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Full Length Research Paper

Disclosure of risk management practices in the top South Africa's mining companies: An annual/integrated report disclosure analysis

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South Africa's mining companies are facing many challenges, ranging from industrial actions, uncertainty in legislation, weaknesses in global export markets, and lack of access to capital. Accordingly, sound risk management and adherence to corporate governance principles and practices are essential to the sustainability of these companies. The objectives of this article are twofold: firstly, to provide a brief overview of the risk management practices based on King III requirement on governance practices, and secondly to assess the risk management disclosures in the annual reports thereof. The objectives were achieved through a literature review on risk management developments as per the requirements of the King III report on Corporate Governance, and supported by empirical evidence obtained from assessing the 2013 annual reports of these top mining companies. The study found that most South Africa's mining companies do disclose their risk management practices in line with the recommendations of the King III report on corporate governance; however, such disclosures are often lacking detail on actual practices and accomplishments could be enhanced.

Key words: Assurance disclosure governance, Johannesburg securities exchange {JSE}, King III, mining companies, risk management.

INTRODUCTION

Risk is defined as the possibility that an event will occur, which will impact an organization's achievement of objectives. This definition was formulated by the Institute of Internal Auditors in the Professional Practices Framework as far back as 2004 (IIA, 2004), and although refined over the years, the term risk still remains variously defined. Hardaker et al. (1997), for instance, define risk as imperfect knowledge where the probabilities of the possible outcomes are known, and uncertainty exists

when these probabilities are not known. There are many forms of risk that can impact the organization, including Information Technology (IT) risk, financial risk, operational risk, network security risk, and personnel risk. Realization of these risks has manifested themselves in major industrial and financial catastrophes such as the sinking of the Titanic, Bhopal, Chernobyl, Three Mile Island, Enron, the British Petroleum (BP) oil spill, the most recent financial crisis and the London Whale (IBM, 2014). These

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have, to some extent, contributed to the growing need for a formal strategy to combat and prepare for known and unknown risks. The IIA (2004) suggests that the formal strategy to combat and prepare for known and unknown risks should involve the identification, assessment, management and control of potential events or situations that could result in catastrophes.

According to Wentzel (2013), the mining industry in South Africa is facing many challenges which, inter alia include production losses, unstable industrial relations and rising administered costs and fluctuating commodity prices. Even within such a challenging environment, the mining companies in South Africa carry substantial economic weight. For instance, KPMG (2013) observed that the mining sector contributed revenue around R330 billion in the South African economy as well as around R17 billion in corporate tax and R6 billion in royalties. The Chamber of Mines (2014) agrees that the mining industry carries a substantial weight in the South African economy and they point out that the industry contributes around 1.4m jobs.

During the exploratory phase of this research, it was noted that very little research exists on the risk management practices in the South Africa's mining sector. This study seeks to assess the extent and level of risk management disclosures in the South Africa's mining sector as per the requirement of King III Report on Corporate Governance.

Annual reports/ integrated reports were utilized as sources of information for the purpose of determining the level and extent of disclosure of risk management information as per the requirement of the King III report on Corporate Governance. According to Ponnu and Ramthandin (2008), annual report disclosure of information on governance which includes risk management is pertinent to investor's decision making as well as stakeholders' interests. Skærbæk (2005)'s annual reports lend legitimacy to an organization, mainly for external readers and audiences.

Objectives, scope and limitations

The objectives of this article are twofold: firstly, to provide a brief overview of the risk management practices based on King III requirement on governance practices, and secondly to assess the risk management disclosures in the annual reports thereof.

In order to determine the risk management disclosures in the annual reports of the top South African mining companies, the data on the top 100 Johannesburg Securities Exchange (JSE) listed companies based on their market capitalization were obtained from Sharenet (2014). All non-mining companies in the top 100 sample were eliminated.

The effect of the elimination process yielded a sample

of fourteen (14) mining companies on the top 100 list and they are listed below in order of their market capitalization: Glencore Xtrata Plc, BHP Billiton Plc, Anglo American Plc, Anglo American Platinum Corporation Limited, Kumba Iron Ore Limited, Anglo Gold Ashanti Limited, Impala Platinum Holdings Limited, Assore Limited, Exxaro Resources Limited, African Rainbow Mineral Limited, Gold Field Limited, Sibanye Gold Limited, Lonmin Plc and Northam Platinum Limited.

The study has specific limitations. The assessment was limited to the 2013 published annual/ integrated reports of the fourteen (14) South African mining companies which are part of the top 100 listed companies based on their market capitalization. Mining companies not in the top 100 list and those that are not listed on the Johannesburg Securities Exchange (JSE) did not form part of the study and represent a research area to explore in future.

In addition to the limitations highlighted above, the content analysis methodology used for the purpose of coding information from the relevant reports has its inherent limitations. However, even with its limitations, Unerman (2000) observed that the recent literature still supports the content analysis technique as an acceptable research method for analyzing annual reports (Abeysekera, 2007; Barac and Moloï, 2010; Brennan and Solomon, 2008; Boesso and Kumar, 2007). This is because the content analysis technique is particularly useful for extracting information which is not explicitly presented in a quantified and structured format, but is implicit in the information.

The remainder of this article provides an overview on the literature review, followed by a section reporting on the findings that resulted from the assessment of risk management disclosures in the fourteen (14) top mining South African companies' 2013 annual reports. In the final section, results are summarized, conclusions reached and recommendations made.

REVIEW OF RELEVANT LITERATURE

King III risk management disclosure recommendations

A major contrast between the earlier King Reports on Corporate Governance (King I and King II) and King III is that the latter applies to all entities regardless of the manner and form of incorporation or establishment. The King III Report on Corporate Governance further contrast with the earlier King Reports as it places risk management at the nerve centre of the company's strategic decision makers. It makes it the focal point of the board by making risk management the responsibility of the board. In 1992, the Institute of Directors in Southern Africa (IoD) commissioned the King Committee to develop a set

of governance principles aimed at promoting the highest standards of corporate governance within the South African business community. The commission of the King Committee yielded the first King Report on Corporate Governance (King I) that was published in 1994 (IoD, 1994). The enhancement of King I continued with the second King Report on Corporate Governance (King II) being published in 2002 (IoD, 2004). Following the amendments in the Company's Act and the changing trends in the international arena, the King II Report on Corporate Governance had to be updated and this process yielded the third King Report on Corporate Governance (King III) (IOD, 2009).

of directors (IOD, 2009). A brief overview of the major risk management disclosure areas is outlined below.

Responsibility to govern risk

In its responsibility to govern risks, the King III Report on Corporate Governance recommends that the board should:

1. Develop the policy and plan for system and process of risk management;
2. Comment on the integrated reporting on the effectiveness of the system and process of risk governance;
3. Express their responsibility of the risk governance on the charter;
4. Incorporate the risk governance in their ongoing training;
5. The responsibility of risk governance should manifest itself in a documented approved risk management policy and plan which should be widely distributed across the company;
6. At least once annually, review the implementation of the risk management plan; and
7. Continually monitor the implementation of risk management plan thereof (IOD, 2009).

To gauge the extent and the level of disclosure of information relating to the board's responsibility to govern risk, the annual/integrated report for each relevant mining company was coded using checklist questions developed and in line with the guiding principle in Table 1.

Determination of tolerance levels

Accordingly, the King III Report on Corporate Governance recommends that the board should determine the levels of risk tolerance as well as the appetite levels annually. Once the levels of risk tolerance and appetite are determined, the board should monitor that risks taken are within the tolerance and appetite levels (IOD, 2009).

To gauge the extent and the level of disclosure of information relating to the tolerance levels, the annual/integrated report for each relevant mining company was coded using checklist questions developed and in line with the guiding principle in Table 1.

Establishment of relevant committee to assist the board

The King III Report on Corporate Governance recommends that risk committee or audit committee is established and this committee should assist the board in carrying out its risk responsibilities. Accordingly, the established committee should:

1. Consider risk management policy and plan and monitor the risk management process;
2. Have as its members executives and non-executives as well as members of senior management. If deemed necessary, independent risk management experts can be invited;
4. Have a minimum of three (3) members who meet at least twice per annum
5. Have its performance evaluated by the board once a year (IOD, 2009).

To gauge the extent and the level of disclosure of information relating to the establishment of the relevant committee to assist the board in discharging its responsibility to govern risk, the annual/integrated report for each relevant mining company was coded using checklist questions developed and in line with the guiding principle in Table 1.

Delegation of responsibilities to management

The board is expected to delegate to management the responsibility to design, implement and monitor the risk management plan. To this extent, the King III Report on Corporate Governance recommends that:

1. The board's risk strategy should be executed by management by means of risk management systems and processes;
2. Management is accountable for integrating risk in the day-to-day activities of the company;
3. The CRO should be a suitably experienced person who should have access and interact regularly on strategic matters with the board and/or appropriate board committee and executive management.

To gauge the extent and the level of disclosure of information relating to the delegation of responsibilities to management to assist the board in discharging its

responsibility to govern risk, the annual/ integrated report for each relevant mining company was coded using checklist questions developed and in line with the guiding principle in Table 1.

Risk assessments

The board is expected to ensure that risk assessments are performed on a continual basis. In promoting the effective and ongoing risk assessments, the King III Report on Corporate Governance recommends that the board ensures:

1. That there is a systematic, documented, formal risk assessment that will ensure that risk assessments are conducted at least once a year;
2. That risks should be prioritized and ranked to focus on responses and interventions;
3. That the risk assessment process should involve the risks affecting the various income streams of the company, the critical dependencies of the business, the sustainability and the legitimate interests and expectations of stakeholders;
4. That risk assessments should adopt a top-down approach; and
5. That they regularly receive and review a register of the company's key risks.

To gauge the extent and the level of disclosure of information relating to the risk assessments, the annual/ integrated report for each relevant mining company was coded using checklist questions developed and in line with the guiding principle in Table 1.

Risk response and monitoring

The King III Report on Corporate Governance recommends that the board ensures that management considers and implements appropriate risk responses and that there is continual risk monitoring. To this extent the following should be adhered to:

1. Management should identify and note in the risk register the risk responses decided upon;
2. Management should demonstrate to the board that the risk response provides for the identification and exploitation of opportunities to improve the performance of the company; and
3. The responsibility for monitoring should be defined in the risk management plan.

To gauge the extent and the level of disclosure of information relating to the risk response and monitoring, the annual/integrated report for each relevant mining

company was coded using checklist questions developed and in line with the guiding principle in Table 1.

Risk assurance and disclosure

In promoting appropriate risk disclosure and assurance, the board is charged with ensuring that there are processes in place enabling complete, timely, relevant, accurate and accessible risk disclosure to stakeholders. The King III Report on Corporate Governance further recommends that the board receives assurance regarding the effectiveness of the risk management process. In order to ensure the appropriate risk disclosure and assurance:

1. Management should provide assurance to the board that the risk management plan is integrated in the daily activities of the company; and
2. Internal audit should provide a written assessment of the effectiveness of the system of internal controls and risk management to the board.

To gauge the extent and the level of disclosure of information relating to the risk assurance and disclosure, the annual/ integrated report for each relevant mining company was coded using checklist questions developed and in line with the guiding principle in Table 1.

RESEARCH METHODOLOGY

For the purpose of determining the level and the extent of information disclosed in each section and to decide if a particular mining company has fully disclosed, not disclosed or obscurely disclosed the required risk management information in line with the recommendations of the King III Report on Corporate Governance, the empirical method known as content analysis was utilized.

Ingram and Frazier (1980) view the content analysis methodology as a methodology that involves the selection of analytical categories within the context of the content material. For Krippendorff (1980), there are three (3) factors that support the suitability of content analysis that can be used for the purpose of coding information in reports namely; stability, reproducibility and accuracy.

1. Stability refers to the ability of a researcher to code data the same way over time.

Assessing stability of the content analysis methodology involves a test-retest procedure;

2. Accuracy refers to the reliability of the coded information; and
3. Reproducibility refers to the extent to which coding produces the same results when the text is coded once more (for the second time) or by the other researchers.

Hsieh and Shanon (2005) support Krippendorff's view and they further indicate that the content analysis methodology is not a single focused methodology as it has three dimensions namely, conventional, directed and summative. Further, Berelson (1952), Krippendorff (1980) and Weber (1990) all agree that content analysis is a systematic, replicable technique for compressing many words of text into fewer content categories based on explicit rules of coding.

Table 1. Guidelines on application of the data analysis tool (content analysis).

	Full disclosure of recommended information	Non-disclosure of recommended information	Abstrusely disclosure of recommended information
Guiding disclosure principles	If the required risk information is disclosed under its category in a paragraph, a few paragraphs or a full page and this information contains all the required information as well as voluntary disclosures for that category, the item is marked as Yes in the checklist.	If there is no disclosure at all of the minimum required risk information, the item is marked as No in the checklist.	If the minimum required risk information is disclosed, however this risk information is not disclosed separately under its category, and is not disclosed in detail i.e. appears in one sentence that does not give adequate details, the item is marked Abstrusely in the checklist.

In order to accomplish the objectives of this article, the coding guiding principles that will be utilized in coding relevant information from the annual reports were formulated and they are presented in Table 1.

RESEARCH FINDINGS AND INTERPRETATION

The research findings presented below demonstrate the results of content analyses performed on fourteen (14) annual/integrated reports that were analyzed for their disclosure of risk management information in their annual reports. Table 2 shows the categories and disclosed topics (number 1 to 16) relating to the responsibility to govern risk, determination of tolerance levels, relevant committee to assist the board discharge its responsibilities and the delegation of responsibilities by the board to management. On the responsibility to govern risk, assessed information revealed that all mining companies fully disclosed the information relating to the commentary on the effectiveness of the system and process of risk management, expression of board's responsibility for governance on the charter and continual monitoring of implementation of risk management plans. Disclosure of information relating to the company wide distribution of the approved risk management policy and plan as well as that relating to the incorporation of risk governance training were concerning. For instance, of the fourteen (14) assessed annual reports, only one (1) company disclosed that it widely distributes the approved risk management policy and plan.

Of the fourteen (14) mining companies assessed for the disclosure of information relating to the tolerance levels, only four (4) fully disclosed that they have determined the level of risk tolerance and appetite, whilst only two (2) indicated that the risk taken during the 2013 financial year was within the defined tolerance and appetite levels.

The top listed mining companies displayed the high level of disclosure with regards to the information relating to the relevant committee to assist the board in

discharging its responsibilities. All companies fully disclosed the information relating to consideration of risk management policies and plans, the constitution of the committees as well as the attendance of meetings. The information relating to the evaluation of the performance of the relevant committees could be enhanced. It was noted during the assessment that only three (3) of the fourteen (14) mining companies had the stand-alone risk committees as the committee of the board. The rest of the top listed mining companies had the hybrid of audit and risk committees.

On the delegation of responsibilities to management, all companies fully disclosed the information relating to the integration of risk on the day to day activities of the company by management as well as the information relating to the formulation of systems and processes for the purpose of executive the board risk strategy. A weak disclosure of information was observed in the disclosure of information relating to the Chief Risk Officers (CRO).

Based on the result displayed in Table 2, it is clear that generally disclosures relating to the experience and the influence of the CRO, evaluation of the relevant committees performance, annual determination of risk tolerance and appetite including the indication as to whether the risks taken in that particular year are within the defined levels, wide distribution of risk management plan and policy across the company, incorporation of risk governance training in the ongoing board trainings as well as the board's integrated reporting comment on the effectiveness of the system and process of risk governance could be improved.

Table 3 shows the categories and disclosed topics (number 1 to 10) relating to risk assessments, risk response and monitoring as well as the risk assurance and disclosures.

All assessed top mining companies fully disclosed the fact that they have a process that systematically ensures that risks are documented and that formal assessments

Table 2. Governance of risk, tolerance levels, board committee and delegation.

No	Category and disclosed item	Full disclosed	Not disclosed	Abstrusely disclosed	Total
Responsibility to govern risk					
1	Policy and plan for system and process of risk management	14	0	0	14
2	Comment on the integrated reporting on the effectiveness of the system and process of risk governance	10	0	4	14
3	Board express their responsibility of the risk governance on the charter	14	0	0	14
4	Risk governance incorporated in the boards ongoing training	0	7	7	14
5	Documented, approved risk management policy and plan widely distributed across the company	1	13	0	14
6	Implementation of the risk management plan at least once, annually	13	0	1	14
7	Continually monitor the implementation of risk management plan	14	0	0	14
Determination of tolerance levels					
8	Determination of the levels of risk tolerance as well as the appetite levels annually	4	3	7	14
9	Risks taken are within the tolerance and appetite levels	2	6	6	14
Relevant committee to assist the board					
10	Committee consider risk management policy and plan and monitor the risk management process	14	0	0	14
11	Membership consists of executive, non-executive and senior management. Committee has access to independent experts.	14	0	0	14
12	Committee have a minimum of three (3) members who meet at least twice per annum	14	0	0	14
13	Performance of risk committee evaluated by the board once a year	9	0	5	14
Delegation of responsibilities to management					
14	Management has risk management systems and processes to execute the board risk strategy	14	0	0	14
15	Management ensures that risk is integrated on day to day activities of the company	14	0	0	14
16	CRO is experienced on strategic matters and has access to the board or its committee and executive management	1	13	0	14

(Source: 2013 annual report disclosure).

are held annually, risks are prioritized and ranked, different types of risks are raised and that boards regularly receive and review the risk registers. However, all fourteen (14) companies abstrusely disclosed the information relating to the approach. It was noted during the assessment that some mining companies indicated in their report that they used both "the top down" and "the bottom up" approaches when they assess their risks.

There was full disclosure on the information relating to the publication of the risk responses. Twelve (12) top mining companies fully disclosed the fact that their risk management plans apportioned the responsibility for monitoring, whilst two (2) did not disclosed this information at all. A weak disclosure was observed on the exploitation of opportunities arising from the proper

response to risk as only five (5) top mining companies fully disclosed this, four (4) of these companies did not disclose the recommended information at all whilst five (5) abstrusely disclosed the recommended information. In contrast, disclosures about the management assurance that risk is integrated to the company activities and internal auditors written assessment on the effectiveness of the system of internal controls and risk management were comprehensively disclosed by the top listed mining companies.

CONCLUSION AND AREAS FOR FUTURE RESEARCH

In conclusion, the paper found that the mining

Table 3. Risk assessments, response and monitoring, assurance and disclosures.

No	Category and disclosed item	Full disclosed	Not disclosed	Abstrusely disclosed	Total
Risk assessments					
1	A process that is systematic, ensures risks are documented, and that there is formal risk assessment at least once annually	14	0	0	14
2	Risks are prioritized and ranked	14	0	0	14
3	Divergence risks are raised	14	0	0	14
4	Top down approach in risk assessments	0	0	14	14
5	Board regular receives and reviews risk register	14	0	0	14
Risk response and monitoring					
6	Noting of risk responses to the risk register	14	0	0	14
7	Risk response leads to identification and exploitation of opportunities to improve the performance of the company	5	4	5	14
8	Responsibility for monitoring risks is defined in the risk management plan	12	2	0	14
Assurance and disclosures					
9	Management assurance that risk management is integrated in the company's daily activities	14	0	0	14
10	Internal audit's written assessment on the effectiveness of the system of internal controls and risk management	14	0	0	14

(Source: 2013 annual report disclosure).

environment in South Africa have become more demanding over the years, resulting in mining companies facing many challenges. Even with these challenges, the mining sector remains the important sector of the South African economy. Given the challenges and the fact that mining is an important sector of the South African economy, adherence to sound risk management practices is essential so that proper scenarios can be developed to either control or mitigate the effect of uncertainties. The study found that according to the risk management disclosures in the Annual Reports, mining companies in South Africa are widely adhering to sound risk management practices as recommended by the King III Report on Corporate Governance.

