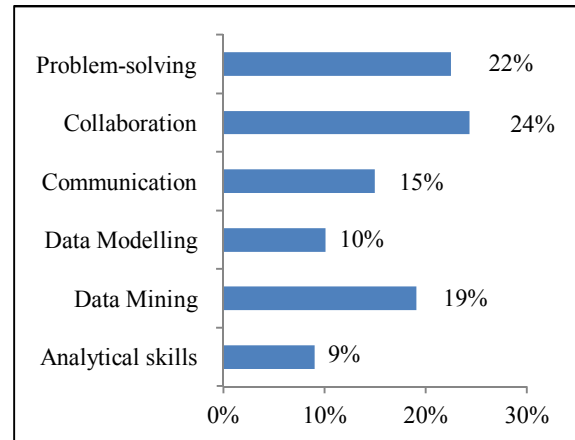


Figure 4. Skills of current candidate for analytics of big data jobs

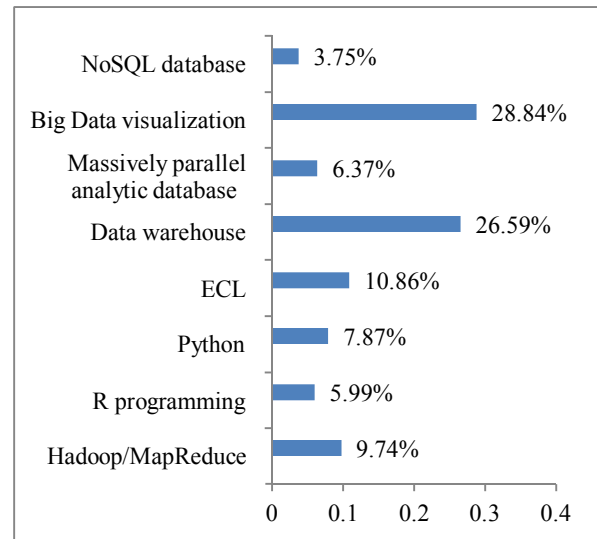


Figure 5. Technical Skills of Candidate for Big Data Analytics Jobs.

Based on analysis of the results' of questionnaire that focuses on identifying of business analytics professions and specific job skills and knowledge required, employability skills and knowledge in Business Analytics that graduates should have (Watson et.al., 2013; Wixom et al., 2014) to include:

- Communication skills;
- Advanced data mining skills to analyze data;
- Application of advanced analytics to customer and transaction data, and an ability to translate data into more effective customer engagement strategies;
- Reporting and data visualization skills needed to involve stakeholders on complex issues;

- Be exposed to the constraints and opportunities of leveraging business analytics within the context of a real organization;
- Ability to work in groups;
- Problem solving skills;
- Adaptability skills;
- Risk management skills;
- Creativity;
- NoSQL skills;
- Time management skills;
- Knowledge of business functions;
- Ability to understand and recognize business problems and how to find solutions;
- Knowledge and application skills of security methods and policies in big data particularly as they relate to privacy and data security;
- Knowledge of databases , data warehousing for big data;
- Knowledge of hardware, networks, and other technical aspect of IT related to big data;
- Practical knowledge of techniques for evaluation and selection of hardware and software dealing with big data.

4. Proposed Business Analytics Academic Curricula

Is the curriculum in Saudi Arabia universities relevant for today's industry needs for big data analytics? Unfortunately, the current graduates' qualifications are far from meeting the needs of the market demands in this area. For us as educators, it is essential to provide curricula that fully prepare students for effective integration into organizations and benefit the industry.

Proposed program of Business Analytics will focus on meeting a significant market demand for individuals with deep analytical talent for dealing with the complexities and possibilities of Big Data in the business and organizational context. The program focuses on students with exceptional quantitative, technical, and communication skills and combines classroom experiences in statistics, data mining, and programming with functional applications such as marketing, social media, and supply chain analytics.

The proposed curricula also focus on balancing the IT technology, management, and business operations elements in terms of the subject offerings, while place emphasis on the service context. The degree includes a set of core and elective courses in Business Analytics. Core courses are designed to develop core competences and knowledge that improve students' capabilities and understanding of the principles and practice of Business Analytics. The elective courses are design to provide students with knowledge of a wide variety of contemporary issues

and topics in Business Analytics systems and their applications.

