



How Business Intelligence Can Influence the Delivery of Excellence in Botswana Accountancy College (BAC)

Ronald Chikati*

*School of Computing and Information Systems, Botswana Accountancy College, Private Bag 00319, Gaborone,
Botswana*

Email: ronaldchikati@yahoo.com

Abstract

In today's turbulent and ever changing environment, every business small or large is struggling to remain competitive and to manage the growing amount of data being generated from a number of existing (legacy) systems. Organizations have to align their business processes with their available information technology (IT) infrastructure to beat competition. In the tertiary education landscape, Botswana Accountancy College (BAC) could exploit the business-IT synergy through implementing a data warehouse strategy. Data warehousing can consolidate and unlock actionable information from the huge deposits of data lurking in the organization. Strategic decision making would be based on available accurate, subject-oriented, past and current information. With a data warehouse (DW) in place, BAC could have a unified view of its organizational performance; it is able to check on performance measures and become more agile to provide superior services to customers than would happen with any other tertiary institution at the moment. DW can support all decision making information needs for all potential end-users at strategic, tactical and operational levels. We argue that this type of business intelligence will propel BAC to become a center of higher education excellence. Results of study showed a high level of readiness for BAC to benefit from the business intelligence that could be derived from a data warehousing strategy.

Keywords: Data warehouse; business intelligence; excellence; data mining; data analytics.

* Corresponding author.

1. Introduction

BAC is one of the several institutions in Botswana offering tertiary education. The College's role and strategic orientation is in skills capacity building and to contribute transforming the Botswana economy into the knowledge economy. Upon its inception in 1998, the college was offering accounting related professional courses like ACCA, CIMA, CIA and AAT offered in joint collaboration with its strategic partners: ACCA global, CIMA global and AAT. However, there has been a dramatic shift that has seen the college expanding the scope of its programme profile. By early 2000, BAC started offering additional programmes at certificate, diploma, and advanced diploma levels and subsequently a degree in Computer Systems Engineering offered in collaboration with the University of Sunderland. More recently, BAC has through a strategic joint venture with the University of Derby, introduced the following business management degree study areas: Accounting and Finance, Travel and Tourism, Business Enterprise and Business management. Today BAC is offering educational tuition up to Master degree level. Within the college, there are many subsystems (departments) using different hardware and applications: student registration, academic departments, human resource, purchasing and procurement, facilities, student services and finance. The BAC's steady expansion has had a huge ripple effect on the educational landscape of the tertiary education in Botswana. This move has stimulated a lot of competition from new and upcoming tertiary institutions. In the early days the only contender was the University of Botswana and by then the two had dissimilar orientation to tuition provision. With introduction of degree programmes at BAC, competition from the University of Botswana and Botswana International University of Science and Technology (BIUST) together with strong players like Botho University (formerly NIIT), BA ISAGO, ABM and several technical colleges in Botswana, has become stiffer for tertiary education. All these institutions are competing for sponsored students, funding, recognition and provision of educational programmes and experiences that are geared to drive the economy in tandem with the Botswana vision. Ideally BAC has an ambition to become a Centre of excellence in the southern region and beyond of tertiary education provision. Thus its strategic initiatives need to be geared towards the achievement of this vision by competing better than any of the other tertiary institutions. There is need to make informed decisions that are based on quality data internally and externally generated. To ensure quality operational, tactical and strategic decision making, BAC could implement data warehousing strategy. The level of strategic excellence is said to have been achieved when an institution is rated highly esteemed according to given factors of consideration and is the institution of choice.

2. Data Warehousing (DW)

Reference [1] argues that organizations could compete better by having the ability to learn from the past, to analyze current situations, and to predict the future scenarios. This kind of business intelligence is what motivates this research to advocate for the adoption of DW strategy in BAC. According to [2] a data warehouse is a separate store of data extracted from one or more production databases to produce an authoritative source for data analysis and decision support. This is reminiscent to physical data warehouse only that data from operational systems in the organization is loaded. It provides tools for quick access to accurate and insightful information that satisfy the information needs of managers at operational, tactical and strategic levels. This means managers are presented with a platform from which they can recognize information they want and use

simple tools to access it [3]. Data warehousing therefore involves the collection of data from several operational systems, cleaning of this data and then loading the data into a single data store that would preserve the data in a consistent structure. Reference [4] maintains that a well-defined and properly implemented data warehouse can be a valuable competitive tool. The benefits that an organization can derive from a data warehouse are innumerable. It enhances an effective and efficient utilization of existing information. Data is treated as an enterprise-wide resource to support processes and decision making and is not seen as belonging to an application or a person or department. High quality information is presented in an easy-to-understand and user-friendly manner and is available just in time. The use of easy to use front-end tools makes it equally easy to sift through the data. The downside of the data warehouse is that it is a costly project to successfully implement and it requires hard work, commitment and dedication by competent personnel (technical developers and business analysts). It takes a long time to develop and may not provide all the data users would want. There is a general laxity with security and privacy issues (controls) and more emphasis is on accountability [3]. Despite these implementation challenges, a data warehouse that is well aligned with organizational strategy will accrue relevant benefits to the organization through economies of scale. The data warehousing strategy has been tried elsewhere and literature shows successes and where failure was reported it was mainly due to unclearly defined business terms [5].