Of concern, however, was the finding that there were certain disclosures that lacked details on the actual practices applied in some respect such as in the disclosure of information relating to the approach to risk assessments, identification and exploitation of opportunities arising from proper risk response, boards comment on the effectiveness of the systems and processes of risk governance, incorporation of risk governance in the ongoing boards trainings, company wide distribution of the approved risk management policy and plan, annual determination of risk tolerance levels and appetite, indication of whether the risk in that particular year was

within the define tolerance and appetite levels, the Chief Risk Officer's (CROs) experience as well access to the board, its committees executives and performance evaluation of the relevant committee responsible for risk. These findings cast doubt on the true state of the risk management capabilities and whether some of these companies have resilient risk management programme that can help the company navigate through when the uncertainties occur.

The assessment was limited to the published annual/integrated reports of the fourteen (14) South African mining companies which are part of the top 100 listed companies based on their market capitalization. Mining companies not in the top 100 list and those that are not listed on the Johannesburg Securities Exchange (JSE) did not form part of the study and represent a research area to explore in future. There is value in undertaking such a study as it could provide the overall state of risk management capabilities in the South Africa's mining sector and in any case; the King III report on Corporate Governance applies to all forms of companies in South Africa.

Conflict of Interests

The author has not declared any conflict of interests.

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Full Length Research Paper

Quality management practice in Ethiopia

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Competitiveness in the global market is becoming fierce. The importance of total quality management is growing to increase customers' satisfaction and as a result to win the market in the long term. However, developing economies like Ethiopia is challenged in their quality of products and services. Based on the Ethiopian Quality Award (EQA) self-assessment model and the 2009 award participants, quality management practice in Ethiopian manufacturing and service industries is studied. The result justifies that quality will be the future challenges of competitiveness. The root causes of the quality problem are investigated and revealed in the study to give directions for the policy makers, the industries and researchers.

Key words: Quality management, quality award.

INTRODUCTION

Ethiopia has registered development in the past five years. According to government's reports two digit rates of economic development have been achieved. Development, progresses, changes and mainly the efforts are clearly seen. However, relative to where the country is going to reside, its achievements are far behind. Many researches have been done to identify and explore the means towards fast and sustainable development. Now, it is understandable by most of the stakeholders that quality related problems are the stumbling block for the majority of the industries. Furthermore, quality related problems were apparent in all the sectors. There were many research conducted to alleviate the problems. Some of these are on: healthcare (Ermiyas, 2009; Shewit, 2009; Marta, 2010), education (Jelalo, 2009; Birhane, 2010), construction industry (Samson, 2008; Wondifraw, 2009; Alemnew, 2010), manufacturing industry (Haben, 2008; Netsanet, 2008; Mesafint, 2008; Birhan, 2008;

Tessema, 2008; Dagne, 2009; Yitagesu, 2009; Amanuale, 2009; Asrat, 2011; Negalign, 2011; Wondifraw, 2010) and public service (Mihret, 2008; Freselam, 2010; Rahil, 2009; Birhan, 2009; Haftom, 2010). These researches studied so far are either at organizational or sector level. Moreover, most of the research was conducted on the consecutive results and effects of quality related problems. So far there is no effort to investigate the causes of poor quality product/services.

As a response to this problem, at national level, the Government of Ethiopia has considered quality as a development infrastructure since 1940s when agricultural products export market began to expand. Efforts made to disseminate quality in the country can be classified into five periods. Pre-Ethiopian Standard Institute, Ethiopian Standards Institute, Ethiopian Authority for Standardization, Quality and Standards Authority of Ethiopia (QSAE) and post-QSAE. Moreover, international

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Table 1. Criteria and weight comparisons of the main quality awards.

The Australian Quality Award		The European Quality Award		The Malcolm Baldrige National Quality Award		The Ethiopian Quality Award (EQA)	
Leadership	17%	Leadership	10%	Leadership	9%	Leadership	15%
Information and analysis	13%	People management	9%	Information and analysis	8%		
Policy and Planning	8%	Policy and strategy	8%	Strategic quality planning	6%	Policy and strategy	8%
People	20%	Resources	9%	Human resources development	15%	Resource management	12%
Quality of process, products and service	22%	Processes	14%	Management of process quality	14%	Processes	15%
Customer focus	20%	People satisfaction	9%	Quality and operational results	18%	Customer focus	25%
		Customer satisfaction	20%	Customer focus and satisfaction	30%		
		Impact on the society	6%			Impact on society	10%
		Business results	15%			Business performance	15%

partners such as United Nations Industrial Development Organization (UNIDO), engineering capacity building program (ecbp) and the Japan International Cooperation Agency (JICA) played measureable roles. Despite the efforts made, the deployment of the quality concept in practice is questionable.

This research aims at diagnosing quality management practice in Ethiopia in general to identify the root causes of quality problems in Ethiopia. The outcome will also benefit the government to device a policy and/or a program for further improvement of quality in the country's product/service.

Research approach

The authors of this paper were leader and member of the Ethiopian Quality Award (EQA) technical team which prepared the self-assessment manual, evaluated the participants' document and proposed award winners to the jury. In due course, the data for this research was acquired. Background to the EQA and its manual, evaluation process and evaluators are briefly

described to verify the accuracy of the data and at the same time, the reliability of the research outcomes.

A quality award is designed to support in the development of organizational excellence and to recognize organizations for their achievements in quality and performance. It is also aimed at raising awareness about the importance of quality and performance excellence as a global competitive edge. Recognizing the need for implementation and integration of quality concepts in the operations of Ethiopian manufacturing and service industries, the Addis Ababa University (AAU) and Walta Information Center (WIC) had initiated the EQA in 2007.

Then after, EQA has developed a self-assessment manual which is carefully designed to accommodate total quality management tenets. The manual is also in parallel with major quality awards such as: Deming Prize (1951) in Japan and the Malcolm Baldrige National Quality Award (1987) in USA. The European Foundation for Quality Management (EFQM) (1988), the Australian Quality Award (1993) and developing countries models are also reviewed. Furthermore, ISO 9000:2000 Quality Management System is used

as an input (EQA, 2009).

Since all quality award models are derived from the tenets of quality management, they look alike. However, they have some differences in their focus area and weight of criteria. Table 1 compares criteria weight of main quality awards. Customer focus and policy and strategy have been given the highest and the lowest weight in all the awards respectively. Very recent researches are focused on: Effective implementation of quality in organizations (Yasin et al., 2011; Srivastav, 2011), the importance of quality concepts (Parast et al, 2011), uses and applications of quality tools and techniques (Parajapati, 2011; Ghosh and Roy, 2011) etc. Root cause analysis has not got attention in the quality improvement effort at national level.

The EQA model's main criteria used to evaluate industries were leadership, policy and strategy, resources management, process management, customer satisfaction, business performance and impact on the society (Figure 1). Under these seven criteria, there are 28 sub-criteria, 65 sub-sub criteria and 361 questions. Overall weight of EQA is 1000 points which is divided into Leadership—150 points, policy and strategy—80 points

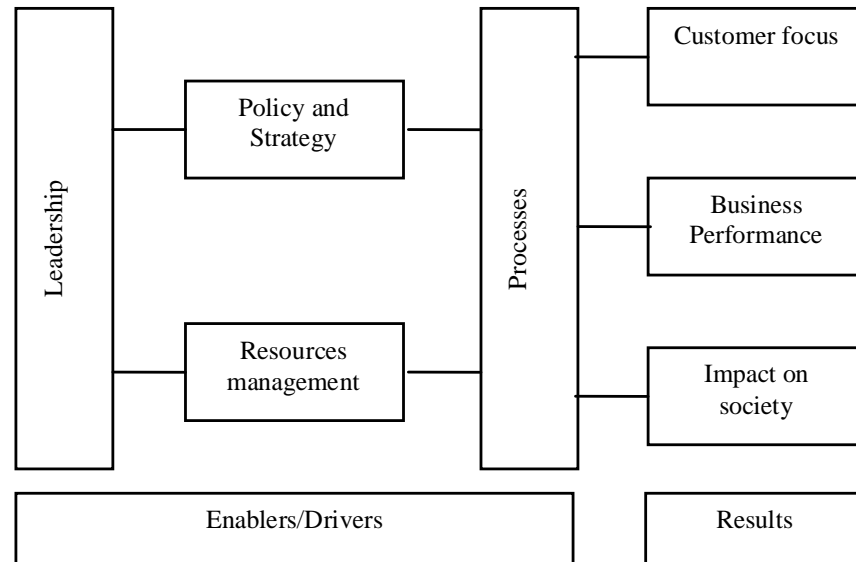


Figure 1. Ethiopian Quality Award.

resources management—120 points, process management—150 points, business performance—150 points, customer focus—250 points and impact on society—100points. Furthermore, sub-criteria weights are shown in Table 2. The weight of sub-sub-criteria and questions' scoring system is well-defined and the examiners will conduct a consensus process to agree on a percentage band within which scores will be given in each category in the application.

The evaluation process of the EQA starts from application and ends in award winners' selection. It has eight stages. These are: (1) application, (2) self-assessment, (3) submission of self-assessment report, (4) independent and subsequent consensus review by the technical committee, (5) Short-listing, (6) second registration, (7) site visit review, (8) recommendation by technical committee (9) recommendation by judges', and (10) EQA board approve.

Since the self-assessment manual is filled by a team which includes top management of the organizations, the data are reliable. Even if there are unreliable data, they were verified in the site-visit stage of the evaluation process.

The technical team is organized from different departments of Addis Ababa University. Every organization is first evaluated individually and there was a consensus review to avoid any bias in evaluation, making the data reliable for analysis.

Therefore, since the EQA manual is carefully designed to accommodate different type of industries and it is a way to diagnoses total quality of an organization, it is possible to conclude that EQA model represent all concepts of quality management. It can also review quality management performances of any organization.

This study is undertaken by taking the first EQA participants.

Data and its analysis

In the first Ethiopian Quality Award program, which was conducted in 2009, there were 43 participants. According to Ethiopian Quality Award classification of industries, 18 were from manufacturing and process industry category, 20 from service for profit-making category, three from construction industry category, and two from service (not-for-profit) category. Participants' specific industrial classification is shown in Table 3.

The organizations' data were fed into the SPSS soft-ware for analyses. Preliminary analysis indicated that Code-SMG-036 and Code SMG-037 are outliers because they did not properly follow the self-assessment manual in accordance with the instruction. Thus, the two organi-zations coded SMG-036 and SMG-037were excluded from further analysis.

Similarly, Code SMG-013 was rejected from further analysis, as it was a new organization whose perfor-mance results being of a short term nature would be difficult to judge. In addition, the self-assessment report was not supported by evidence as it is proved in the site visit.

Hence, three organizations were rejected and 40 orga-nizations were used for statistical analyses. According to the EQA model the analyses were conducted at overall result, criteria and sub-criteria level. In all the cases, after actual data analyses, transformed data analyses followed. Furthermore, quality management practices in the manufacturing industries and service industries will be separately analyzed to reveal their unique characteristics.

RESULT AND DISCUSSION

Overall result level

Using SPSS software, EQA self-assessment overall

Table 2. EQA criteria and sub-criteria weights.

No.	EQA criteria and sub-criteria	Weight
1	Leadership	150
1.1	Commitment to excellence and continuous improvement	23
1.2	Development and deployment of policies and strategies	21
1.3	Allocation of appropriate resources	21
1.4	Motivation and recognition of employee's effort	21
1.5	Customer relationship management	23
1.6	Leader's involvement in achieving organizational objectives	23
1.7	Public responsibility	18
2	Policy and strategy	80
2.1	Relevant policy and procedures	35
2.2	Sound and focused strategy	25
2.3	Deployment of policies and strategies	20
3	Resource management	120
3.1	Targeted human resources management	30
3.2	Optimized material resource management	20
3.3	Effective financial resources management	25
3.4	Efficient facilities management	25
3.5	Knowledge-based information management	20
4	Processes management	150
4.1	Optimized product/service processes	35
4.2	Synergic supporting processes	30
4.3	Processes planning and control	30
4.4	Integrated business processes	30
4.5	Review and improvement of processes	25
5	Customer satisfaction/focus	250
5.1	Exceeding internal customers' satisfaction	90
5.2	Meeting internal customers' satisfaction	80
5.3	Review and evaluation of customer satisfaction	30
5.4	Level of product/service comparative value	50
6	Business performance	150
6.1	Degree of financial performance	60
6.2	High market share	30
6.3	Increased productivity	60
7	Impact on society	100
7.1	Significant socio-economic impact	60
7.2	Enhanced environmental impact	40

results were analyzed based on the actual quantitative value and then the transformed qualitative grades.

The minimum and maximum results were 322 and 882, respectively. The range is very high, which explains uncertainty in the industries' quality practice. Again, the mean is 642. Based on 1000 points, it explains the performance is about 65% regarding quality. Both the skewness and kurtosis are negative which also indicates weak quality management practices.

The range and mean of manufacturing industry are better than service industries that show relative stability of the former sector in its practice. On the contrary, the manufacturing industries have negative skewness and

the service industries show positive skewness. But, since the service sector mean is lower than that of the manufacturing industries it does not reflect good quality management practices in the service sector (Table 4).

EQA quantitative values were changed into qualitative grades. The evaluation scale was divided into six categories: Above 90 — excellent; 83—89.9 — very good; 75—82.9 — above average; 60—74.9 — average; 50—59.9 — below average, and below 49.9 — is considered as poor. For the purpose of analysis, these qualitative values are again changed into quantitative values. Excellent is labeled as — 1; very good as— 2; above average — 3; average — 4; below average — 5

Table 3. List of EQA participants by sector.

Sectors	No.	Sectors	No.
Basic metal	2	Healthcare	2
Fabricated metal products	2	TVET	3
Motor vehicles and trailers	2	University and Colleges	2
Mining	1	Construction Consulting	2
Building materials	1	Hotels	1
Paint manufacture	3	Insurance	1
Beverage processing	2	Transport	3
Food processing	2	Construction	3
Agriculture, farming, poultry	1	Real estate	2
Pulp and paper	1	Environment	1
Plastics	1	ICT	2
Public service	1	Trading	2

Table 4. Descriptive statistics of the overall result.

	N	Range	Minimum	Maximum	Mean	Variance	Skewness	Kurtosis
Total Mark	40	560.42	321.58	882.00	641.52	17314.87	-.329	-.314
Manufacturing Industry	18	430.00	452.00	882.00	701.79	10897.00	-.654	.757
Service Industry	22	545.92	321.58	867.50	592.21	17674.14	.081	-.072

Table 5. Descriptive statistics of the overall result.

	Overall	Manufacturing industry	Service industry
N	40	18	22
Mean	4.3	3.9	4.6
Median	4.0	4.0	5.0
Mode	4.0	4.0	4.0
Std. Deviation	1.1	1.0	1.1
Variance	1.2	1.0	1.1
Skewness	-.3	-.3	-.5
Std. Error of Skewness	.4	.5	.5
Kurtosis	.1	.8	.4
Std. Error of Kurtosis	.7	1.0	1.0
Range	4.0	4.0	4.0
Minimum	2.0	2.0	2.0
Maximum	6.0	6.0	6.0

and poor is labeled as — 6.

From the descriptive statistics, the mode is average, the median is average, and the mean is also in the range of average scale. Exceptionally, the mean and median of the service industry is lower than those of the manufacturing industries. This explains that service industry's performance is below average. Skewness of overall result, manufacturing industry and service industry are all negative. Kurtosis is positive for all (Table 5). There is no organization which scores excellent. Three organizations are in the very good range, one from service industry and the other two from manufacturing industry (Figure 2).

One way analysis of variance (ANOVA) is used to analyze mean variance of manufacturing and service industry. First box plot is drawn and then the analysis proceeds. The result shows significant difference between the two groups.

Criteria level

EQA's seven criteria, i.e. leadership, policy and strategy, resources management, process management, customer focus, business performance, and impact on the society

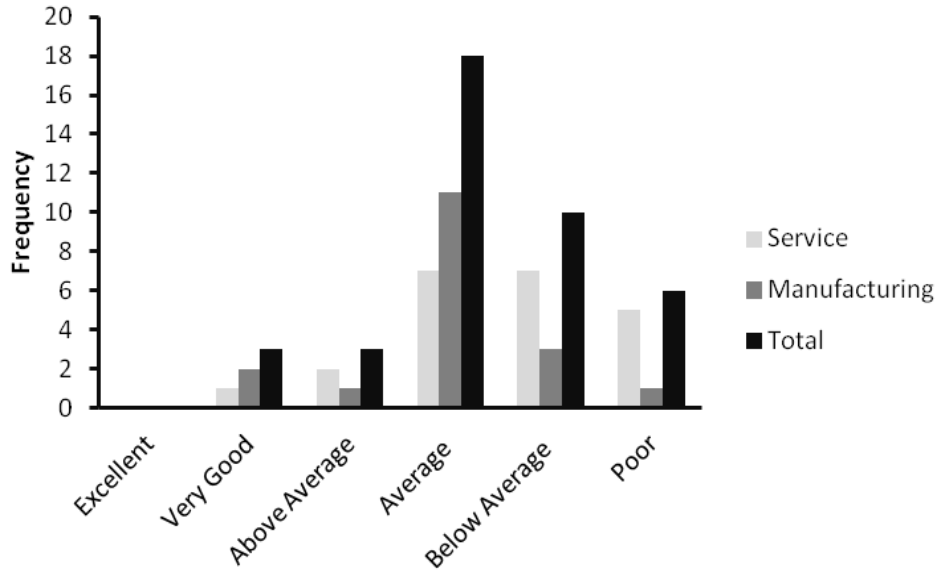


Figure 2. EQA overall score.

are analyzed and the descriptive statistics is shown in Table 6.

The ranges of all criteria results are very high, which shows uncertainties of quality management practices. The mean of all criteria is less than 70% of their weight. Business performance and impact on the society are the least in their mean. Similar to the overall performance of the EQA, all the criteria are also negatively skewed. What is unique in the analysis is that, policy and strategy is the highest in its negative skewness, which depicts the problem of policy and strategy.

The ranges of manufacturing industries are smaller than those of the service industries in all the criteria. Similarly, the standard deviations of the manufacturing industry are lesser than those of the service industry in all criteria except on impact of the society which is approximately equal.

The mean of the manufacturing industry is greater than that of the service industry in all the criteria. This shows relative stability and awareness of quality management in the manufacturing industry.

Similar to the overall result, all criteria in the manufacturing industry as well as in the service industries have negative skewness. But resources management, customer satisfaction and business performance from manufacturing industry and policy and strategy from service industries are significantly skewed.

The analysis clearly indicates that all the industries have poor performances in all EQA criteria. Similarly, to the overall result, manufacturing industry has a relatively higher performance in all quality criteria

In the overall variance analysis above manufacturing industry's mean is significantly different from that of the service industry. Similarly, every criterion is analyzed

independently and resources management, processes management and customers' satisfaction of the manufacturing and service industries are significantly different. By implication, the other four criteria showed similar mean.

Since criteria of EQA have been weighted differently, it is difficult to compare their results. In order to conduct comparative analysis, all the criteria's results are transformed into the same scale to ensure normalization. EQA total weight is 1000 marks. When it is divided by seven criteria each criterion will have about 143 marks. All results are transformed into this scale and statistical analysis has been conducted. Business performance and impact on society becomes the category with the least mean. In addition, process management's mean is also among the least in the service industry particularly. The mean in manufacturing industry is better than that in the service industry (Figure 3).