The core and elective courses of the program are:

- Introduction to Business Data Analytics
- Business Big Data Management
- Business Decision modeling and optimization
- Data Mining for Knowledge Discovery
- Statistical Methods
- Big Data Research Methods
- Big Data Strategy
- Cloud Infrastructure of Big Data Support
- Enterprise Information Architecture
- Technology for Business Analytics: Platforms and Applications
- Mobile Analytics
- Big Data Security
- Predictive Analytics
- Marketing Analytics
- Overview of Econometrics
- Financial Analytics
- Basic Analytics Programming
- Ethics and Intellectual Property of Business Analytics
- Business Analytics Capstone (which includes an industry-sponsored project that incorporates the benefits of an internship and case competition).

5. Objectives of the Proposed Business Analytics Curricula

The Business Analytics program focuses on use of big data for analysis and improvement of business processes. The major expected outcome of the program is providing students with an understanding of BA tools and their application in a business context. The program provides a strong foundation in data analytics by introducing state-of-the-art analytical techniques in Data Management, Data Mining, Applied Statistics, Optimization, Consumer Behavior, Risk Management, and Decision Theory. Students will be trained to solve real problems in marketing, finance, accounting, and scientific applications and acquire skills to: systematically improve existing and strategically design new processes; manipulate databases and analyze large-scale business data to provide actionable insights; understand variability of data and its impact on decision making. Students graduating with a major in BA will be prepared to work with organizations (profit or non-profit) to specify, design, develop, implement, and use analytics to derive information technology solutions that address the organization's big data. The proposed curricula will introduce students to the latest technologies; provide quality

graduate education covering the modern technologies of various BA disciplines; provide higher education opportunities for Information Systems knowledge seekers in order to become eligible for better jobs. Graduates of the Business Analytics program will fill positions in the private or public sectors such as business analysts, data scientists and analysts, data mining architects, business intelligence consultants, and big data managers. Business Analytics students should be also prepared for other careers such as: systems analysis and design, database administration, chief information officer, industry analysis, marketing analytics, predictive analytics. Successful BA professionals must know how to apply IT to a specific business problem and how to integrate IT tools with business processes.

The applicants for this program may come from various backgrounds such as business, IT, engineering, economics, statistics, mathematics, and other related fields. An applicant with business background may have to take the prerequisite courses in IT area, while applicant with an IT background may have to take the prerequisite courses in business such as operations management, finance, accounting, marketing, economics, and management. This flexibility allows students to concentrate on obtaining the required basic knowledge on other elements that will be helpful in building up the deep understanding of compulsory and elective courses offered.

6. Conclusions and Recommendations

Conducted survey suggests that the current state of BA in universities of KSA may be behind in delivering effective Business Analytics program and courses offerings to students in the universities. The survey reveals that organizations are facing numerous challenges with big data initiatives such as lack of skilled employees and leadership to analyze and manage big data. This research serves as a call for action to be taken by universities to close a widening gap between the BA skills of graduates and BA market needs.

Proposed curricula concentrate attention on practical and management issues as well as on theory to solve managerial problems. It aims at minimizing the gap between industry demand and academia. The curriculum is aligned with the corresponding market demand. The career opportunities in BA require students to know both the technologies and the business, as well as an environment in which they will work. The results suggest that there is a high growing demand for professionals who have knowledge of how to analyze, design, manage, and maintain big data and present the resulted information and knowledge to managers on all levels.

Taking into consideration the employability issues and the requirements of the new economy, it is time for universities in Saudi Arabia to fulfill their role in providing graduates with the necessary skills and attitudes to compete in the local and regional work environment.

Based on the content analysis, we recommend the following:

- To open new Business Analytics programs among Saudi Arabia universities.
- To place more emphasis on embedding BA knowledge in MIS and MBA programs, or introduce an MIS and MBA programs with concentration area in Business Analytics.
- Universities can graduate students with a broader range of BA skills using an interdisciplinary approach.
- To offer a certification programs in Business Analytics to train graduates and IT professionals presently employed in Business Analytics.

The future direction is to design a BA system for regular business user. Such system consists of an environment that combines sophisticated statistics and complex algorithmic power of advanced analytics tools with the ease of use and flexibility of visual data discovery tools. This Business Analytics system will be connected to social and internet data sources, including Facebook, Twitter, Salesforce, Google Analytics, etc.; generating predictions, forecasts in moments, without requiring mastery of any special analytic language; and work with all types of data, without remodeling while scaling to support billions of data records.

Corresponding Author:

Dr. Hasan Al-Sakran
Department of Management Information Systems
College of Business Administration
King Saud University
Riyadh, Saudi Arabia
E-mail: halsakran@ksu.edu.sa

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