3. BAC Business Case

For BAC to successfully thwart the competition, sound strategic decisions have to be made from a data-driven informed position. There is a need to back up the more considered strategic options in BAC with accessible, timely, accurate, complete and high quality data. With a lot of information being generated from disparate business operations in BAC, management believe that there is need to harness this heterogeneous information and package it in a manner that makes it usable by operational, tactical and executives for a quick response to turbulent changes in the educational landscape. External and internal sources of information are very useful vantage points from which salient decisions can be derived. Despite the fact that there could be several reckoned sources of decision making, one home-grown solution could be through using a data warehouse in order to achieve actionable business intelligence. A data warehousing strategy could enable BAC to use its transaction processing (legacy) systems, use its different departmental databases and use the massive flat files archived everywhere in the organization to make competitive strategic decisions. The large data stores that were accumulated over a long period in BAC could be mined to have an insight into useful information that could be used to make informed strategic decisions. The researcher further maintains that perhaps problems with decision making in an organization could be due to lack of right information to right people at the right time. With a data warehouse no business opportunities and threats come and pass by unobserved.

4. Business Intelligence

According to Forrester report [6] *Business Intelligence* is a set of methods, processes, architectures, applications, and technologies that gather and transform raw data into meaningful and useful information used to enable more effective strategic, tactical, and operational insights and decision-making. Since most, if not all organizations are using and generating data, this data needs to be changed to information in order to help business perform even

better. This is where BI comes in. An organization has to have a 360 degrees of its information systems and process to ensure all necessary business information is gathered. Business intelligence depends on a comprehensive integration and data quality initiatives that are backed up with the right level of attention, resources and funding [7]. We can further, argue that to make right decisions business must generate accurate data. It is therefore expected for a business to use reliable data aggregation methods, sound BI reports and data analysis derivatives that ensure high quality data. A use case scenario is when a business has to bring together and exchange data about customers, suppliers and/or products that exists across multiple systems. Proper data handling techniques need to be ascertained in order to come up with informed strategic initiatives. BAC, for instance work with isolated Customer Relationship Management (CRM), Supply Chain Management (SCM) systems, use web services and use merged systems from her corporate mergers to co-operate with her partners effectively. For us BAC needs to implement a data warehousing strategy to generate insightful information and for her to be more strategically competitive. This would enable generate real-time information that could be shared across multiple systems. However to be able to generate actionable information, patterns and trends inherent in the data, data mining (for knowledge discovery on data at rest) and data analytics (aka machine learning) tools and techniques need to be used. There is need to employ tools that cleans and transform poor data in the organization to ensure its accuracy [8,9,10]. Machine learning tools aim to automate data retrieval and analysis through approaches like dash-boarding and data visualization in the case of building a data warehouse.

5. Tools and Technologies for Data warehouse Design

Today there are a number of business intelligence tools that can act as the building block for data warehouses. Some examples of such tools are SAP, sandbox and dashboards. They provide interactive environments in which users play with data and tools to achieve interesting results. According to Ballard and his colleagues (2006), most users respond positively to graphical dashboards embedded in enterprise portals, and require little if any training in how to use them. A dashboard provides a graphical user interface that can be personalized to suit the needs of the user and top executives are the primary target users. BAC can choose one from these tools to build and implement a data warehouse strategy. BAC could constitute a team of technical staff to work on each component area of the data warehouse and implement a data warehouse.

6. Barriers to successful implementation of Data warehousing strategy

- Several authors [11,12,13,14] believe that building a data warehouse (DW) is difficult and require great commitment by management and support from the technical IT professionals.
- Data in an organisation is kept in various formats like word format, spread-sheets, xml, etc. Great technical skill is expected to create a single interface view that suggests homogeneous data source.
- Applications appear like they are all resident a central point whereas some will be running from other machines in the organisation. The challenge is network connectivity and delays in response times when querying the databases
- There is no one-size-fits-all strategy to data warehousing and there are different development methodologies which makes it difficult to standardise data warehouse.