The analysis in all the criteria shows the performance of Ethiopian industries is low, and more so is that of the service industries performance is below average in all the criteria. Furthermore, policy and strategy is the least visible in the practiced criteria. This indicates that policy and strategy is the most problematic area among all the criteria. The EQA manual gives light weight for policy and strategy. According to Deming, consistency of purpose in policy and strategy is the first principle where quality starts and it is there where Ethiopian industries are found lacking.

Sub-criteria level

The overall result shows poor practices of quality

Table 6. Descriptive statistics of criteria level.

	Overall					Manufacturing Industry				Service Industry			
	Weight	Range	Mean	Std. Deviation	Skewness	Range	Mean	Std. Deviation	Skewness	Range	Mean	Std. Deviation	Skewness
Leadership	150	102.32	103.05	22.42	-.77	59.85	109.55	14.81	.59	90.84	97.74	26.28	-.57
Policy and Strategy	80	73.00	54.77	13.73	-1.70	33.80	57.78	9.78	-.14	71.30	52.30	16.07	-1.71
Resource Management	120	64.45	83.86	17.71	-.27	63.00	94.03	15.45	-1.29	56.45	75.54	15.10	.11
Process Management	150	110.13	94.56	29.41	-.647	67.02	110.00	17.97	-.83	108.13	81.93	31.19	-.07
Customer Satisfaction	250	139.88	164.55	38.25	-.590	139.06	179.72	31.68	-1.32	135.88	152.14	39.32	-.15
Business Performance	150	116.39	84.81	26.99	-.733	112.39	88.60	25.17	-1.28	116.39	81.70	28.59	-.42
Impact on Society	100	73.43	57.72	16.64	-.426	60.34	62.21	16.45	-.22	60.43	54.03	16.24	-.72

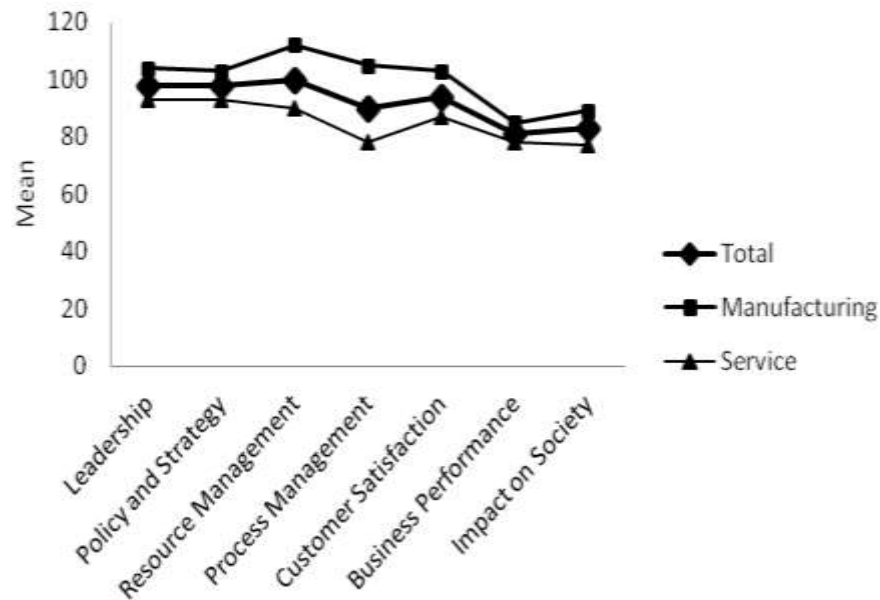


Figure 3. Mean of transformed criteria.

management in Ethiopian industries. In addition, in the criteria analysis, the problem is associated

with all the criteria. At the sub-criteria level the root causes for the problem are clearly identified.

In fact, almost all the sub-criteria are negatively skewed which practically shows weak quality

management practices in Ethiopian industries. However, the most critical problems for both the manufacturing and service industries are discriminated as follows and summarized in a fish-bone diagram at the end.

Under leadership, there are seven sub-criteria. Among these development and deployment of policies and strategies, and customer relationship management are exceptionally skewed negatively (Table 7).

Under policy and strategy, there are three sub-criteria. All of them are significantly skewed negatively. However, the weakness of the manufacturing industry and the service industry are a little bit different. Manufacturing industries have relevant policy and procedures there problems are lack of sound and focused strategy, and deployment of policy and strategy. While the service industries are devoid of relevant policy and procedures. Under such circumstances in the case of the service industries, it is impossible to deal with sound and focused strategy and deployment of policy and strategies.

Under resources management, there are five sub-criteria. Targeted human resources management and efficient facilities management are significantly negatively skewed. Facilities management is not as such a problem in the service industry as it is in the manufacturing industry.

Under process management, there are five sub-criteria. Optimized product/service process is the only criterion that is common problem of both manufacturing and service industries. However, it is more serious in the manufacturing industry than in the service industry. Processes planning and control and integrated business processes are also negatively skewed sub-criteria in both the manufacturing and service industries. Synergic supporting processes are a problem related to the manufacturing industry.

Under customer satisfaction criteria there are four sub-criteria. The first two sub-criteria, namely, exceeding internal customers' and meeting internal customers' satisfaction are significantly negatively skewed in all industries. In the manufacturing industry, however, the skewness is more amplified. In the service industry meeting internal customers' satisfaction is the most skewed sub-criteria.

Under Business performance, there are three sub-criteria. Degree of financial performance is negatively skewed in both the manufacturing and service industry.

Under impact on society, there are two sub-criteria, namely, significant socio-economic impact and enhanced environmental impact. They are both negatively skewed in manufacturing and service industries. In the service industry in particular socio-economic impact is highly skewed.

As explained previously, every criterion, sub-criterion and question has its own weight in the Ethiopian Quality Award evaluation process. So far, actual data with different weights have been used for analysis but without equal weights it is difficult to carry out comparative analyses. In order to avoid this problem and extract

maximum information out of the actual data, all the sub-criteria have to be changed into one scale. That means similar weight is given for all the sub-criteria and all the scores of the organization is transformed into one scale as has been attempted above at the criteria level analyses.

Comparative analyses are conducted by skewness, mean and standard deviations of the sub-criteria. Those sub-criteria that have higher skewness and lesser mean with minimum standard deviation are listed out and cross checked from the above results. In this way, the root cause of quality problems in the Ethiopian industries is identified and represented by a fish-bone diagram (Figure 4).

Conclusion

Through analyses of the EQA self-assessment report evaluation, generally, quality management practices in Ethiopia was found to be low in all the tenets including leadership, policy and strategy, resources management, process management, customer satisfaction, business performance and impact on society. Among these factors, policy and strategy is the most critical problem area despite the least weight given by the EQA. Comparatively, the service industries quality management practice is weaker than that of the manufacturing industries as measured by all the quality parameters. Therefore, the quality promoters, particularly the government should give special attention to the service industries quality. However, both manufacturing and service industries should be supported to laydown their day-to-day activity on a long term strategy and also to improve the root causes for the poor quality management practice.

It is necessary to propose intervention points for the consideration of the industries. There are a number of literatures that advise about the means and mechanism for improvement. Often the literatures lack clarity and consistency on the measures to be implemented at the shop floor level. Sometimes, the literature mixes-up the cause and effect, thereby making it difficult to decide on the measures to be implemented. For example, in all quality awards including that of EQA both the causes and the effects of quality improvement efforts are evaluated. But, when an organization needs to improve its performance, the starting point of the analysis and intervention should be only on the side of the causes. In the EQA manual, the causes are leadership, policy and strategy, resources management and processes management. Leadership is intertwined with all the other causes and hence it is difficult to consider it independently. Therefore, the research proposes to consider policy and strategy, resources management and processes management within the industries.

As a whole future research should be conducted in the

Table 7. Descriptive Statistics — sub-criteria.

	All			Manufacturing			Service		
	Std. Deviation	Skewness	Kurtosis	Std. Deviation	Skewness	Kurtosis	Std. Deviation	Skewness	Kurtosis
Commitment to excellence and continuous improvement	3.25	-0.41	-0.08	2.34	0.14	-0.61	3.73	-0.16	-0.62
Development & deployment of policies & strategies	4.48	-1.88	4.38	1.95	-0.21	-1.42	5.28	-1.35	1.91
Allocation of appropriate resources	4.59	-0.3	-0.52	3.93	-0.52	-0.05	4.94	-0.02	-0.59
Motivation and recognition of employee's effort	4	-0.57	1.16	3.34	0.19	0.4	4.55	-0.86	1.36
Customer relationship management	5.58	-1.11	0.73	3.13	-0.04	-0.63	6.9	-0.76	-0.71
Leader's involvement in achieving organ. Objectives	5.14	-0.87	0.97	4.38	-0.13	-1.29	5.76	-1.06	1.21
Public responsibility	3.73	-0.45	-0.53	3.22	-0.29	-0.98	4.01	-0.36	-0.73
Relevant policy and procedures	6.62	-1.06	3.55	5	0.6	-0.14	7.81	-1.44	3.78
Sound and focused strategy	5.22	-1.21	1.78	3.89	-1.35	2.07	5.93	-0.93	1.1
Deployment of policies and strategies	4.67	-0.97	0.43	3.63	-1.35	1.9	4.93	-0.71	-0.06
Targeted human resources management	5.87	-1.53	3.9	4.31	-1.1	0.43	6.41	-1.51	3.86
Optimized material resource management	3.09	-0.81	0.41	1.79	0.1	-1.42	3.11	-0.54	-0.4
Effective financial resources management	5.37	0.14	0.99	5.55	-0.13	2.78	4.37	-0.26	-0.78
Efficient facilities management	6.12	-1.33	1.5	5.61	-3.14	10.91	5.72	-0.79	0.76
Knowledge - based information management	5.51	-0.72	-0.4	5.45	-0.91	0.47	5.58	-0.64	-0.75
Optimized product/service processes	8.02	-1.25	1.48	7.48	-2.21	6.14	8.43	-0.78	0.34
Synergic supporting processes	6.98	-0.42	-0.92	5.22	-0.94	1.5	6.77	0.02	-1.37
Processes planning and control	7.5	-0.97	0.43	3.75	0.15	-1.02	8.09	-0.45	-0.73
Integrated business processes	6.29	-0.94	0.69	4.59	-0.63	-0.37	6.76	-0.76	0.08
Review and improvement of processes	6.93	-0.64	-0.24	5.04	-0.65	-0.21	7.15	-0.34	-0.67
Exceeding internal customers' satisfaction	19.74	-0.99	0.53	17.72	-1.89	5.8	20.12	-0.6	-0.61
Meeting internal customers' satisfaction	15.81	-1.41	2	14.41	-2.74	9.32	14.71	-1.32	1.76
Review and evaluation of customer satisfaction	7.17	-0.1	-1.04	5.69	0.01	-1.17	8.2	0.06	-1.31
Level of product/service comparative value	8.22	0.07	-1.1	7.94	0.06	-1.17	8.61	0.1	-1.05
Degree of financial performance	15.06	-0.99	0.8	14.76	-1.12	1.45	15.24	-1.08	1.01
High market share	9.72	0.57	2.09	10.15	1.08	4.11	8.74	-0.15	-1.26
Increased productivity	11.76	-0.38	0.07	9.38	-0.02	-0.37	12.9	-0.21	-0.19
Significant socio - economic impact	12.38	-0.6	0.32	10.14	-0.1	-0.39	13.14	-0.59	-0.1
Enhanced environmental impact	7.64	-0.34	-0.51	8.11	-0.43	-1.25	7.43	-0.28	0.5

field of quality management in Ethiopia to increase effectiveness and efficiency of the industries and make them more competitive in international

markets. Specifically, research endeavors should concentrate on quality improvement in the service industries and in the sector of public

administration. Identification and the knowledge of customers' expectation are the starting points for embarking upon quality improvements.

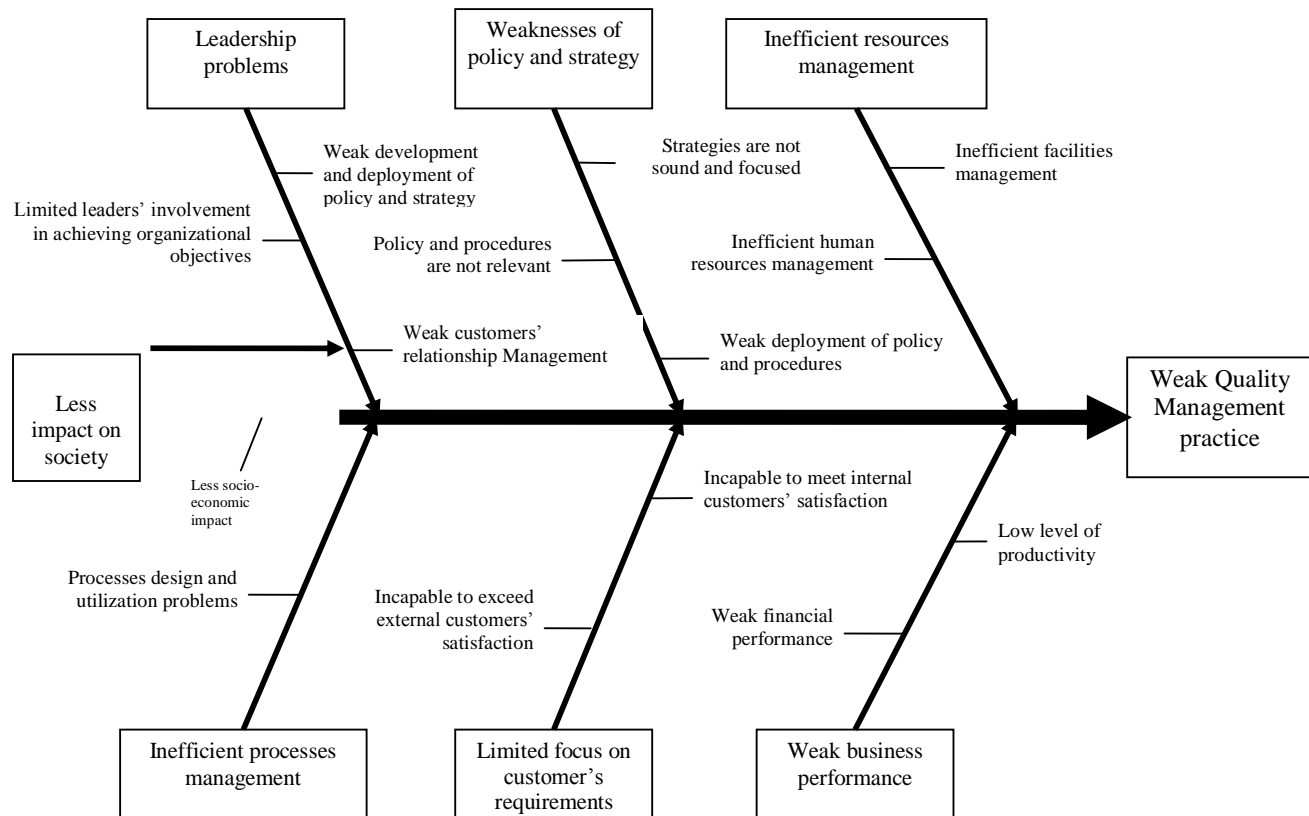


Figure 4. Root causes of quality problems in Ethiopian industries

Researchers could study the consumers' behavior so that industries could align their products and processes to customer needs and requirements.

Conflict of Interests

The authors have not declared any conflict of interests.

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Full Length Research Paper

Export diversification and economic growth in some selected developing countries

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Nowadays, export diversification has become one of the most important economic objectives of development strategies in the developing countries. For various reasons, such as preventing instability in export prices of primary products in global markets and consequently, reducing fluctuations in exchanges of them compared with industrial goods, producing dynamic benefits resulted from exporting various goods and increasing productivity of production factors may increase the rate of economic growth. The main purpose of this study is to investigate the role of export diversification in the economic growth of some selected developing countries over the period of 2000-2009. Accordingly, the relationship among GDP per capita, physical capital stock, labour force, and export diversification index was studied using the generalized method of moments (GMM). The results showed that reducing export specialization and, consequently, increasing export diversification have significantly positive effect on the rate of economic growth of these countries.

Key words: Export diversification, economic growth, developing countries, GMM.

INTRODUCTION

In recent years, many policy makers have been interested in the issue of export diversification in economic literature, which means increasing the number of export goods and decreasing the dependence on a single source of income. However, different studies have proposed different definitions. Alwang and Seigel (1994) and Amin Gutierrez de Pineres and Ferrantino (1997) have defined diversification as development of export portfolio of a country from primary products to industrial goods. In another group of studies such as Love (1983) and Hirsch and Lev (1971), diversification is expressed as not specializing the export portfolio in a limited number of export goods. Therefore, the larger the number of export goods in an export

portfolio, the more diverse the exports of a country would be.

Economic development is a synchronous process with transformation of structural form in which the countries move from the production of primary products towards the export of industrial goods. The most important reason for this change is the income elasticity of demand for the exports of industrial goods in global markets. Many developing countries, which are dependent on primary products or offer limited range of export portfolio, often suffer from uncertainty of their exports. Therefore, export diversification is a way to reduce these kinds of limits.

Another important issue is the competitiveness of the

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countries' exports in global markets and increasing growth of foreign trade exposing their exports to international competition. The purpose of this article is to investigate the role of export diversification in the economic growth of some selected developing countries. In the first and second sections, export diversification and its relation to economic growth will be studied theoretically and experimentally. In the third section, export diversification index will be defined and the procedure of this variable will be analyzed. The fourth section will discuss the model and classification of data. In the fifth section, the economic model of the developing countries over the period of 2000-2009 will be analyzed. And, finally, the sixth and seventh sections will include conclusions and suggestions respectively.

THEORETICAL BASIS

Recent studies in the literature of international trade have emphasized the role of trade in speeding up innovation and facilitating transmission of knowledge and technology. New theories of growth focus on advantages of a dynamic export sector based on increasing returns to scale and external effects of export sector on the other sectors. These external effects mainly include expansion of advanced techniques, employment of highly-skilled work force, and improvement of managerial skills due to the intense competition that exporters face in global markets (Romer, 1990; Barro, 1991; Sachs and Warner, 1995). Theoretically, there are various ways by which export diversification may lead to increase in economic growth. Herzer and Lehman (2006) believe that export diversification may have positive effect on economic growth by reducing dependence on the limited number of primary products. This theory may prove right about the developing countries that are heavily dependent on the exports of primary products and farming sector. Based on theories of the structuralist economists, developing countries in order to achieve a stable economic growth should move from exporting primary products towards exporting industrial goods (Chenery, 1979; Syrquin, 1988). Furthermore, according to the Prebisch-Singer theory, export diversification can prevent weakening of exchange relationships in the developing countries.

Potentially, there are two main channels concerning the effect of export diversification on economic growth. The first channel involves preventing the instability of export incomes known as portfolio effect. This view suggests that the developing countries exporting primary products often suffer from price instability of export goods. Price instability of export goods makes the exporters of these goods face fluctuations in their export incomes. Moreover, these fluctuations may lead to rise in uncertainty of macroeconomics variables and can be harmful for long-term economic growth.

Therefore, higher degree of export diversification will

lead to fewer fluctuations through creating higher stability of the export incomes and will increase purchasing power in these countries. In turn, the increase purchasing power will result in larger investment and, consequently, rapid economic growth. In addition, exchange rate in the countries that are considerably dependent on limited number of products experiences fewer fluctuations than it does in the countries with diverse economic structure. These fluctuations may be an obstacle to investment in exchangeable goods and services (Ghosh and Ostry, 1994; Bleaney and Greenaway, 2001). Also, Agosin (2007) points out that the countries offering limited range of export portfolio, due to frequent fluctuations in export incomes, would face a variety of fluctuations which, in turn, would lead to low rate of economic growth in these countries. He argues that during economic depression the work force and available capacities would go through unemployment to such an extent that they may not easily return to the state of equilibrium in the period of economic prosperity.

The other channel of effect is associated with dynamic advantages of export diversification. Strategy of export diversification in terms of desirable effect on resource allocation not only may result in assured improvement in the allocation based on countries' relative advantage in international trade but, more important than that, would lead to realization of dynamic profits. While resource reallocation based on relative advantage raises the income level, the dynamic profits of export diversification play an important role in increasing the rate of income growth. Increasing use of the factories' capacities, realization of economies of scale, and job creation through exporting labor-intensive products have caused a multiplier effect that increases the demands for intermediate inputs and the consumer demands as well as leading to growth in the total factor productivity. The marginal factor productivity in export-oriented industries is significantly higher than that of other industries. This difference seems to be partly due to beneficial side effects of the sector developed by export sector (Barmaki, 1378: 940).

A review of experimental studies

We found no research in Iran concerning the role of export diversification on the economic growth. Thus our review of experimental studies is limited to foreign studies.

Using time series data and AEG model, Naudé and Rossouw (2011) investigated the relationship between export diversification and economic performance in Brazil, China, India, and South Africa during that period of 1962-2000. They concluded that there is a U relationship between export specialization and the growth of per capita income in China and South Africa. The findings from Granger causality method showed that there is a causal relationship between export diversification and per capita income in Brazil, China, and the Saharan countries

in Africa. Furthermore, the findings resulted from AEG model showed that in South Africa export diversification has a positive and very significant effect on economic growth of these countries during the period.

Using time series techniques and Granger causality in their research, Arip et al. (2010) studied the long-term relationship between export diversification and economic growth during 1980-2007 in Malaysia. The results showed that export diversification has a remarkable role in the economic growth of Malaysia. Furthermore, they suggested that Malaysia has to diversify its exports in order to reach a sustainable economic growth.

Dalila and Eric (2008), in a research about MENA group (the countries of Middle East and North Africa), pointed out that export diversification has become the most important goal of development strategies in Middle Eastern and North African countries. In addition, direct foreign investments can play a key role as a complementary factor for export diversification in the process of economic development. Using pooled data method and GMM model, they showed that direct foreign investment and export diversification have a positive and significant effect on economic growth of this group of countries.

Export diversification index

Some of the researchers investigating the effect of export diversification on economic growth are Arip et al. (2010). They used DSD (degree of specialization and diversification) as their export diversification index for Malaysia. DSD index was introduced by Balassa (1989) and is calculated as:

$$\sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (RCA_i - \bar{RCA})^2} \quad (1)$$

Where N represents the number of goods, indicates the relative advantage of export goods, and indicates the mean of index for N goods from the sample. In fact, this method uses the standard deviation of index as the export diversification index. The equation (2) shows the mathematical relations of index. Based on the equation (1), it is evident that a lower standard deviation in this equation indicates a higher degree of export diversification. However, a higher standard deviation in the equation indicates a higher degree of export specialization. In other words, if the export diversification index reduces during a period, then it will mean that the country in question has experienced a higher degree of export diversification during that period and vice versa.

$$RCA_i^j = \frac{\{x_i^j\} / \{x_i^w\}}{\{x_i^j\} / \{x_i^w\}} \quad (2)$$

In equation (2), is the relative advantage index, represents

the goods exported by the country, indicates the total exports of the country, represents the total goods exported in the world, and finally represents the total exports in the world.

Figure 1 shows the process of export specialization (export diversification) in the selected countries. As it is shown, export specialization index for these countries has been in decline from 2002 to 2008. This indicates that, in recent years, the developing countries have keenly been pursuing the policy of export diversification and trying to develop and diversify their export portfolio.

DATA DEFINITION

Generally, we can apply three methods to study the effects of trade policies on economic growth; that is, panel observations, time series, and general equilibrium models. The method of panel data was used in this research.

Data collection

To study the effect of export diversification on economic growth, the data from 23 developing countries with more similar economic conditions and more suitable data were used. Furthermore, the issue of export diversification has been high on the agenda. The selected countries included Argentina, Algeria, Ecuador, Indonesia, Iran, Brazil, Bangladesh, Bolivia, Pakistan, Turkey, Tunisia, Peru, Chile, Saudi Arabia, Colombia, Philippines, Malaysia, Morocco, Egypt, Mexico, Nigeria, India, and Venezuela.

Determining the variables

In this research, generalized method of moments (GMM) was used as an estimation method for dynamic data panel in which cross-sectional data and time series data are employed.

The general model of regression for cross-border growth is:

$$\text{Ln}y_{it} = \alpha \text{Ln}y_{i,t-1} + \beta' \text{Ln}X_{it} + \varepsilon_{it} \quad (3)$$

Where is real GDP per capita, is lagged real GDP per capita, is a matrix of explanatory variables, and is error term of the regression. We apply the Arellano-Bond approach (Arellano and Bond, 1991) to estimate model and remove fixed effects and we use instruments matrix to remove the correlation of the lagged variable with the other explanatory variables. In this approach, Arellano and Bond propose a two-stage GMM estimator. In experimental studies, various variables are used for X vector, such as physical investment, human capital, population, labor, government expenditures, foreign direct investment, exchange rate, etc. Regarding particular conditions of the selected countries and the available data, the following model may be used to examine the effect of export diversification on their economic growth:

$$\text{LnGDPP}_{it} = \alpha + \text{LnGDPP}_{it-1} + \beta_1 \text{Ln}K_{it} + \beta_2 \text{Ln}L_{it} + \beta_3 \text{Ln}ED_{it} \quad (4)$$

Where GDPP, K, L, and ED represent GDP per capita, total physical capital, labor force, and export diversification index respectively. In this equation, i and t indicate the relevant sections and time respectively.

The required data for annual model estimation for the selected countries during 2000-2009 are as follows:

GDPP: GDP per capita at the fixed price of 2000, WDI (2010)

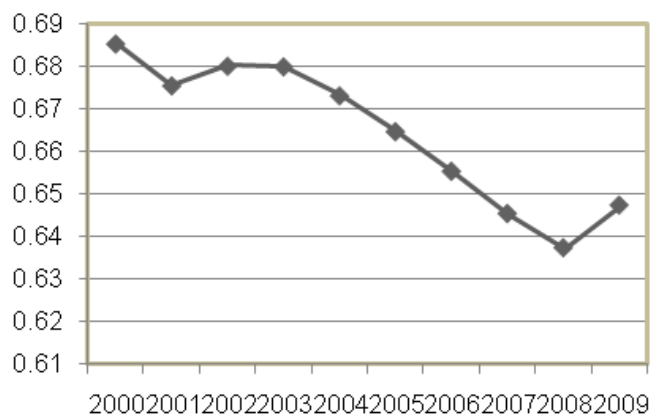


Figure 1. The process of export specialization (export diversification) in the selected countries. Source: calculated using sample data.

Table 1. Equation (4) estimation, fixed effects.

Dependent variable: Real GDP per capita			
Variable	Coefficient	T-Statistic	Probability
LnGDPP(-1)	0.21	14.68	0.00
LnL	0.54	27.57	0.00
LnK	0.15	28.49	0.00
LnED	-0.27	-9.61	0.00
J – Statistic			0.292
Wald Test	215.64		

Source: calculated using sample data method results.

K: gross fixed capital formation at the fixed price of 2000, WDI (2010)

L: active labor force, WDI (2010)

ED: export diversification index (DSD), UNECTAD (2011)

Model estimation and coefficient interpretation

In this section, we estimate equation (4) and present the results. However, the main problem in estimating the models is that the lag of dependent variable on the right side of the equation is related to the country-specific cross-sectional effects. This model makes the estimation by means of pooled data (fixed effects or random effects) biased and inconsistent. Therefore, in order to estimate the models, we used the generalized method of moments (GMM) which is developed for dynamic panel models. Moreover, the variable lag as an instrument in the GMM estimator is used to remove the correlation of the lagged dependent variable with the error term. The results of estimation after various tests are shown in Table 1.

As shown in Table 1, all the variables in the model are statistically very significant and the coefficients are consistent with the economic theories. According to the

results of Wald test that involves distribution with degrees of freedom equal to the number of explanatory variables minus the fixed component, the null hypothesis that all the coefficients are zero at the significant level of 1% is refuted and, consequently, the validity of the estimated coefficients is confirmed. Also, the Sargan test statistic, which involves distribution with degrees of freedom equal to the number of over-identifying restrictions, refutes the null hypothesis that the residuals are correlated with the instrumental variables? According to the results of this test, the instrumental variables applied for model estimation are valid enough. Thus, the validity of results to be interpreted is confirmed.

The coefficient of export specification (diversification) index is 0.27 and statistically significant at the level of 99% indicating that export diversification has positive effect on the developing countries' economic growth. As the model is estimated in logarithmic form, the variable's coefficient indicates its elasticity to economic growth. Regarding the estimated coefficient of export specification (diversification) index, if the export specification reduces by 1% in the developing countries, the economic growth will increase by 0.27%. This is consistent with the studies of Heiko (2008) on about 80 developing countries and Dalila and Eric (2008) about the countries of Middle East and North Africa and many other studies carried out in developing countries. The coefficient of export specification index estimated by pooled data and logarithmic method has always varied from 0.16 to 0.30 and increase in export diversification has had statistically positive effect on the rate of these countries' economic growth. Furthermore, the variables of lagged GDP per capita, labor force, and physical capital have had positive and statistically very significant effect on the rate of economic growth of these countries.

Therefore, regarding the findings, it may be suggested that the effect of export diversification on economic growth of the countries in question is positive and increasing export diversification and export development based on the relative advantages and reducing the portion of primary products in export portfolio may lead to increase in the rate of economic growth through increasing export diversification and decreasing the fluctuations of export incomes.

Conclusion

In recent years, many policymakers have been interested in the issue of export diversification in economic literature that involves increasing the number of export goods and decreasing the dependence on a single source of income. For various reasons, such as instability in export prices of primary products in global markets and, consequently, high fluctuations in exchanges of them compared to industrial goods, this issue has also attracted many policymakers in the developing countries.

The main purpose of this research is to investigate the

relationship between export diversification and economic growth of some selected developing countries. Concerning the findings of the researches carried out, there is no consensus about the way in which export diversification influences the economic growth in different countries; that is, some confirm positive effect and some other confirm the negative effect.

In this research, the relationship among GDP per capita, physical capital stock, labor force, and export diversification index in 23 developing countries was studied using the GMM method. The findings showed that the effect of export diversification on these countries' economic growth is positive and significant. In fact, increasing export diversification and export development based on the relative advantages and reducing the portion of primary products in export portfolio as well as decreasing the fluctuations of export incomes will lead to increase in the rate of economic growth in the long term.

Policy recommendations

We can expect that if a country can encourage a proper and diverse mixture of export portfolio, then all or remarkable portion of the fluctuations in a subset of export goods may be evened out. Therefore, diversification of export goods is recommended as a solution to get rid of drops in export prices and export earnings instability.

Conflict of Interests

The authors have not declared any conflict of interests.

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Full Length Research Paper

The critical success factors assessment of ISO 27001 certification in computer organization by test-retest reliability

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In the era of fast growing information technology, information security management system (ISMS) assessment has become a top priority of considerations in the operational organization because potential crisis increases when ISMS is vulnerable. The impact of ISMS will also bring revolutionary change on the management of business. The example used in study is the computer center at the Shih Chien University in Taiwan that the ISO27001 certification was done by 2011 and 2012. With 54 hours of ISO27001 auditor course training to the task group (TG), we carried out questionnaires and evaluated the weights of critical success factors (CSFs) for ISO27001 certification by the vote-ranking analytic hierarchy process (VAHP) model. The findings show that top-down ranking involves policy and planning, execution and management, checking and correction, management reviews and provides a heuristic two stages and seven-step procedure for introducing the CSFs of ISO27001 certification. There are no significant differences between 2011 and 2012 ranking results.

Key words: Critical success factor (CSF), ISO27001, vote-ranking analytic hierarchy process (VAHP).

INTRODUCTION

When information technology is growing faster than ever before, the information security management system (ISMS) assessment has become a top consideration in the operations of most organizations. The vulnerable ISMS would bring disaster to the enterprise. The impact of ISMS will also bring revolutionary change to the management. The International Organization for Standardization (ISO) and the International Electro technical Commission (IEC) have created a specific system for global standardization. National certification bodies, the members of ISO or IEC, are the technical committees established by a specific organization that they help to deal with technical activities in the specific fields in terms

of harmonizing national standards with International Standards. The ISO27001 international standard introduces a system approach for establishing, implementing, operating, monitoring, reviewing, maintaining and improving organization's information security. It adopts the "Plan-Do-Check-Act" (PDCA) process model, which is applied to structure all ISMS processes. There are 11 controls including security policy, organization of information security, asset management, human resources security, physical and environmental security, communications and operations management, access control, information systems acquisition, development and maintenance, information security incident

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management, business continuity management as well as compliance (ISO/IEC 27001, 2005).

The problem for many organizations is the setup of their information security management system. The solution is to find way to learn and initialize an effective information security management system. In fact, in order to do so, a set of successful management by ISO27001 certification is the right way. The critical success factors (CSFs) in project are the criteria with which the success of the project can be judged and evaluated, and defined distinctly and clearly being an essential issue. Examples for ISMS's CSFs are to deliver its functionality, fulfill the ISMS requirement of the client, satisfy all stakeholders' needs, and meet the pre-stated objectives. The ISO27001 certificated process is ensured to implement and maintain the appropriate level of information security by the third party certification.

The objective of this study is to complete the third party certification analyses on the implemented ISO27001 in the computer center of Shih Chien University (SCU) in Taiwan. This study has recruited students, who have accepted forty-four hours of ISO27001 auditor course for tackling the questionnaires by test-retest reliability. The test-retest reliability is to measure the reliability by performing the same survey with the same group of people but at different time; then followed by the vote-ranking analytic hierarchy process (VAHP) model for the evaluating the weights of CSFs. The assessment shows the process of validating and accrediting the management information security issues of CSFs for ISO27001 certification.

The rest of this paper is organized as follows: Literature review on CSFs-related issues, then the multiple criteria decision-making methods. Third, the origin and evolution of the methodology of vote-ranking analytic hierarchy process (VAHP), from data envelopment analysis (DEA) is introduced. Fourth, the two stages and seven-step procedures for CSFs of ISO27001 certification project are illustrated and a numerical example is provided with two questionnaires in 2011 and 2012. Discussion and result are the last, where comparison is made in terms of the result of the CSFs of ISO27001 certification.

LITERATURE REVIEW

The awareness of critical issues in ISMS has implications for business, researchers, academic institutions and professional societies. However, what is important in ISMS at any given time is dependent on both the management and technology environment at that time.

Therefore, periodic assessment of the critical issues in IS and MS is necessary. Billions of dollars have been spent in the projects of software security because their success is very important to organizations, system departments, and system managers. Software security is the key factor for deciding the success or failure of a software product in nowadays rapid changing market.

Since software security plays a key role in IS, DeLone

and McLean (2003) proposed an IS success model that consists of six interdependent measures of IS success: system quality, information quality, user satisfaction, individual impact and organizational impact. System quality and information quality are two major components of software quality. Hartog and Herbert (1985) employed surveyed MIS managers of *Fortune 1000* companies throughout the USA. They ranked 23 issues with top five issues which were: aligning MIS with business goals, data utilization, educating senior personnel, software development, and productivity. The IS chief executives were asked to write down their CSFs. The most cited CSFs were: system development, data processing, human resource development, management control of MIS/DP organization, relationships with the management of parent organizations, and management of change (Martin, 1982).

CSF for non-information issued application

The CSFs provided a simple but theoretically sound multiple-criteria methodology for the evaluation of key performance activities or business alternatives. The strength of CSFs lies in its ability to structure a complex, multi-person, multi-attribute problem hierarchically, and then to separately investigate each level of the hierarchy, combining results as the analysis progressing. This CSFs-evaluated process can then be translated into priority weights or scores for ranking the successful practices or processes. In many situations, this CSFs-evaluated process can be designed for multi-criteria benchmarking and performance management, such as customer relationship management (King, 1988; Alshawi et al., 2011), new product development (Chen and Lee, 2009; Sun and Wing, 2005), enterprise resources planning (Brown and Vessey, 2003; Malhotra and Temponi, 2010; Salmeronand, 2010), knowledge management (Tabrizi et al., 2011), ISO and total quality management (Oakland, 1993; Singels et al., 2001; Poksinska et al., 2003; Sila and Ebrahimpour, 2005; Sambasivan and Fei, 2008; Sammalisto and Brorson, 2008; Ramli et al., 2011), hospital management (Stocka et al., 2007; Blake et al., 2010), IS Integration (Stylianou et al., 1996; Yen et al., 2008).

Belassi and Tukul (1996) suggested a new scheme that classifies the critical factors, and describes the impacts of these factors on project performance. The statistical analyses of the results demonstrated the differences between the critical success factors identifying in a previous study from literature and the factors identifying with the use of their scheme. Many critical factors, such as factors related to project managers' performance, factors related to team members and environmental factors, became apparent with this study. Hoffmann and Schlosser (2001) used a comprehensive questionnaire which was to interview the random samples of key executive in 164 Austrian small and medium-sized enterprises

(SMEs). They identified critical success factors in alliance-making with special consideration given the specific situation of SMEs. Fortune and White (2006) reviewed a set of critical success factors from 63 publications which had demonstrated that the formal system model was capable of distinguishing the successful and unsuccessful projects. In addition to the literature described above, the readers were referred to critical success/failure factors of project management by theoretical studies or empirical studies (Ahmed and Capretz, 2007; Fusco, 1997; Jeannette, 1998; Cooke-Davies, 2002; Wang and Huang, 2006; Gray and Larson, 2008; Raymond and Bergeron, 2008; Lu and Yuan, 2010, Ika et al., 2010).

CSF for information issued application

The information system (IS) success model is widely used to evaluate IS implementation. The updated model consists of six constructions, which are net benefits, intention to use system, user satisfaction, and three independent variables including system quality, information quality and service quality. System quality in e-learning studies is defined as help functions and end-user facilitation in the education process. Information quality is defined as end-user performance enhancement resulting from the use of system information. Service quality is defined as providing quality support to facilitate system usage (Guynes and Vanecek, 1996; Soong et al., 2001; DeLone and McLean, 2003; Petter and McLean, 2009). The perception of critical IS issues depends greatly on environmental characteristics and the backgrounds of the chief executives (Badar, 1992; Fitzgerald, 1993).