- Security and privacy issues are a drawback to data warehouse implementation. Proper security controls, like controlled access to the data centre, access rights assigned and an effective corporate security policy expected.
- Scalability issues needs to be addressed. For example, how is the DW expected to growth overtime, how many concurrent users to be supported, and the nature of the complexity of the queries? It would be expected that data access functions should linearly grow with the size of the DW [11]
- A project is bound to fail if cultural issues are being ignored, inappropriate architecture is adopted, unclear business objectives are pursued; there is missing information and unrealistic expectations and low data quality being considered [12].

BAC may have to consider most of them immediately except the worry for network connectivity and security and privacy issues. This research feels the exceptions are long term barriers that could be contended with after the deployment of the data warehouse. The expansion of the current bandwidth in BAC can help solve the intermittent loss of connectivity and if proper configuration policy is implemented on a DW, security and privacy issues could be easily mitigated.

7. Case Studies of Successful Data Warehouse Implementation

A DW was successfully implemented at Rensselaer Polytechnic Institute which needed a better way to make admissions and financial decisions. Like many organizations, systems and processes for collecting and analyzing business data were fragmented. Executive meetings to discuss strategy too often stalled over the accuracy of reported numbers [15,16]. The data warehouse was implemented and that resulted in a huge return on investment. Arizona State University (ASU) developed a client/server application to integrate student, financial and human resource data in an integrated data warehouse [3]. The aim was to make ASU remain as competitive as Fortune 500 companies. The project revealed that building a DW is painstaking and extremely complex and requires planning, hard work and time commitment. It can extract a lot of money and effort. However, after successful deployment, users experience a “never-ending” list of benefits. After 3 years of experience, the future of ASU DW became clear and it became the telescope into ASU’s distributed data stores. It is shown in the case that the real power of the DW is actualized after many years and once this is achieved there is a high return on investment. In view of these case studies, it is possible for BAC to implement once and become a pacesetter in the higher education landscape in Botswana. Reference [3] concluded that when it comes to the adoption of the DW, the question is not whether to build it but when. Thus, data warehousing is could be a strategic tool in BAC.

8. Best Practice for successful data warehouse implementation

A wide community of researchers, though using different wordings seem to concur that there are a number of best practices for implementing a data warehouse. However, BAC has to consider the following [13,16,17], and [18]:

8.1. Project must fit with corporate strategy and business objectives

A data Warehouse solution must come to solve organisation problems and must assist an organisation achieve its goals. Therefore, the solution must fit into the mission, vision and the business needs of the organisation.

8.2. There must be complete buy-in to the project by executives, managers, and users

A data warehouse technology is an expensive, complex venture and thus cannot take off without the support of top management. Top management must allocate people, money and other resources for the project. Everyone involved including general users must be in support for the project.

8.3. It is important to manage user expectations about the completed project

Users must be informed about the intended goals of the DW project so that they are aware of what needs to be achieved. This will help them contribute realistically towards the delivery of solution to address their needs

8.4. The data warehouse must be built incrementally

The DW construction must be on a data mart by data mart basis. This means the problem is divided into manageable smaller component. This is a 'divide and conquer' approach. In this case if one data mart is correctly built move to another data mart (business component). This reduces the complexity of the design issue.

8.5. Build in adaptability

The data warehouse must adapt to the changing needs of the business. It must grow as the BAC needs keep on changing. It must be possible to fine tune the DW to current needs. This also implies that the delivery of such a project must be within a short time frame to ensure that you achieve even the initial objectives set.

8.6. The project must be managed by both IT and business professionals

Data warehouse is not just about delivering a technical product but delivering on one that also addresses the business needs. The business systems analyst should look into the business processes and procedures. IT professionals must ensure the DW adheres to the specifications. This is one reason why so many professionals are involved in the development of the DW

8.7. Only load data that have been cleansed and are of a quality understood by the organization

Since a DW deals with heterogeneous data sources, it must be able to combine these sources into a single seamless central repository. To achieve, the data must be standardized through the use of ETL tools in order to aggregate and deduplicate the data. The outcome must be consistent data shared across the enterprise.

8.8. Do not overlook training requirements

This is a vital consideration since the intention is to build a system that must help the business achieve its goal. The success of such a system depends on whether the entire user community is able to exploit the major

functionalities of the system. Users at all levels must be trained on how to use the system to address the information needs. Train schedules must be part of the implementation plan.