Project management and information systems project management usually acquired by organizations as software packages are meant to provide managers with the decision-making support which is needed in planning, organizing, and controlling IS projects. The better information leads to a better insight into what should be delivered by the project. By improving the project planning, budget and design, project risk management is assumed to contribute to the success of the project. In particular, very little has been written on international development project success criteria and critical success factors. Most of the IS projects are too frequently failure to achieve their goals due to a number of problems that could be termed “managerial” and “organizational”: imperfect IS project design, poor definition requirement, delays between project identification and start-up, delays during project implementation, cost overruns, coordination failure, etc. (Chapman and Ward, 1997; Maguire, 2002; Yeo, 2002; Desouza and Evaristo, 2006; Raymond and Bergeron, 2008; Ahsan and Gunawan, 2010; Bakker et al., 2010; Gorla and Lin, 2010; Yang et al., 2012),

While many organizations across all industries have embraced various types of e-business solutions, a considerable number of cases indicate that creating the

successful services on the internet or APP-enterprise is a challenging task. Channel conflicts, legacy systems, resistant business partners, confusion on strategy, and corporate cultures prevent existing firms from successfully integrating e-business into business practices. A number of CSFs of e-learning systems studies have been found in both developed and developing countries. Along with the rapid development of e-business, firms around the world currently encounter rigorous business competition. With greater customer demand and newly emerging technologies, firms must implement innovation and reform in response to the significant challenges they face (Dubelaar et al., 2005; Salmeron and Herrero, 2005; Sung, 2006; Cotteleer and Bendoly, 2006; Shaha and Siddiquib, 2006; Selim,2007; Chang et al., 2009; Chang et al., 2011; Bhuasiri et al., 2012).

METHODOLOGY

Data envelopment analysis

Data Envelopment Analysis (DEA) is a set of methods and models based on mathematical programming and used for characterizing the efficiencies and inefficiencies of decision-making units (DMUs) with the same multiple to-be-minimized and to-be-maximized indices. DEA is a relative efficient measurement to calculate weights by comparing the performances. The efficiency index of DEA is the ratio of best-practice performance to actual performance. There are three powerful DEA models include the Additive model (Charnes et al., 1985a), BCC model (Banker et al., 1984), and a classical model known as the CCR model (Charnes et al., 1978). To compare overall supplier performance, they proposed a novel approach which bases on DEA, and provided benchmarks on which the poorly performed suppliers could rely on to improve their service. Their studies employed the questionnaire of supplier’s capability and performance assessment to collect data for those of to-be-minimized and to-be-maximized variables (Seiford, 1996; Ram et al., 2001; Banker et al., 2004).

Given data, we measured the efficiency of each DMU through the optimization process. Let DMU_o be DMU_o as it was evaluated, where o ranges from $1, 2, \dots, n$, each of which uses an amount x_{io} of input, $i = 1, \dots, m$, and produces the output y_{ro} , $r = 1, \dots, s$. The objective is to find the weight of v_i , $i = 1, \dots, m$ for inputs, and u_r , $r = 1, \dots, s$ for outputs. Then to maximize the measurement, it is to divide the outputs by inputs. Charnes et al. (1978) formulated the DEA model as follows:

$$\begin{aligned}
 \text{Max } \theta &= \frac{\sum_{r=1}^s u_r y_{ro}}{\sum_{i=1}^m v_i x_{io}} \\
 \text{s.t. } \frac{\sum_{r=1}^s u_r y_{rj}}{\sum_{i=1}^m v_i x_{ij}} &\leq 1 \quad (j = 1, \dots, n) \\
 v_i &\geq \varepsilon > 0, \quad i = 1, \dots, m \\
 u_r &\geq \varepsilon > 0, \quad r = 1, \dots, s
 \end{aligned}
 \tag{1}$$

Vote-ranking analytic hierarchy process

DEA is an analytical procedure for measuring the relative efficiency of DMUs that perform the same type of functions and have the identical goals and objectives. The weights used for each DMU are those maximized ratio of the weighted input over the weighted output. A well-known method for ranking candidates in a ranked-voting system is to compare the weighted sum of their votes when the suitable weights are determined. Cook and Kress (1990, 1992) also presented an approach to the problem which is to rank candidates in a preferential voting. They considered an alternative method but it does not specify the sequence of weights by applying DEA.

It is rational to suggest the rule that the weight of higher ranked votes must be no less than the next ranked votes. Let n be the number of voters which means there are R candidates vote in S places, where R is much larger than S . While considering aggregation of votes where x_{rs} is the number of the s th-place votes received by the candidate r , r ranged from 1 to R , then a discrimination intensity function $d(s, \varepsilon)$ can be defined, with the model processed (2).

Where, the u_{rs} is the weight of candidate r placed on s th-place votes; the notation Z_r is the objective function to evaluate candidate r 's desirability. The candidate expects for the assigned weight u_{rs} so as to maximize the sum of weighted votes in terms of *candidate*. Hence, $d(1, \varepsilon)$ ensures that first-place votes are not less than second-place votes. In theory, it allows the candidate to choose the most favorable weights in terms of one stand under normal DEA condition. With the restriction of additional "assurance region", the weight for a s th-place vote should be greater than the $(s+1)$ th-place vote.

$$\begin{aligned}
 Z_{rr} &= \max \sum_{s=1}^S u_{rs} x_{rs} \\
 \text{s.t. } Z_{rq} &= \sum_{s=1}^S u_{rs} x_{qs} \leq 1, \quad q=1, 2, \dots, R; \\
 u_{rs} - u_{r(s+1)} &\geq d(s, \varepsilon), \quad s=1, 2, \dots, S-1; \\
 u_{rs} &\geq d(s, \varepsilon).
 \end{aligned} \quad (2)$$

Green et al. (1996) further developed this model by setting certain constraints to the weights. They pointed out that the form $d(s, \varepsilon)$ would affect the ranking result and does not allow DMUs to choose their own weights unreservedly. Therefore, they presented an alternative procedure that involves using each candidate's rating by oneself along with each candidate's rating by all candidates. This procedure is referred to as Green's method and consists of two methods of setting constraints: (1) The difference of weight between s th-place and $(s+1)$ th-place for any s is allowed to be zero; and (2) the differences must be greater than zero.

Different vote-ranking methodologies were used in the ranked voting systems such as the DMUs in DEA that have many outputs but with only one input. They proposed a method that determines an entire order of candidates under the condition of decreasing and convex sequence of weights. They incorporated the condition of decreasing and also convex sequence of weights into DEA as the assurance region. They considered that the instability is caused by the above, and inefficient candidates should not be used to discriminate efficient candidates. Efficient candidates would never be changed when discrimination occurs, and under this condition, inefficient candidates are added or removed (Hashimoto and Ishikawa, 1993; Hashimoto, 1997; Obata and Ishii, 2003; Foughi and Tamiz, 2005).

Noguchi et al. (2002) revised the application of Green's method and showed that the different weights among objects gave rise to different ranking results. In the total ranking method by DEA, if

setting particular constraints to a weight, "strong ordering" can be employed, which is characterized by the following constraints: (1') $u_{r1} \geq 2u_{r2} \geq 3u_{r3} \dots \geq S u_{rS}$, (2') $u_{rs} \geq \varepsilon = 1 / [(1+2+\dots+S)n] = 2 / (n * S(S+1))$. The value of u_{rs} in (2') must be positive because it needs to retain the information of the last place that makes $u_{rs} \geq \varepsilon$ reasonable. Weights should satisfy the following inequalities: $u_{r1} - u_{r2} > \dots > u_{r(s-1)} - u_{rs} > u_{rs} - u_{r(s+1)} > \dots > u_{r(S-1)} - u_{rS} > 0$. As $u_{rs} - u_{r(s+1)} < u_{rs} - [(s-2)/(s-1)]u_{r(s+1)}$. In constraints, inequality (2') is derived from the value of ε and inequality (1'). In this multiple criteria case, it is defined as follows:

$$\begin{aligned}
 Z_{rr} &= \max \sum_{s=1}^S u_{rs} x_{rs} \\
 \text{s.t. } Z_{rq} &= \sum_{s=1}^S u_{rs} x_{qs} \leq 1, \quad q=1, 2, \dots, R; \\
 su_{rs} &\geq (s+1)u_{r(s+1)}, \quad s=1, \dots, (S-1); \\
 u_{rs} &\geq \varepsilon = \frac{1}{[(1+2+\dots+S)n]} = \frac{2}{n * S(S+1)}.
 \end{aligned} \quad (3)$$

To rank alternatives, one of the most popular methods is to compare the weighted sum of votes after the right weights being determined to each alternative. The different weights among objects are made in different ranking results proposing a new method of ordering to solve the decision-making problem in weights ranking (Liu and Hai, 2005, 2006; Hai, 2008; Hai and Tsou, 2009). In the paper, the Noguchi's voting and ranking is used to develop criteria in each level from hierarchy analysis process that this methodology is called *Vote-ranking Analytic Hierarchy Process (VAHP)*.

The critical success factors of ISO27001 certification

For ISO-certification project management, International Standard adopts the "Plan-Do-Check-Act" (PDCA) process model to structure all ISMS processes. PDCA is a robust model for implementing the principles in those guidelines, which govern risk assessment, security design and implementation, security management and reassessment. The PDCA process can be interpreted as follows. (1) Plan (establishing the ISMS): Establish ISMS policy, objectives, processes and procedures that is relevant to managing risk and improving information security and to deliver results in accordance with an organization's overall policies and objectives. (2) Do (implement and operation of the ISMS): Implement and operate the ISMS policy, controls, processes and procedures. (3) Check (monitoring and reviewing the ISMS): Assess, where is applicable, measure process performance against ISMS policy, objectives and practical experience as well as report the results to management for review. (4) Act (maintaining and improving the ISMS): Take corrective and preventive actions, based on the results of the internal ISMS audit and management review or other relevant information, to achieve continual improvement of the ISMS (ISO/IEC 27001, 2005). In study, we proposed two stages and seven-step procedures for assessing CSFs of ISO27001 certification (Figure 1).

Stage 1 : Define ISMS issues and group a task group

Step 1: ISO27001 auditor course training and a successful case study

Initially, 50 junior students from information management department were selected and formed a task group. A particular

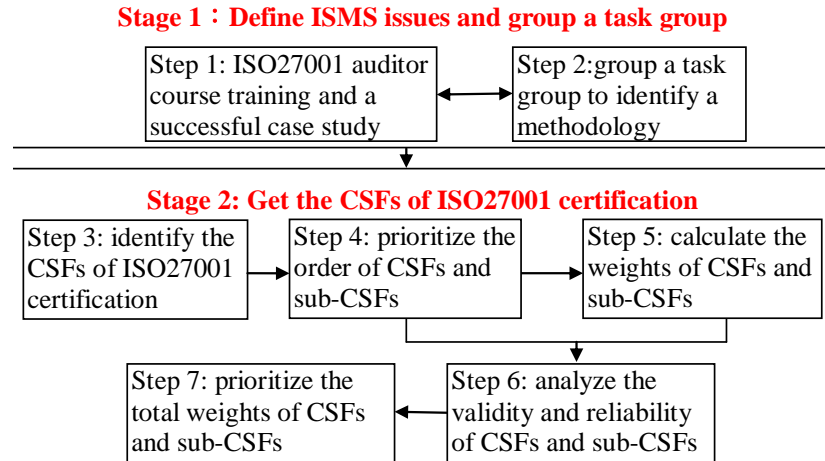


Figure 1. The flow chart of the CSFs of ISO27001 certification.

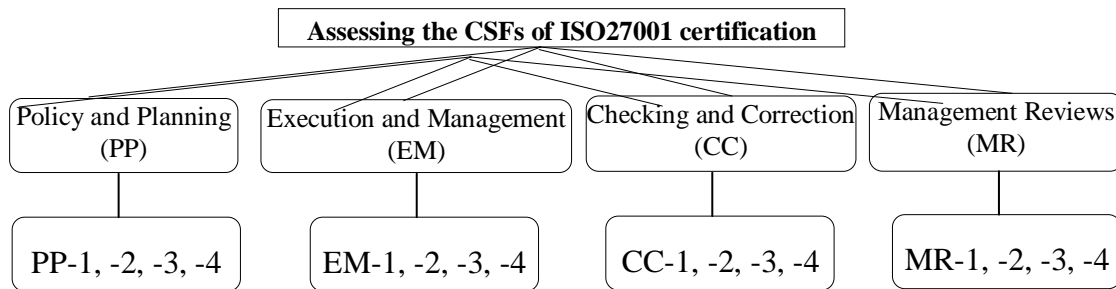


Figure 2. The analytical hierarchy structure of the CSFs of ISO27001 certification.

ISO27001 auditor course training of up to 54 h was given to this task group (TG) before starting their works such as carrying out questionnaires, evaluating and calculating the weights of critical success factors (CSFs) for ISO27001 certification by using VAHP model. The TG understands the internal auditing procedures for assessing CSFs of ISO27001 certification project, an example of the Shih Chien University, ISO27001 certification.

Step 2: group a task group to identify a methodology

In the paper, the Noguchi’s voting and ranking mode (3), originated from DEA method, is used to develop criteria in each level from hierarchy analysis process. This methodology is called VAHP, which has AHP spirits and analytical process, but the weighting method is different.

Comparing the benefits of the VAHP and AHP, the summary is as follows: (1) The VAHP method is easy to understand and used for getting priority or weights. All experts are given the opportunity to examine the priority weights calculating from their initial responses and to assess the reasonableness of the ranking. (2) The construction of the objective hierarchy of criteria, attributes and alternatives facilitates communication of the problem and solution recommendation. (3) It provides “vote ranking” rather than “paired comparison” for quantifying and measuring consistency. (4) The strongest features of the AHP are that they generate numerical priorities from the subjective knowledge expressed by the estimates of paired comparison matrices (Liu and Hai, 2005).

Stage 2: Getting the CSFs of ISO27001 certification

Step 3: identify the CSFs of ISO27001 certification

The interviewed personnel included ISO27001 leader auditors and the director of information computing center. The first step is to structure the problem into a hierarchy (Figure 2). The goal of top level is to select CSFs of ISO27001 certification. There are four criteria for the second level that support the top goal; they are “Policy and Planning (PP), Execution and Management (EM), Checking and Correction (CC), Management Reviews (MR)”. On the third level, all four criteria on level two are decomposed into twelve sub-criteria. On the bottom level, there are twelve different weights of CSFs evaluated in terms of the sub- criteria of the third level.

The CSFs, in terms of SCU according to ISO2700, were evaluated including “S1: Policy and Planning (PP), S2: Execution and Management (EM), S3: Checking and Correction (CC), S4: Management Reviews (MR) (Table 1). The VAHP provided a simple way and with theoretically multiple-criteria methodology, the alternative CSFs was evaluated. It was used to identify sub-criteria, and study each level of the hierarchy independently.

The twelve sub-CSFs are PP-1: Top-manager’s commitment and leadership; PP-2: connect to effective information security policy and objectives; PP-3: Effective process approach; PP-4: Effective information asset risk assessment and improvement, EM-1: Implement and operate the ISMS; EM-2: Establishing roles and responsibilities for ISMS; EM-3: Effective training, awareness and

Table 1. Definitions of the critical successful faction for ISO27001 certification.

CSFs	Sub-CSFs	Definitions
S1: Policy and Planning	PP-1 Top-manager's commitment leadership	Developing clear and effective ISMS strategies and supporting activities, etc., selecting and empowerment project manager, providing sufficient budgets and motivation through leadership and equipping people to achieve them.
	PP-2 Connect to effective information security policy and objectives	Clearly defined and properly communicated strategies and objectives, which can be summarized in the form of a mission statement, compatibility with ISMS requirement, from top to bottom, are to work closely as a winning team.
	PP-3 Effective process approach	Using the international standard to promote the adoption of a process approach for establishing, implementing, operating, monitoring, reviewing, maintaining and improving an organization's ISMS. Identifying the CSFs and critical processes, a term used to represent the most important sub-goal of a business.
	PP-4 Effective information asset risk assessment and improvement	Clearly identifying the risk assessment of confidentiality, integrity and availability for information asset. Developing and publishing effective document of procedure to never-ending improving processes.
S2: Execution and Management	EM-1 Implement and operate the ISMS	Formulating a risk treatment plan that identifies the appropriate management actions, resources, responsibilities and priorities for managing information security risks. They have capability to manage the ISMS activities to meet the organizational objectives or goals.
	EM-2 Establishing roles and responsibilities for ISMS	Clearly establishing roles and responsibilities for information security. Conforming the information security policy and to meet the information security objectives, communications to the organization are essential responsibilities under the law. It is required for continual improvements. Mangers are responsible for all problem-solving activities.
	EM-3 Effective training, awareness and competence	Manager provides that resources of equipment and for training. Ensuring that all personnel whose responsibilities (assigned) defining in the ISMS are capable to perform the required tasks. Providing the necessary trainings or taking other actions for personnel in order to perform work effectively in ISMS.
	EM-4 Effective information risk management	Defining the independent examination of risk assessment to provide information for overall process of risk analysis and risk evaluation. And effective coordinated activities to direct and control an organization with regard to information security or risk.
S3: Checking and Correction	CC-1 Documentation requirements , control of records and documents	Establishing different level records and documents to meet the documentation requirements specified in ISO 27001. For overall PDCA processes, the operating procedures shall be documented, maintained, and made available to all users. The results of the ISMS shall be clearly documented and records shall be maintained well
	CC-2 Emergency management and controlling	Minimizing the risk of ISMS by avoiding the law suits from a breach of contract, the negligence of consumer protection and the faulty ISMS.
	CC-3 Effective internal and system audit management	Conducting a formal quality and information system audit that is requested by ISO27001 with the Self-audit, second party audit (customer) and third party-audit (ISO27001 assessor). The organization shall conduct internal ISMS audits under the planned intervals to determine the control objectives, controls, processes and procedures of its ISMS.

Table 1. Cont'd

	CC-4 Never-ending improvement system	The PDCA approach must focus on the development of problem-prevention mentality, but it is easy to understand the effort that is required to change attitudes and approaches. The organization shall continually improve the effectiveness of the ISMS through information security policy, information security objectives, audit results, analysis of monitored events, corrective and preventive actions, as well as management reviews.
	MR-1 Company-wide involving and improvement	The organization must work closely for achieving perfection. Each unit, each activity, each person in the organization would perform interactively that affects the entire organization. The commitment made by all personnel is a requirement of "Company-wide ISMS improvement". Management review checks each department's ISMS objectives and effects because most of the attacks are preventable by specific security processes.
	MR-2 Effective management review system	The management review system should include the establishment of a process the structure of ISMS improvement team in the organization. It contains the assessing opportunities for the improvements and the necessary changes of ISMS, which includes the information security policy and information security objectives, reviewed inputs and outputs.
S4: Management Reviews	MR-3 Effective motivation management	Employing manpower effectively, we should develop the culture "person oriented" philosophy that can achieve ISMS by means of participation voluntarily rather than be forced under control. The vision is that each employee is willing to devote their talents in achieving the goal of ISMS.
	MR-4 Project knowledge management	There are three levels of ISMS knowledge management, at least. First, set up the course to train employees in terms of basic techniques. Second, learn the enterprise system in details, which includes the system's strengths and vulnerabilities. Third, keep up with the fast-changing world with the potential threats and the way to exploit the talents to cope with it. Professional security consultants or project knowledge management can assist for the initial security strategy setup and a periodic audit. They can provide the continuous learning process and specific system development that can result knowledge creation in the organization. Criminal background check

Sources: references from (Österlea et al., 2003; Oakland, 1993; Cortada, 1996) and ISO27001:2005.

competence; EM-4: Effective information risk management; CC-1: Documentation requirements , control of records and documents; CC-2: Emergency events management and controlling; CC-3: Effective internal and system audit management; CC-4 Never-ending improvement system; MR-1: Company-wide involving and improvement; MR-2: Effective management review system; MR-3: Effective motivation management; MR-4: Project knowledge management.

The test-retest reliability had been applied with same questionnaires carrying out respectively in 2011 and 2012. Fifty effective questionnaires were obtained out of 69 with responsive rate of 72.5%.

Step 4: prioritize the order of CSFs and sub-CSFs

The TG selected different orders for the candidates of CSFs or sub-CSFs. TG had votes from 1 to S (S≤R); R is the number of CSFs or sub-CSFs. For this purpose, four CSFs "S-1, S-2, S-3, S-4" and twelve sub-CSFs "PP-1, PP-2, PP-3, PP-4, EM-1, EM-2, EM-3, EM-4, CC-1, CC-2, CC-3, CC-4, MR-1, MR-2, MR-3, MR-4" were obtained. These criteria were regarded as candidates. Four orders

were drawn from 1 to 4 and sum up as shown in Tables 2 and 3. Table 2 shows the votes of rank (from 1st to 4th) for CSF "S-1" in 2011 and 2012 (27, 10, 7, 6) and (25, 17, 4, 4), respectively. The managers got the order of criteria without the weight. The weight of each ranking was determined automatically by the total votes of each candidate.

Step 5: calculate the weights of CSFs and sub-CSFs

When $n=69$, $S=2$ and $\epsilon=0.00145= \lceil 2/(69 \times 4 \times 5) \rceil$; in Table 2 and Eqs. (3), the weights of eight criteria can be calculated. Table 2 shows the weight of CSFs "S-1, S-2, S-3, S-4" in 2011 and 2012 (1.000, 0.731, 0.584, 0.600) and (1.000, 0.811, 0.705, 0.398). Through normalization process, the results are (0.343, 0.251, 0.200, 0.206) and (0.343, 0.278, 0.242, 0.137).

The weights of Sub-CSF, as shown in Table 3, are also calculated by using the same methodology. The index of S1: "Policy and Planning" indicates the weight for sub-CSFs "PP-1, PP2, PP-3, PP-4" in 2011 and 2012 (0.993, 1.000, 0.923, 0.788) and (0.849, 1.000, 0.737, 0.564). After normalization, those sub-CSFs value turn out to be (0.268, 0.270, 0.249, 0.213) and (0.270, 0.317, 0.234, 0.179).

Table 2. Priority votes and weights for CSFs of ISO27001 certification.

CSFs	Votes				Weights	Ranks
	1 st	2 nd	3 rd	4 th		
S1: Policy and Planning	25(27)	17(10)	4(7)	4(6)	1.000[0.343] (1.000[0.343])	1(1)
S2: Execution and Management	13(8)	22(25)	13(14)	2(3)	0.811[0.278](0.731[0.251])	2(2)
S3: Checking and Correction	12(5)	8(13)	21(17)	9(15)	0.705[0.242](0.584[0.200])	3(4)
S4: Management Reviews	0(10)	3(2)	12(12)	35(26)	0.398[0.137](0.600[0.206])	4(3)
Sum	50 (50)	50 (50)	50 (50)	50 (50)	2.914[1.000] (2.915[1.000])	

WSRT-p value=0.932; Cronbach's α =0.903. *The number in () belongs to 2011 questionnaire survey data, other than the 2012 data. The number in [] represents the normalized data.

Table 3. Priority votes and weights for sub-CSFs of ISO27001 certification.

Sub-CSFs	Votes				Weights	Ranks	sub-CSFs	Votes				Weights	Ranks
	1 st	2 nd	3 rd	4 th				1 st	2 nd	3 rd	4 th		
S1: Policy and Planning							S2: Execution and Management						
PP-1	16 (15)	12 (13)	7 (8)	15 (14)	0.849[0.270] (0.993[0.268])	2 (2)	EM-1	13 (20)	19 (10)	11 (13)	7 (7)	0.971[0.272] (1.000[0.297])	2 (1)
PP-2	21 (16)	16 (11)	10 (18)	3 (5)	1.000[0.317] (1.000[0.270])	1 (1)	EM-2	12 (10)	20 (19)	15 (17)	3 (4)	0.958[0.269] (0.885[0.254])	3 (3)
PP-3	7 (9)	19 (22)	22 (10)	2 (9)	0.737[0.234] (0.923[0.249])	3 (3)	EM-3	18 (15)	10 (17)	15 (11)	7 (7)	1.000[0.281] (0.938[0.278])	1 (2)
PP-4	6 (10)	3 (5)	11 (14)	30 (22)	0.564[0.179] (0.788[0.213])	4 (4)	EM-4	7 (5)	2 (4)	8 (9)	33 (32)	0.636[0.178] (0.579[0.172])	4 (4)
WSRT- p value=0.622; Cronbach's α =0.815							WSRT-p value=0.924;Cronbach's α =0.928						
S3: Checking and Correction							S4: Management Reviews						
CC-1	15 (12)	12 (11)	9 (12)	14 (15)	0.813[0.264] (0.839[0.242])	2 (3)	MR-1	16 (22)	20 (11)	6 (13)	8 (4)	1.000[0.286] (1.000[0.315])	1 (1)
CC-2	23 (16)	12 (19)	13 (10)	2 (5)	1.000[0.325] (1.000[0.289])	1 (1)	MR -2	12 (15)	14 (12)	17 (17)	7 (6)	0.881[0.252] (0.858[0.270])	2 (2)
CC-3	7 (14)	13 (13)	20 (13)	10 (10)	0.670[0.218] (0.909[0.262])	3 (2)	MR-3	8 (2)	9 (15)	18 (10)	15 (23)	0.742[0.212] (0.566[0.178])	4 (4)
CC-4	5 (8)	13 (7)	8 (15)	24 (20)	0.596[0.194] (0.715[0.206])	4 (4)	MR-4	14 (11)	7 (12)	9 (10)	20 (17)	0.870[0.249] (0.749[0.236])	3 (3)
WSRT-p value=1.000; Cronbach's α =0.732							WSRT-p value=1.000;Cronbach's α =0.651						

*The number in () belongs to 2011 questionnaire survey data, other than the data in 2012; the number in [] represents the data by the normalization process.

Step 6: analyze the validity and reliability of CSFs and sub-CSFs

The study of CSFs of ISO27001 certification, the questionnaire and procedure referring to ISO27001 are discussed and confirmed by the director of the computer center, leading auditors and TG. All those contents and contexts should be considered as the "validity" value.

Wilcoxon signed rank test (WSRT), proposed by Wilcoxon (1954), has been applied in the case of a symmetric continuous distribution and nonparametric test. The test is carried out by considering the differences in the ranks (Walpole et al., 1998; Aczel and

Souderpandian, 2002). Table 2 shows these differences of CSFs "S-1, S-2,S-3,S-4" in 2011 and 2012. It is assumed in the null and alternative hypotheses that the distributions of the two populations are identical. The two population distributions are not identical. The value of the statistic lying inside the non-rejection region ($z=-0.085$, p -value=0.932, Cronbach's α =0.903) is far from the critical point for any conventional level of significance, if it is to carry out the test at $\alpha=0.05$. The CSFs of ISO 27001 certification for "S1: Policy and Planning (PP), S2: Execution and Management (EM), S3: Checking and Correction (CC), S4: Management Reviews (MR) between 2011 and 2012 have no significant difference. Other than that, the WSRT methodology was used to find the tests of sub-CSFs in

Table 4. Priority of the total weights of CSFs and sub-CSFs.

CSFs(a)	sub-CSFs(b)	Weights (c=axb)	CSFs(a)	sub-CSFs(b)	Weights(c=axb)
Policy and Planning 0.343(0.343) ↔	PP-10.270(0.268)↔	0.093 (0.092)	Execution and Management 0.278(0.251) ↔	EM-10.272(0.297) ↓	0.076(0.075)
	PP-20.317 (0.270)↔	0.109 (0.093)		EM-20.269(0.254)↔	0.075(0.064)
	PP-30.234 (0.249)↔	0.080 (0.085)		EM-30.281(0.278) ↑	0.078(0.070)
	PP-40.179(0.213)↔	0.061 (0.073)		EM-40.178(0.172)↔	0.049(0.043)
Checking and Correction 0.42(0.200) ↑	CC-10.264(0.242) ↑	0.064 (0.048)	Management Reviews 0.137(0.206) ↓	MR-10.286(0.315)↔	0.039(0.065)
	CC-20.325(0.289)↔	0.079 (0.058)		MR-20.252(0.270)↔	0.035(0.056)
	CC-3效0.218(0.262) ↓	0.053 (0.052)		MR-30.212(0.178)↔	0.029(0.037)
	CC-40.194(0.206)↔	0.047 (0.041)		MR-40.249(0.236)↔	0.034 (0.049)

*1.The number in () belongs to 2011 questionnaire survey data, other than the data in 2012; 2. “↔” symbol indicates the rankings are indifferent. “↑” symbol means that the comparison between 2011 and 2012 has improved rank. “↓” symbol means that the comparison between 2011 and 2012 has downgraded rank.

Table 3. These Cronbach’s α and P-value of sub-CSFs for PP-1, -2, -3, -4, EM-1, -2, -3, -4, CC-1, -2, -3, -4 and MR-1, -2, -3, -4 are Cronbach’s α=0.815, 0.928, 0.732, 0.651 and P-value=0.622, 0.924, 1.000, 1.000. These data provide a strong evidence for showing that the CSFs and sub-CSFs of ISO 27001 certification are reliable in both 2011 and 2012.

Step 7: prioritize the total weights of CSFs and sub-CSFs

The weights of the second level of CSFs in Table 4 were through the normalization process. The values on the bottom level are the global weight for each of the twelve factors that they can be calculated by the multiplication of the weight of CSFs and sub-CSFs such as the global weight of PP-2 is 0.093

In Table 4, “↔” symbol indicates the rankings are indifferent. “↑” symbol means that the rank between 2011 and 2012 increases. For the global weights of the “S1: Policy and Planning”, the ranks of the CSF and their sub-CSFs stay unchanged. For the total weights, i.e. global weights, of “S3: Checking and Correction” that the rank of the CSF and sub-CSF “CC-1” improves. The changes of the rank of the sub-CSFs are remarkable.

DISCUSSION

The ranking from these two consecutive years reveals there is no significant consistency. The first two CSFs, “Policy and Planning” and “Execution and Management” are consistent in the ranking but the last two CSFs change, where “Checking and Correction” is shifted to the fourth place ranking after “Management Reviews”. The “Policy and Planning” is always on the top level of management hierarchy, the critical factor, and always the initiator of ISO27001. This is because it is the origin of

leadership, direction, motivation and support. If it is misplaced, the system will break down. The concern of top manager would be to keep all employees in right track including ISMS. Once there is loose control in management, then there will difficulty in running an ISMS unit or department. The results conform to total quality management (TQM) and Six Sigma that motivate employees to reach ISMS goal, which is actually not an easy task. The leaders need to provide the appropriate working environment for all managers and employees to make it easier to reach the ISMS goals.

The top-down management principle, including the top-manager’s commitment and leadership that improve the effectiveness of organization, is stressed by the results of the implementation and certification of ISO27001. In addition, the internal and external third-party audit activities could also provide assistance to ensure effectiveness. These auditing approaches, which are “Checking and Correction” and “Management Reviews” can certainly enhance the effect of evaluation. The interval observations of the CSFs could illustrate ISO27001 clause by test-retest reliability.

The following is the discussion of the results in Tables 1, 2 and 3.

(1) In the consecutive years of 2011 and 2012, the ratio of unchanged rank for four CSFs and sixteen sub-CSFs of the ISO27001 certification was up to 50 and 75%, which shows no significant difference by statistical test. There is only one place that changed in the ranking indexes of “S3 and S4”, “EM-1 and EM-3”, “CC-1 and CC-3”. For ISO 27001 management, the assessed CSFs are valid and

reliable by test-retest between two years.

(2) In terms of "Policy and Planning" CSF, the two most important indexes are "commitment and leadership" and "connect to effective Information security policy and objectives". Top-managers should pay more attention to effective policy and planning for establishing and managing the ISMS. Considering the corporate characteristics, organization, location, assets and technology, top manager has the responsibility of clearly defining ISMS policy and identifying risk, such as feasibility assessment, and whether the information security policy can link the business objectives and performance evaluation.

(3) For "Execution and Management" CSF, there is only one place that shifted in the indexes of "EM-1 and EM-3" but shows no significant difference. The two most important indexes for "Implement and operate the ISMS" and "Effective training, awareness and competence" imply that the company should ensure responsibilities are assigned to each personnel, which are defined in the ISMS. They are competent and comprehensive to perform the required tasks. Education should be focused onto a specific team with emphasizing word "comprehensive", because it needs to work with these ISMS practices cutting across all functions and levels in organization. "5.2.2 Training, awareness and competence" and "4.2.2 Owing to the complexity of interconnections among departments, to implement and operate the ISMS" should start with a chosen department for demonstrations. All personnel should be part of it; a substantive success would not be easy to reach.

(4) For "Checking and Correction" CSF, according to the interval evaluations, there is no significant difference in the ranking of indexes, "CC-1 and CC-3"; it is only one place that changed. Considering the effective guidance documents of internal and external audits, the organization shall conduct the diverse ISMS audits at planned intervals to determine whether the control objectives, controls, processes and procedures of ISMS have been reached. For PDCA process, the operating procedures shall be documented, maintained, and available to all end-users. And then, the records and documents on different level should be established to meet the requirements of the ISO 27001. The documented procedure for emergency events management and risk evaluation of ISMS must be checked by "4.2.3 Monitor and review the ISMS" at each predetermined time.

(5) For "Management Reviews" CSF, there is no significant difference in the interval evaluations in the ranking. The two most important indexes, which are "Company-wide involving and improvement" and "Effective management review system", imply that each unit of an organization must work closely to achieve perfection. To setup the permanent recognition process team in organizations indicates that all levels and functions with the continuously improvements, monitors, implementations and recognition programs are linked to "8, ISMS improvement". Management review to check each department for the ISMS's

objectives and effects indicate that the most attacks on or defects of information system are preventable and correctable. In review, it should include the assessed opportunities for the improvement and the need for changes of ISMS, which contain the information security policy and objectives, as well as review inputs and outputs.

There are four major parts have been done in this study. Initially, it focused on functional activities, personnel, assets to ensure the consistency with ISMS policies and objectives, which include a framework for setting the objectives and establishing the sense of directions and principles for actions with regard to information security and organization's strategic risk management context. In terms of ISMS, with the identifications of the correct methodology for risk assessment, legal and regulatory requirements are carried out. Secondly, it is required to check how the actual ISMS development process functions are measured and managed. On the stage of implementation and operation of the ISMS, the personnel of corporative management and connected departments should have a full understanding of ISMS issues. System management methods must be understood by the employees that would ensure the system's successful import. Thirdly, it is important to have good communication inside the organization and for all personnel to participate. The process involves identifying and overcoming the barriers on the implementation stage and also to make all personnel passionate to ensure cohesion for achieving objectives. Finally, addressing how to use "never-ending improvement" methodologies is needed.

The result shows the top-down ranking as: "policy and planning, execution and management, checking and correction, management reviews". We provide a heuristic seven steps to introduce the CSFs of ISO27001 certification: (1) The top management provides an effective "policy and planning" and connect to information security policy and objectives; (2) Formulating a risk treatment plan that identifies the appropriate management actions, resources, responsibilities and priorities for managing information security risks; (3) Selecting a project manager of ISO27001 certification; (4) Obtaining budgets and defining the range of ISO27001 certification; (5) Setting an executive schedule and total companies' training program; (6) Schedule; (7) Paying attention to emergency events by 80-20 management and controlling; (8) Holding a periodical "Management Reviews meeting" by top management and providing a reasonable amount of resources to corrective actions; (9) Establishing different level records and documents to meet ISO 27001 requirements; (10) Creating a business culture of never-ending improvement system.

Conclusion

This study has completed the CSFs analysis of ISO

27001 certification of the computer center at Shih Chien University in Taiwan, of consecutive two years (2011 and 2012). Based on ISO clauses, the “top-down” ISMS process has been set up with the certification methodology, which included “Policy and Planning, Execution and Management, Management Reviews and Correction” for 4 CSFs and 16 sub-CSFs. The task group was coordinated by the ISO27001 leading auditor and the director of computer center, on which basis the successive discussion, communications and confirmations were made. The analytical process, VAHP approach, is used for decision-makers to generate non-inferior multi-criteria decision-making (MCDM) process, which could analyze the inherent tradeoffs among the relevant CSFs systematically. With the result, it proves that the implementation of ISO 27001 in the computer organization is successful.

With this specific lesson learn, we believe that this methodology is useful for the evaluations of other business organizations with specific CSF. We also expect that this method can be applied effectively on some ISO related topics such as the assessment of ISO 14000, ISO 22000 and OHSAS 18000 to have a reliable and concrete analytical result for decision-makers in their decision processes.

Conflict of Interests

The authors have not declared any conflict of interests.

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Full Length Research Paper

Financing of small and medium enterprises (SMEs): Determinants of bank loan application

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The main focus of this paper is to answer the question, 'what are the factors that determine a SME to apply for a bank loan?' Four elements namely human capital, firm, business strategy and information asymmetry underlie this study's theoretical framework. The main objective of the paper is to develop a bank loan model based on applicability. The model was developed using quantitative method coupled with a hypothetical-deductive testing approach, applied on primary data on loan applications gathered from the questionnaires. The logistic regression tests indicate that the business experience of a firm's owner does not have a significant relation with the firm's tendency to apply for a bank loan. The educational background of the firm's owner, the firm's size, collaterals and loans with interest were found to be negatively related to its tendency to apply for bank loans. However, the firm's business plans and start-up relationship with bankers were found to be positively related to the firm's applying bank loans.

Key words: SME bank loan application, education and experiences, firm size, business plan, collaterals, loan with interest, Libya.

INTRODUCTION

The Libyan economy is currently heading to an economic structural development and an expanded privatization of areas that are commonly controlled by the government. This direction has urgently necessitated the alleviation, assessment, and motivation of the condition of SMEs while supporting the existing enterprises, rather than merely relying on large companies. Thus, in 2011, the new Libyan regime was forced to lay down a long-term economic plan with the objectives of sustaining the economic development and diversifying the production

base by reducing the country's over whelming dependence on the oil industry, which is a deflationary source of income. The plan also aims at creating and developing viable private sectors capable of sustaining the economic growth.

In most developing countries, banks are often unable or unwilling to give term loans to SMEs. They prefer to lend to large, established businesses with well-developed balance sheets and credit histories of additional assets for the collateral required in conventional bank financing

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(Gallardo, 1997), which obstructs the access to external formal finance of SMEs. This situation can be attributed to firms' size, age, lack of business strategy, collateral, financial information, and bank requirements as well as the owner's or manager's educational background and business experience.

Badri (2006) finds that 73% of small firms in Libya depend on informal financial sources, and only 11% of the firms are applying for bank loans. The imposed interests on loans by banks may further limit apply for formal loans of SMEs. Religious and cultural factors can have a major impact on this issue. These obstacles cannot be better understood without highlighting the religious and cultural implications in the process of obtaining loans.

According to the National Program for the Development of Small and Medium Enterprises annual report (2010), the lack of Islamic finance makes some entrepreneurs reluctant to complete the procedures after the approval of conventional banks. Other relevant studies have a similar conclusion. World Bank (2008) Almhrog (2003), Abd-wahab (1996), Metwally (1996), and Hasan (1990) find that most owners of SMEs do not want to obtain loans from conventional banks, such as commercial banks, because they believe that commercial bank loans come with interest, which is prohibited in Islamic law. Therefore, religion has an important role in the search for external financing.

Despite an agreement between certain researchers on the existence of financial obstacles in obtaining loans, no comprehensive studies have been conducted on the matter, and no solutions on these obstacles have been recommended. Al-Hwuty (2007) points out that only a few studies have been carried out on Libyan SMEs, their sizes, and the obstacles they face.