9. Methodology

This research, in addition to use of secondary data, it uses the primary source data collection method. Data was collected using structured questionnaires that were designed for departments, students and the Information Technology (IT) department and using semi-structured interviews with senior management. The aim was to check on Data warehouse implementation readiness. Top 10 managers were interviewed in connection with which data help them make decisions in the organisation. 125 questionnaires were distributed to the wider BAC community that included departmental units, IT department and current students and ex-students. Heads of departments and the Executive director need to be participants here because these are directly involved in articulating the future of BAC in the light of competition from other tertiary institutions. The wider BAC community has to participate because they understand whether the college is doing enough to make BAC a college of excellence. Furthermore the researcher visited secondary documentary data from Literature review to assess which organisations had implemented data warehouses and what design methodologies were used. SPSS and Microsoft Excel were used to analyse collected quantitative data.

9.1. Observations

The investigation was carried out through the distribution of three sets of questionnaires and semi-structured interviews were conducted with heads of departments (senior management) in BAC. 64 questionnaires for departments were distributed to BAC staffs who occupy various positions. However, only 33 questionnaires were returned; a response rate of 51.6%. A set of 50 questionnaires were distributed to BAC students who had stayed 1-3 years (63.6%) and 4 and above years (30.3%). Only 33 responded giving a response rate of 76%. The third set of 11 questionnaires was directed to the Information Technology Services (ITS) department and only 6 were received back (54.5% response rate). It showed 1 database administrator and 1 systems analyst and 3 support technicians who have only worked for 1-12 months. 7 of the target 10 top management team were interviewed and some top managers could not be found during the scheduled times due to their commitments. Nonetheless, 70% of the targeted respondents were interviewed. Based on these response rates and the categorisation of questions, the researcher is confident about the contribution of the insight derived from this data.

9.2. Results and Discussion

The information produced in BAC come in different formats as determined by the applications that are used to produce it. Results showed that word processing, Excel, database (Oracle and Access) reports and information from the VIP Info Slip applications are used and exchanged among departments. SPSS Table 1 below shows that 48.5% of the respondents indicated that they handle data and reports produced by these applications.

Table 1: Various applications used in BAC departments.**Data format used**

Application	Frequency	Percent	Valid Percent	Cumulative Percent
word document	2	6.1	6.1	6.1
excel	7	21.2	21.2	27.3
database	7	21.2	21.2	48.5
VIP Info Slip	1	3.0	3.0	51.5
all above plus other	16	48.5	48.5	100.0
Total	33	100.0	100.0	

Although we have a case of many applications in use, the study revealed that no any other application to support the operational information needs of various departments other than MS Office applications. The table below shows that only 3% of the respondents have other applications in their departments.

Table 2: Predominant applications for department information support

Is there any other application being used in your department other than MS office?

	Frequency	Percent	Valid Percent	Cumulative Percent
yes	1	3.0	3.0	3.0
no	31	93.9	93.9	97.0
other	1	3.0	3.0	100.0
Total	33	100.0	100.0	

Although some data is exchanged among departments for use in decision making that data is in an inconsistent format. 60.6% of the respondents also indicated that the information exchanged is inconsistent. Top management responses to how they make strategic decisions for the college indicated that 75 % of the times based on their experience and gut feelings and 80% of the participants also showed that most of their decisions are informed from systems running in the college. Perhaps the explanation for this juxtaposition could be that decision making requires situational analysis which may require experience, intuition and data. This is further aggravated by the fact that top management in BAC do not have a system in place to generate reports for strategic use. Departments revealed they infrequently produce reports needed to support strategic decision making (see chart below).

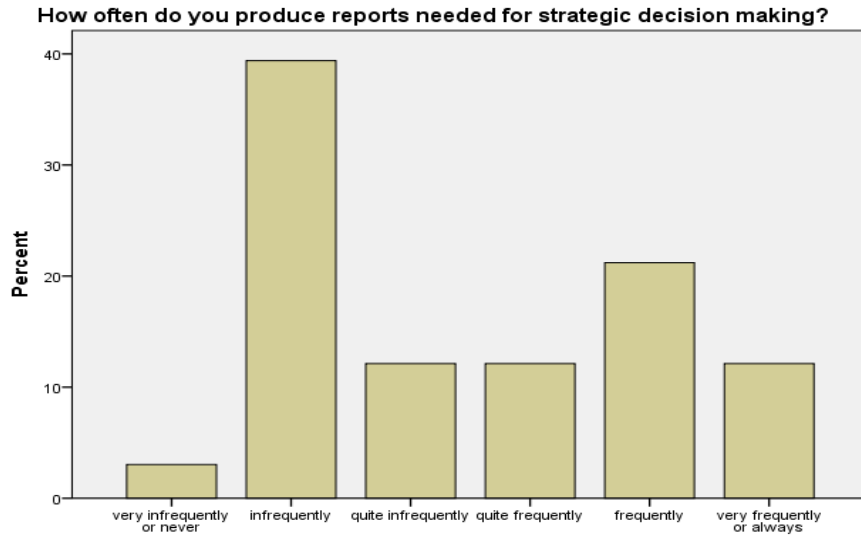


Figure 1: Frequency of Report Generation

This could imply that largely decision making in BAC is not informed by what is happening in the departments. There is need in BAC to implement decision support data warehousing tool for making informed decisions for the trajectory of the college. From the student perspective, there are many critical factors they consider for choosing a particular tertiary institution. The following table 3 shows the factor and how popularly it was rated.