This finding clearly shows that funding problems impede the owners of SMEs in Libya in their search for external formal finance. It also raises concern on the following main question "Which SMEs have applied for external formal finance, and which firms have not done so?" The researchers framed the research question to solve this issue: what factors determine the bank loan application of SMEs? Therefore, the main objective of this paper is to develop a model of bank loan application.

Theory and hypotheses

No specific theory describes how firms access external formal financing. Romano et al. (2001, p. 287) mention that "financial theories do not adequately explain financial behavior." Thus, researchers have used different theories to explain how small firms access external financing. Various theories have been developed based on this information. These theories investigate factors that influence the application of SMEs for external formal

financing.

Four theories are chosen as theoretical research frameworks to achieve the objective of the study. These theories include information asymmetry theory, human capital theory; firm and strategy theories.

Some owner-manager and firm characteristics, business strategies, and bank conditions are selected based on the four theories to identify the relationship between these variables and SMEs in the application to bank loans. Thus, this study combines different theories to understand firms apply for bank loan.

Banks in SME financing and information asymmetry problems

The main formal financing source for SMEs is the bank. According to the European Central Bank (2011), 40% of respondent firms use their overdraft facilities or credit lines, and more than one-third of firms have used bank loans. Longenecker et al. (2012) mentions that commercial banks are the primary providers of debt capital to firms. Commercial banks prefer firms with proven track records and sufficient collateral in the form of hard assets. Proven track records and collaterals are difficult to obtain for small businesses.

The lack of access to bank loans of SMEs is attributed to information asymmetry. Finance gap hypothesis suggests that SMEs suffer from a shortage of financing, which is caused by information asymmetry (Ed Vos et al., 2007; Berger and Udll, 1998). Behr et al. (2011) mention that lending in developing economies, specifically lending to micro and small enterprises, is particularly affected by information asymmetries between borrowers and lenders. Thus, startups and expansion potentials cause difficulties in obtaining intermediate external financing, which depend mainly on internal financing or informal external financing such as friends and family. Constraints on external financing are significant issues, and SMEs use internal financing as a fallback option (Pissarides et al., 2003).

Considerable progress has been attained in the last two decades in advancing theoretical knowledge on the influence of information asymmetry on optimal loans (Peltoniemi and Vieru, 2013; Nofsinger and Weicheng, 2011; Ed Vos et al., 2007; Bester, 1985; and Stiglitz and Weiss, 1981). Information asymmetry refers to a situation where owner-managers possess more knowledge about the prospects and risks facing their business than lenders. Verrecchia (2001, p. 171) defines information asymmetry as "the difference in the cost of capital in the presence/absence of an adverse selection problem that arises from information asymmetry."

Banks require certain information on firm performance before approving loans to ensure that the project is commercially viable. However, this information is not

always readily available from SMEs, and owners of small businesses possess more and better information about the performance of their businesses than banks. Storey (1994, p. 205) notes that “the small business owner is likely to be significantly better informed about the business than an outsider such as a bank.” Thus, banks do not have ample management information on SMEs. The high costs of resolving information asymmetry can increase the difficulty of small firms to obtain loans (Riding et al., 2010). This phenomenon results in small firms being offered with less capital or capital at higher rates compared with large firms. Inadequate information affects the willingness of banks to supply debt financing to small firms because of uncertainty. These problems lead to the existence of a “debt gap,” wherein commercially viable projects do not obtain funding (Binks et al., 1992).

Bank conditions may also aggravate financial constraints that stem from information asymmetry, incentive problems, and limited collateral. Financial intermediaries may restrict the supply of loans to some businesses, thus precluding the financing of valuable investment and production opportunities. Lehmann and Neuberger (2001) explain that when banks obtain more information about borrowers, fewer opportunities will be generated to improve borrower motivation by setting loan contract terms, which include interest rates and collateral requirements. Therefore, banks may focus more on the value of the available collateral during financial distress when information is incomplete. Chan and Kanatas (1985) show that collateral improves the estimated expected returns of lenders when lenders and borrowers possess varying information; that is, collateral can serve as a source of additional indirect information in rational expectations that signal contexts.

The following are the roles of collaterals when the owner possesses more information on the probability of success of a firm than a bank (Storey, 1994, p. 210): (i) collaterals limit downside losses by providing assets to banks in the event of project failure; (ii) collaterals provide incentives to entrepreneurs to commit him or herself to the project; (iii) collaterals provide signals to the bank that the entrepreneur believes the project is likely to succeed because the owner will not commit their personal resources to the project if otherwise.

Collateral creates a problem for small firms because they often have no significant fixed assets to use as collateral in their early years of establishment. Therefore, the lack of collateral is often one of the main reasons that prevent small businesses from applying for bank loans. The World Business Environment Survey is a cross-sectional survey on investment climates and business environments that covers 10,000 firms in 80 countries from 1999 to 2000. The Business Environment and Enterprise Performance Survey (BEEPS) is a joint effort of the World Bank and the European Bank for Reconstruction

and Development. BEEPS collect data on ease of access to financing. Two rounds of surveys that cover firms in Eastern European countries, the former Soviet Union, and Turkey have been conducted in 1999 and 2002. The Investment Climate Assessment (ICA) has recently reviewed the investment climates of 58 countries based on the surveys of more than 32,000 firms. ICA surveys primarily involve the business perceptions of investment climates in different countries. These surveys also contain questions regarding the fund sources of new investments and collateral requirements to reveal substantial variations in financing practices across countries (Claessens and Tzioumis, 2006). Results show the five top and bottom countries in financing and the major obstacles and collaterals needed in availing a bank loans. Moroccan banks require 98.9% collateral for loans. Morocco has the highest collateral requirement next to Libya. Eltaweel (2012) finds that several businesses do not borrow from banks because of various reasons such as the absence of reliable information on the financial conditions of borrowers and difficulties in evaluating the risk of lending to small business. This finding increases the percentage of required collateral by as much as 125% of the sum of the loan in some cases. Hasan (1990) and Rozali et al. (2006) indicate that SMEs find difficulties in borrowing from commercial banks because of inadequate collateral requirements.

The ability and desire of SMEs to borrow from formal financing is often restricted, thus forcing SMEs to borrow from informal financing sources (non-banks). This type of financing does not require collateral and comprehensive business information. Bhaird and Lucey (2010) confirm that the personal funds of firm owners and funds from friends and family are extremely important in firms with low turnovers. This situation suggests that the collaterals required by banks may act as an indicator of owner-manager decisions to apply for bank loans. Hence, this study hypothesizes the following:

H1: *Collaterals required by banks will likely influence owner-manager decisions to apply for bank loans.*

Asymmetry information problem between collaterals requirement and firm- bank relationship

Banks are the main providers of financing to firms and have the capacity to generate higher and better information than other financial intermediaries. Therefore, firm-bank relationship is a useful tool in resolving problems associated with asymmetric information in business and lending. Voordeckers and Steijvers (2006) Degryse and Cayseele (2000) and Harhoff and Korting (1998) find that collateral requirements decrease with increasing bank–borrower relationships. Borrowers with more concentrated and long-lasting bank relationships have less

stringent collateral requirements.

Therefore, a strong firm–bank relationship will increase the willingness of owner-manager to apply for bank loans. Bonfim and Daniel (2012) indicate that firms with previous relationships with banks can regain access to such banks. Daskalakis et al. (2013) mention that “firms that use short-term debt also employ long-term debt, and firms that do not use short-term debt do not use long-term debt. Firms that have relationships with banks are able to apply both short- and long-term debt, whereas firms that do not have such a relationship are not capable of applying and accessing any form of funds from banks.

The following hypothesis on firm–bank relationships and bank loan applications is proposed on the basis of the arguments between asymmetry information and collaterals:

H2: *The source of financing for startups (bank–firm relationship) will influence the firm to apply for a bank loan.*

Human capital theory and SME financing

Human capital includes knowledge, skills, competencies, abilities, attitude, talents, and experiences that are used by an individual to provide value to a firm, achieve the goals of a firm, and support the success of a firm (Davenport, 1999; Becker, 1975). Human capital is defined as a key element in improving firm assets and employees, increasing productivity, and sustaining competitive advantage. Florin et al. (2003) finds that human capital is a significant source of success in entrepreneurial firms. The human resources of a business venture act as a surrogate indicator of the competence and credibility of a firm and confidence level of external and internal stakeholders.

The owner-manager is one of the most common components of SMEs. The majority of SMEs are owned and managed by the same individuals. By contrast, large firms are normally managed by a team of professionals appointed by the shareholders of the firms. Therefore, the characteristics of owner-managers such as level of education and experience affect firm survival and access to external financing. Thus, highly educated entrepreneurs will choose to dissolve their firms and seek lucrative employment opportunities (Gimeno et al., 1997). Nofsinger and Weicheng (2011) suggest that owner-manager experiences play an important role in explaining differences in external financing.

Coleman (2000) examines education, years of experience, and access to external finance. He finds some evidence that education is positively related to access to external loans. Irwin and Scott (2010) explore some of the barriers that increase the bank finance problems faced by SMEs. They found that educational level does

not have a significant impact to finance sources, except those with A-level education who frequently used friends and family and remortgaged their homes. Ed Vos et al. (2007) find that the amount of experience determines the propensity to apply for loans.

Therefore, education and experience are significant in applying for external formal financing.

However, some studies suggest that the benefits of this knowledge are limited to the managerial roles and not the operational roles of business owners (Dobbs & Hamilton, 2007). Sonnentag (1998) mentions that experience should not be equated with knowledge because experience may or may not lead to increased knowledge. Dabo (2006) and Al-kharusi (2003) use Spearman's correlation analysis fail to find any association between the level of education of owner-managers and application for financing.

Earlier studies find that the influence of human capital to firm performance and the education of owner-manager are not related to the success of a firm. Cassar (2004) discovers a negative relationship between bank financing and owner experience.

However, SME owners and workers in developing countries often have relatively low levels of education than employees in large firms (Nichter and Goldmark, 2009). Human capital theory states that the education and experience of owner-manager influence the access of firms to external financing. Thus, the present study formulates the following hypotheses:

H3: *The education level of owner-managers will likely influence the application of firms for bank loans.*

H4: *An experienced owner-manager will likely influence the firm to apply for a bank loan.*

Theory of the firm and SME financing

The determination of firm size may be based on the value of capital investments or the number of employees, which are input measures of firm size because they are the internal factors of the firm (Alam, 2003). Firm size has received limited attention in the empirical tests of symmetry and simultaneity hypotheses because differences in size reflect differences in other variables such as age (Miguel, 2010).

You (1995) cites that size theories on firm size can be classified into four approaches, namely, the conventional microeconomic approach (or the technological approach), transaction cost approach (or the institutional approach), industrial organization approach, and dynamic model of size distribution approach.

The dynamic model of firm size and distribution includes stochastic, life cycle, and evolutionary models. The primary source of innovation in this approach is research and development. In pursuing this activity, larger and more established firms have an advantage than

smaller and newer firms. These models correlate the size of the firm to its age and growth (Di Tommaso and Dubbini, 2000; You, 1995). Di Tommaso and Dubbini (2000) suggest that firms enter the market as small firms and grow through learning. A small and young firm faces greater risks and turbulence than a big firm. Small firms also encounter difficulties in obtaining credit. Thus, Cassar (2004) indicates that the interactions between outside/inside financing and firm size are important and should be controlled when examining such financing relationships. Firms that seek growth are more likely to apply for external equity and debt capital than firms that do not exhibit growth (Riding et al., 2010). Du and Girma (2012) find that firm size plays an important role in the way financial structure affects the growth process. Riding et al. (2010) and Bhaird and Lucey (2010) state that firm size is positively related to external financing application. Romano et al. (2001) discover that firm size is significantly associated with debt. New and younger firms use fewer banks and other finance institutions than older firms (Nichter and Goldmrk, 2009; Longenecker et al., 2008; Cassar, 2004; Romano et al., 2001).

On the other hand, Pickernell et al. (2013) find that new and young firms are more likely to apply for external resources than older firms. Zhang (2008) studies the choice of formal or informal financing in China and finds that firm size has a significant negative correlation with formal financing. Daskalakis et al. (2013) find that younger firms usually lack sufficient internal funds and do not have easy access to external equity. Thus, these firms are more reliant on external debt sources. Ed Vos et al. (2007) find that older firms have less loan applications than younger firms. They also indicate that firm size is not a determinant of the propensity to apply for loans. Larger firms are more likely to receive approval but do not apply more or less often. The following hypotheses are formulated based on the above statements:

H5: *Firm size will likely influence the firm to apply for a bank loan.*

Business plan and SME financing

A strategy is a plan designed to achieve a particular objective. When applied to business activities, a strategy is defined as the overall plan of a firm in coordinating the separate functional areas of a business, achieving business objectives, analyzing external and internal environments, and determining the strategic direction of the firm. These premises suggest that a business plan is contextual and dynamic in nature and is deployed by owner-managers as tools to achieve short and long-term objectives.

Small businesses do not normally prepare plans to operate the business or achieve external financing,

particularly during the startup stage. However, small businesses tend to operate gearing ratios similar to or higher than large firms, with a proportion of short-term debt that is higher than large firms, once a business plan is established. Romano et al. (2001) show that SME owners do not usually use formal business plans as sales documents during the startup stage to obtain debt or other external financing. However, once SME owners start using a business plan, they tend to apply for and use more financing than large firms.

A business plan is an important tool for applying for and obtaining external formal financing. Business owners can provide their business plans to investors who may be willing to serve as partial owners or to various credit institutions such as commercial banks that may be willing to provide business loans. The business plan should be clear and convincing. Romano et al. (2001) indicate the significance of business plans and its relation to debt. Small businesses and owners without established formal planning processes tend to rely on family loans as financing sources. They also find that business plans are less likely to be considered by older family owners who have control of the family. Al arusi (2003), Dabo (2006), and Abdul Wahab (1996) find that written business plans are significantly related to debt applications.

This discussion tests the influence of business strategy attributes (business plan) on applying to bank loans. The following hypotheses will be tested:

H6: *A written business plan will likely influence the firm to apply for a bank loan.*

Financing of SMEs and Loan with interest (religion factor riba)

The ideology that governs the current economic system of the world is interest oriented, thus resulting in economic disparities, concentration of wealth in the hands of the few, monopolies, and widening gaps between the rich and the poor. However, Islam prohibits riba -usury- in business transactions. The verses of the Qur'an state the following. "That which you give as interest to increase the people wealth increase not with God; but that which you give in charity, seeking the Goodwill of God, multiplies manifold" (Surah Al-Rum, verse 39). "O believers, take not doubled and redoubled interest, and fear God so that you may prosper. Fear the fire which has been prepared for those who reject faith, and obey God and the prophet so that you may receive mercy" (Surah Al-Imran, verses 130-2). In this context, Islamic financing is the act of providing financial products or services that conforms to Islamic law. Thus, business partners under Islamic law share both profits and losses compared with business partners in the conventional financial system, which relies on the lender-borrower concept.

Islamic banking has emerged as an alternative to conventional banking. Islamic banking aims to cater to the needs of Muslims, who believe that the activities of conventional banks and their religious and moral tenets are incongruent. A study by the World Bank (2008) suggests that religion is one of the internal reasons of SME owners in seeking external formal financing.

Almhrog (2003) finds that most SME owners do not want to obtain a loan from commercial banks because such loans from come with interests, which is prohibited in Islam. Abdul Wahab (1994) cites a case study on the influence of religious beliefs, specifically Islam: a Malaysian owner-manager in the United Kingdom refused to borrow from banks because interest is prohibited under Islamic law. Moreover, Hasan (1990) discovers that the owners-managers of SMEs do not employ bank credits because of their negative attitudes toward conventional. Banking in Libya has no Islamic banks thus far. This may be one of the underlying reasons behind the reluctance of SME owners in Libya to apply for bank loans. The hypothesis regarding this issue is stated in the following:

H7: *Loan interests (riba) from conventional banks will likely influence the decision of the owner-manager decision in applying for a bank loan.*

METHODOLOGY

What factors determine the bank loan application of SMEs? To answer this question, small firms are divided into dimension of probability to apply for a bank loan. The data for this paper were taken from the results of a survey that the authors undertook in Libya. The selected 530 SMEs based on the firm size (1 to 50 employees) belong to different sectors of the economy. The survey yielded 364 valid questionnaires were deemed useable responses. During the survey, the respondents had provided some attributes of the characteristics of SMEs owner-manager such as their level of education and experiences also size and age of the firm, businesses strategy which include business plan. Moreover, sources of financing startup, whether apply bank loan after started or not.

Econometric model of probability for bank loan application

Our empirical investigation aims to study the probability and influence of human capital, firm and business strategy, and bank conditions on the bank loan application of a firm after the startup stage as dependent variables. To test these interactions, we considered the following model:

Bank loan application = constant + owner-manager characteristics + firm characteristics + business strategy + bank conditions + ε_i

To investigate this model, the logistic regression model is used. When measuring Y, data are taken from the survey question "whether his/her business has ever applied for a bank loan for additional financing after the startup stage."

If the answer is "yes," the financing practices employed are considered a case of "bank loan," and the response is coded with

"1"; otherwise, is the response is coded with "0". We estimate the coefficients (Y) by using the following model:

where Y denotes the bank loan application. Therefore, Y for additional financing after the startup stage is equal to $\beta_0 + \beta_1$ Education level + β_2 Previous business Experience + β_3 Business Plan + β_4 SME startup size + β_5 Firm startup financing (firm-bank relationship) + β_6 collateral required by bank + β_7 loan with riba (religion factor) + ε_i

The independent variables represented by X_i in equations are expressed on proxies of the conceptualized theories as shown in Table 1.

RESULTS AND DISCUSSION

Hypotheses testing for the bank loan-application model

To understand better the determinants of SMEs in Libya in the loan-application model, logistic regression is performed to assess the effect of the number of factors on the reporting probability of respondents regarding their bank. The loan-application model contains seven independent variables: firm characteristics (size, business plan, and firm startup financing sources), owner-manager characteristics (education level and experience), and bank conditions (required collateral and interest with loan (riba)). The dependent variable is the question on whether the owner-managers have ever applied for bank loan after the startup stage (Yes = 1, No = 0). However, before testing the hypotheses by logistic regression, a multicollinearity test is conducted necessary. Multicollinearity can affect the parameters of a regression model. To test the multicollinearity, which refers to the relationship among independent variables, correlation analysis is performed as a preliminary test on the seven independent variables. The correlations among the independent variables are shown in Table 2.

Table 2 shows that most of the correlations are relatively low. Although some of the correlations are significant, the highest and lowest correlation values are 0.489 and 0.038, respectively. Therefore, based on Spearman's correlation, the degree of multicollinearity is very low. Pallant (2010, p. 151) observes that, "multicollinearity exists when independent variables are highly correlated ($r = 0.9$ and above)." Zhang (2008) also indicates that a correlation coefficient of 0.6 or more suggests potential multicollinearity. To confirm the result of the current study, the collinearity statistics test is employed to test the multicollinearity. Result shows that variance inflation factor (VIF) for all independent variables is within 1.059 to 1.952. In this context, Myers (1990) suggests that a VIF value greater than 10 is a cause for concern. No collinearity issue is found between the predictor variables. Tolerance value is another test for multicollinearity. Menard (1995) and Field (2003) suggest that a tolerance value less than 0.1 indicates a serious collinearity

Table 1. Independent variables measurements.