Table 3: Factor consideration rate

Factor	Considered (%)
Quality of the qualification	97.0
Availability of program	90.9
Employability	87.9
Reputation of college	87.9
Delivery of quality programs	84.8
Course duration	78.8
Tuition fees	72.7
Location of Compass	54.5
Availability of student support services	33.3
On campus accommodation	33.3

All the factors outlined in the table above are very significantly considered by students. Student want to enroll with an institution highly esteemed, with quality academic program and whose graduates are employable. There is need for a business intelligence tool that can help generate this kind of information as and when it's needed to make agile and prompt responses to competition.

10. Recommendations

User training is required for all potential users to be able to derive the maximum benefits from the data warehouse technology. Users have to be trained in the use of business intelligence reporting tools like the dashboard and sandbox or analysis tools for data mining [19,20,21,22]. It is how users are able to exploit the DW technology that determine their competitive advantage, otherwise what is the point having a very good technology that no one knows how to use. BAC user community must be equipped with numerous procedures and processes that assist them in data collection, data sharing and data reporting to ensure better data-driven decision making. Any future-oriented organization may immensely benefit from data analysis of historical data and then use or deploy predictive analytics tools to drive innovation and success in business operations [23,24]. The primary focus for any organization to be a center of excellence lies in weaving attainable strategic goals that are supported by a set of pragmatic principles that guide management teams at all levels to achieve these efficiently. For BAC there is need to improve organization data and information so as to improve business practices and guarantee success. According to [25,26] business analytics and intelligence used with data warehouses help transform strategic goals in capabilities that can be achieved through appropriate simulation, forecasting and prediction. The strategic goals influence the tactical goals that can spawn new projects such as delivery systems, technology or services to support new capabilities. As a ripple effect tactical goals will influence new operational goals that will bring about new or changed business processes and activities to be performed. This snowball effect will enable BAC to be able to identify and analyze potential data sources internal and external to the organization and how to use the data to accentuate the business intelligence of the organization. A data warehousing technology strategy necessary to achieve this. Furthermore, a data warehouse strategy that is well implemented informs the organizations what data they have and what information they need for informed decision making [27]. Thus organization can easily establish their data requirements and the business level of data reporting that is appropriate. We therefore advocate for the combined use of data and visualization tools to add depth and understanding of organizational data that perhaps would previously have been unknown. The derived insights may inform the organization to develop necessary bespoke applications for its strategic intent. Knowledge management initiatives must be imperatives for organizations to know what they have so that they are able to configure their capabilities to beat competition in any industry of occupation.

11. Conclusion

Across all categories of questions, the general trend was towards implementing a data warehousing strategy in BAC. It came out that paper-based reports from course managers, student information from registrar about student enrolment and dropouts, financial statements on college performances, reports to and from external bodies like Tertiary Education Council (TEC) and the Ministry of education, reports on budgets, student feedback, student quotas and their sponsorship, all are useful for strategic decision making. However, such information is not available immediately and at times the information is not timely, accurate and consistent. There was also a general agreement that to satisfy students and other stakeholders and gauge organizational performance, information must come from parents, students, employers, staff, college performance metrics and so on. However the challenge remains that the information come in 'silos' and are fragmented and not quality information. BAC measures/targets like student retention, student attrition rates, employability information

were all agreed upon but the general sentiment was it is difficult to measure their impact on college strategic initiatives. Managers felt there is need for student alumni database, community engagement through industrial attachments, reliable archives for student records like transcripts and the need for a records officer and to create a big data source for BAC. Looking at the varied nature of the data required, a data warehouse can consolidate multi-dimensional large data stores. The contribution of this research is to enlighten organizations that their fortune to beat competition relies on the past and current data they possess which if properly used for strategic decision making can unlock doors of opportunities before their rivals. This business intelligence will propel organizations like BAC to become educational centres of excellence. For further research, it will be interesting to investigate empirically how post DW implementation outcomes compare with the pre-implementation outcomes.

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