Highest Education	1= university graduate, otherwise= 0
Previous business experience	1= Yes, 0= otherwise
Written Business Plan	1= Use 0 = otherwise
SME Size start-up (number of employees)	
SME size start-up number 1-3 workers	= 1, 0= otherwise
SME size start-up number 4-10 workers	= 1, 0= otherwise
SME size start-up number 11-17 workers	= 1, 0= otherwise
SME size start-up number 18-25 workers	= 1, 0= otherwise
SME size start-up number 26-above workers	= 1, 0= otherwise
Firm start ups financing option	1 = firm start up with bank loan (firm – bank relationship),0 = otherwise
Collateral required by bank, no problem	= 1, otherwise =0
Loan with interest –Riba-, no problem	= 1, otherwise =0

Table 2. Correlation of independent variables for the bank loan-application model.

Variables	1	2	3	4	5	6	7
Size	1.000						
Business plan	.442**	1.000					
Start-up financing	.350**	.489**	1.000				
Education	.182**	.212**	.074	1.000			
Experience	.168**	.066	.049	-.063	1.000		
Loan with interest	-.334**	-.282**	-.185**	-.047	-.068	1.000	
Collateral	-.064	-.100	-.074	-.038	-.058	-.256**	1.000

** . Correlation is significant at the 0.01 level (2-tailed).

problem. The tolerance values in the current study are from 0.512 to 0.948, which is far above the critical tolerance value of 0.1. The results of the three tests indicate the absence of multicollinearity issues. Therefore, no serious multicollinearity is found among the variables. Consequently, all independent variables are included in the following empirical models.

Based on the results of the model, (Table 3) it could be found the results of the model are satisfactory.

Table 3 gives the results of the logistic Regression analysis for the determinants of loan- application with included the results of variables in the equation which are the most an important to find out the results of testing hypotheses and contribution of each of predictor variables. The direction and relationship significance among the variables are shown in Table 3

Results in Table 3 shows that the model is highly significant. Six explanatory variables are statistically significant at the 0.1 level (firm size, business plan, firm startup financing, required collateral, loan with interest (riba), and education level), whereas experience was statistically insignificant in the model.

X1 Firm size: Bank financing is the most important source of external financing for small firms. However, many small

Table 3. Results of the logistic regression analysis for the determinants of bank loan- application.

Variables	B	S.E.	Wald	Sig.
Size (X1)	-.469	.218	4.633	.031**
Business plan (X2)	1.321	.390	11.443	.001***
Start-up financing(X3)	2.989	.423	49.868	.000***
Education(X4)	-.613	.364	2.843	.092*
Experience(X5)	.028	.322	.008	.930
Collaterals(X6)	-1.783	.402	19.639	.000***
Loan with interest (X7)	-2.558	.414	38.201	.000***
Constant	1.323	.530	6.227	.013

Number of observation, 362; d.f. of Regression, 7; Chi-square statistic, 182.070 at significance level, 0.000; p-value, 0 .000; Cox and Snell R², 0.395; Nagelkerke R², 0.553;-2 Log Likelihood, 272.025; Hosmer and Lemeshow chi-square, 4.349 at significance level, 0.824; Predicted Correct at Block 0, 68%; Predicted Correct at Block 1, 85.4%; -2Log likelihood at Block 0, 454.094; -2 Log likelihood at Block1, 272.025; (-2Log Block 0) – (-2Log block 1) = Chi-square;454.094 – 272.025 = 182.070; *Significant at 10% level; **Significant at 5% level; ***Significant at 1% level.

firms are often reluctant to borrow from banks because loan approval depends on the size and credit risk of a

firm (Neuberger and Rāthke, 2009). On the contrary, some studies have indicated that SMEs rely heavily on internally generated funds. SMEs tend to operate gearing ratios that are similar to or higher than large firms, with a proportion of short-term debt that is higher than large firms. Theoretically, firm size will positively affect the decision of the owner-manager to apply for a bank loan. Therefore, larger SMEs apply for bank loans more often than smaller SMEs because of the availability of collateral. In terms of loan requirement, smaller SMEs may have more demands and needs for financing after the startup stage than larger SMEs for growth, whereas larger SMEs require internal financing. Statistical tests are conducted to determine if the employment size of small businesses affect the decision of the firm to apply for a bank loan after the startup stage. The results indicate a significant negative effect between employment size and bank loan application. Thus, smaller SMEs are more likely to apply for bank loans after the startup stage than large SMEs. The firm size beta value of this study is -0.0469 , which is statistically significant at 0.05 (5%) (Table 3). This result implies that larger SMEs have lower beta values when applying for loans because these SMEs can use internal financing. Another reason for this result is that a bank loan may not be needed at the moment. The European Central Bank (2011) confirms this result, thus proving that 23 and 8% of large SMEs expect improvements in their internal funds and bank loans, respectively. Large SMEs rely more on internal financing than bank loans. This result may also suggest that the startup sizes of most SMEs in this study are smaller because 66.8% have only three employees. Nevertheless, this result concurs with the findings of Daskalakis et al. (2013), Pickernell et al. (2013), Bhaïrd and Lucey (2010), and Zhang (2008). However, the hypothesis is supported.

X2 Business plan: A business plan is an important tool in obtaining external financing. Romano et al. (2001) find that small family business owners who do not have formal planning processes tend to rely on their families for loans. A firm that plans to apply for a bank loan will likely have a business plan before applying. A business plan positively affects SMEs that apply for bank loans. The result in Table 3 shows that the business plan has a significant effect on the loan applications of SMEs. The beta value is 1.321 and is significant at 0.01 (1%). Therefore, the study proves that a business plan has a positive influence on bank loan applications. Thus, the hypothesis is supported.

X3 SME startup financing (firm–bank relationship): This study and other studies have confirmed that most SME startup financing originate from informal financing sources. Only a few SMEs can start up with a bank loan because lending to small enterprises is affected by

information asymmetries. Therefore, SMEs that finance their startups with bank loans are perceived to have a good rapport and relationship with their banks. These SMEs also tend to reapply for another loan. By contrast, firms that finance their startups with informal financing will be reluctant to apply for bank loans because of fear of rejection or other reasons such as loans with interest (riba). Based on this assumption, the availability of startup financing sources influences the firm to apply for a bank loan. In this study, the beta value for firm startup financing is 2.989 and is significant at 0.01 (1%). This finding concurs with the result of Daskalakis et al. (2013). The hypothesis is also supported.

X4 Education: Human capital is important for organizations, particularly for the continuous improvement of the firm in terms of knowledge, skills, and abilities. Furthermore, the owner-manager is one of the most common SME ownership characteristics because the majority of SMEs are owned and managed by the same person. Therefore, the level of education of the owner-manager influences and affects the decision to apply for external financing. In this study, the proxy of the education level is measured by the variable university and above (“1”) and otherwise (“0”). We hypothesize that the education level of the owner-manager affects the decision to apply for a bank loan. Logistic regression analysis reveals that the levels of education of owner-managers in Libya influence their decisions to apply for bank loans after the startup stage. The education level of the owner-manager is negatively related to loan application. A negative link between the education of the owner-manager and bank loan-application probability suggests that 66.5 % of respondents in this study have completed education below the university level. Nichter and Goldmark, (2009) cites that SME owners in developing countries often have relatively low levels of education than large firms. This finding is consistent with the findings of Ed Vos et al. (2007) and Irwin and Scott (2010). In the current study, the beta value for education is -0.613 and is significant at 10% level (Table 2). Therefore, the hypothesis is supported.

X5 Business Experiences: Experience is one of the most important human capital components to explain the role of input resources in a firm. Experience, along with education, enhances the human capital volume of the firm. Furthermore, financial investment will be required for business growth. However, obtaining the necessary amount of financing often depends on the skills of the owner-manager. Ed Vos et al. (2007) find that experience is positively related to loan application. Therefore, the experiences of owner-managers affect the decision to apply for a bank loan. In the current study, experience is used as a proxy for human capital. The proxy is coded “1” if the owner-manager has previous business experiences

and “0” if otherwise. Experience is an insignificant factor in this study. Bank loan-application probability has a beta value of 0.31 and is insignificant at 0.925. Zhang (2008) also obtains a similar result. He finds that experience is statistically insignificant and is a negative predictor of the dependent variable choice of financing sources. However, the result may suggest that experienced owner-managers use internal financing sources for business expansion. This condition also suggests that the majority of respondents in this study (60.4%) are inexperienced. This finding indicates that experienced owner-managers do not necessarily employ more or less bank loan financing practices in Libya because significant factors exist that affect the financing choices of Libyan SMEs. Consequently, experience is irrelevant. This result does not support the hypothesis.

X6 Collaterals: Larger firms show higher probabilities of loan-application success than smaller firms (Freel, 2007), which exhibit higher risks than larger firms. Banks require collaterals for loans (Berger et al., 2011). Thus, larger and older SMEs have more assets as collateral than smaller and younger SMEs and have technical sophistication in reducing information opacity to access external formal financing. Small and young firms have few collaterals and short credit histories. Therefore, small firms have difficulty obtaining funds from banks. The ability and preference of SMEs to borrow from the bank are also often restricted. Thus, SMEs may borrow from informal financing sources (non-bank), which require no collateral. Therefore, the required collaterals of banks affect the decision of SMEs to apply for bank loans. In this study, the beta value of collateral requirement is -1.783 and is significant at 0.01 (1%). This finding agrees with the finding of Etaweel (2012). Therefore, the hypothesis is supported.

X7 Loan with interest: Loans from commercial banks involve interests. However, interests (riba) are prohibited in all affairs in Islam including business transactions. The verses of the Qur’an state the following: “*that which you give as interest to increase the people wealth increase not with God; but that which you give in charity, seeking the Goodwill of God, multiplies manifold*”(Surah Al-Rum, verse 39) (30:39). “*O believers, take not doubled and redoubled interest, and fear God so that you may prosper. Fear the fire which has been prepared for those who reject faith, and obey God and the prophet so that you may receive mercy*”(Surah Al-Imran, verses 130-2). The World Bank (2008) suggests that the religious factor is one of the internal reasons of SME owners in seeking external formal financing. Therefore, loans with interests affect the decision of owner-managers in applying for a bank loan. The current study finds that the X7 beta value is -2.558 , negatively related to the decision to apply for a bank loan, and significant at 0.01 (1%) (Table 3). Therefore, the hypothesis is supported, which implied that a

loan with interest would negatively affect the decision of the owner-manager to apply for bank loan in Libya. This finding confirmed the 2010 annual report of the national program for SMEs in Libya.

Six hypothesizes, namely, firm startup financing sources (firm–bank relationship), firm size, business plan, collateral, loan with interest, and owner-manager education level, are supported. The hypothesis on owner-manager experience is not supported.

Conclusion

This study examines the determinants of bank loan applications. Thus, this study aims to identify the major influences on the decisions of small firms in applying of bank loan, Logistic regression model, namely, the loan application is generated to explain the determinants of bank loan application of SMEs in Libya . The results show that firm characteristics, such as business size (a smaller firm has a higher probability to apply for a bank loan), business plan (a firm with a business plan has a higher probability to apply for bank loan), and firm startup financing sources, such as bank loan or informal financing (a startup firm with a bank loan has a higher probability to apply for a loan after startup), are characteristics associated with bank loan applications after the startup stage in Libya. Conditions of banks, such as required collaterals and loan with interest (riba), are significant negatively associated with bank loan applications in Libya. Owner-manager characteristics, such as education level and experience (an owner-manager with a lower education level has a higher probability to apply for a bank loan), is factor associated with bank loan applications after the startup stage in Libya. However, experience is not likely to influence bank loan applications.

In summary, SMEs that started with bank loans, have prepared business plans, are smaller, and are under owner-managers with less education are more likely to apply for bank loans after the startup stage. However, SMEs face collateral requirements and loan with interest (riba) when applying for bank loans.

Conflict of Interests

The authors have not declared any conflict of interests.

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Full Length Research Paper

An exploratory investigation into using ITSM metrics to indicate the business value of IT in a South African financial services company

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Companies' executives have long realised the importance of IT in conducting business. As such, an ever larger portion of capital is allocated to IT. Managers see an opportunity to reduce the input cost of producing value for clients by reducing IT expenditure; however, managers need a clear picture of the value of IT to make appropriate cut of IT cost. This study explores the value the IT unit provides to business, by investigating a method of identifying IT metrics that are significant to IT managers and extending their significance beyond the IT unit to business executives. The Gartner business value model was used to link IT metrics to financial metrics in a South African financial services company. Senior business executives, business process owners and IT respondents were interviewed to get pertinent information, and an exploratory approach was taken to investigate the information garnered. The results illustrate that if a set of leading indicators of financial performance can be identified by senior business executives, the business activities that support these leading indicators and the IT services these activities rely on can be uncovered. By identifying IT services that have a bearing on future financial performance, the metrics recorded around them may be used to demonstrate the impact that the IT unit has on future revenue.

Key words: Business value, ITSM, metrics.

INTRODUCTION

The aim of this research is to demonstrate the value of using Information Technology Service Management (ITSM) metrics to business stakeholders; particularly decision makers. Stakeholders are increasingly pushing for IT managers to demonstrate the value of the IT unit to business (Holtsnider and Jaffe, 2012). The goal of Information Technology Service Management (ITSM) is to manage IT infrastructure as a resource of a company

while optimizing IT services to satisfy business requirements and controlling associated costs (Galup et al., 2009).

A model that links a set of metrics that is significant to both IT managers and business stakeholders was used to indicate IT value (Smith, 2007). The Gartner Business Value model was used to identify ITSM business metrics, which are generally defined by the ITIL best practice

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framework (Coyle, 2007; Brittain and Coyle, 2009; Steinberg, 2006).

This study explores the use of asset of ITSM metrics in a South African financial services company to demonstrate the business value of IT to those business decision makers. The financial company had implemented ITIL as a case study. Both managers and IT staff were interviewed and documentation was examined. The company granted permission to conduct the research, provided all respondents remained anonymous, and the company was given a fictitious name -Finstitute.

LITERATURE REVIEW

An IT department in a large organisation can be seen as a collection of coherent, related, self-contained functions that span multiple divisions including hardware installations, software installations, networking systems, application management and other systems related to the storage, transfer and manipulation of information (Zammuto et al., 2007). The foundational goal of IT in a company is to provide a cost effective service to meet the company's needs and align with its business strategy (McNaughton et al., 2010).

With the realisation of the criticality of IT as a resource (Beachboard et al., 2007; Bloodworth and Herron, 2007; Carr, 2003; Smith, 2007), the associated costs have exponentially increased in the last few decades, pressing IT managers to demonstrate the value of IT in economic terms to business decision makers (Coyle, 2009; Smith, 2007).

Benefits of IT

IT can provide both tangible and intangible benefits. Tangible benefits are those which affect a company's bottom line, and can be measured by a quantitative, objective and in many cases, financial means (Ward and Daniel, 2006; Ward and Peppard, 2002). Many companies have found the intangible benefits of IT to be difficult to demonstrate, and measure their investments solely on hard benefits. Intangible benefits are typically measured qualitatively (Ward and Daniel, 2006), and have been found to include the following benefits (Beachboard et al., 2007; Ward and Daniel, 2006; Ward and Peppard, 2002):

1. *Competitive advantage* is derived from delivering something that is unique and difficult to replicate or copy by a competitor. Sustaining this competitive advantage means ensuring the unique feature is also unable to be substituted by a competitor (Bharadwaj, 2000; Ward and Daniel, 2006);
2. *Increased internal efficiencies* by means of reducing costs associated with resources, allowing companies to

do more with fewer resources, thereby improving economies of scale (Ward and Daniel, 2006; Ward and Peppard, 2002; Zammuto et al., 2007). This increase in output while limiting input cost is referred to as productivity (Ward and Peppard, 2002); and

3. *Aiding decision making* by getting information about customers, potential customers, markets and internal technology available to senior executives in order to make strategic decisions (Ward and Daniel, 2006; Ward and Peppard, 2002). This improved information may give decision makers the ability to make decisions about resourcing in the future, resulting in increased economies of scale (Ward and Daniel, 2002; Zammuto et al., 2007).

The management of IT as a service (ITSM)

As the IT unit spans many technology silos and disciplines, the evaluation of the impact of this unit on company performance means that the demonstration of the benefits falls into the domain of IT service management (ITSM). Galup et al. (2009) defines service to be the coordination of people, technology and processes that result in a change in the performance of an entity.

The impact of the IT unit on companies' performance is synonymous with the definition of IT as a service. The IT unit includes the people, processes and technology responsible for IT, while ITSM is the management of the IT unit responsible for delivering service and infrastructure to the company. The goal of ITSM is to deliver this service to a company in a cost effective way, while improving the quality of the service delivered. ITSM focuses on a particular set of IT operations that include service delivery and service support (Galup et al., 2009).

ITIL

While IT costs are significant and emphasis has been put on assigning monetary value to IT investments, the attention of Chief Information Officers (CIO) are being diverted away from the day to day management of IT by factors including the needs of stakeholders, cyber threats and regulatory compliance (Beachboard et al., 2007; Carr, 2003). A multi-dimensional, best practice framework, the Information Technology Infrastructure Library (ITIL) has been developed to help IT managers improve day to day IT operations. ITIL has become popular as it liberates the IT manager from day to day operational tasks to concentrate on these other factors (Beachboard et al., 2007; Galup et al., 2009).

IT metrics

As a generic best practice framework, ITIL provides for a

myriad of metrics that measure any number of variables at many levels in the IT unit (Coyle, 2007; Brittain and Coyle, 2009; Steinberg, 2006). The variables can be categorised around the type of information they can provide as follows:

1. At an operational level, information about historical events can be measured (referred to as *operational metrics*).
2. At a management level, another set of metrics can provide information that forms the basis of making business decisions (known as *performance metrics*).
3. At a company-wide level, there are metrics that indicate the need to take action (referred to as *tolerance metrics*).

ITIL implementations are initiated because they are expected to reduce costs, while improving delivery and quality of IT services to a company (Beachboard et al., 2007; Galup et al., 2009). ITIL implementations are therefore initiated to achieve ITSM goals. The aspect of providing metrics for the IT unit enhances the improvement of service because it means the magnitude of improvement can be measured (Beachboard et al., 2007; Galup et al., 2009; Steinberg, 2006). The improvement of delivery and quality of service along with the reduction of associated costs suggests that the implementation of an ITIL framework leads to a performance increase of the company (Galup et al., 2009).

Why use ITSM metrics to indicate value?

While a large amount of capital is spent on IT every year, up to 90% of that goes into the day to day operations associated with providing IT services to companies (Carr, 2003; Galup et al., 2009).

Using ITSM as a discipline to manage the IT unit as a service provides an opportunity to link the costs associated with the IT unit with the benefits the IT unit brings (Galup et al., 2009). IT managers need to interpret these ITSM metrics to business executives so that all the nuanced benefits IT brings to companies become synonymous with increased company's performance (Brittain and Coyle, 2009; Beachboard et al., 2007; Galup et al., 2009; Smith 2007).

A model to indicate IT value (Gartner Business Value Model)

Smith (2007) suggested a way to demonstrate IT value to a financially conscious audience by selecting leading indicators of financial performance in the income statement and can be linked to the IT unit.

These indicators of financial performance are well

known to senior business executives, as they are used to show the future profitability of the company. Leading indicators are different to other financial instruments in that they have a reliance on business processes to achieve them (Smith, 2007). "For example, one of the processes that results in revenue is the sales process. One of the activities performed in a typical sales process is qualifying a sales lead.

Therefore, measuring the number of qualified sales in a given period is a leading indicator of revenue" (Smith, 2007, p5). These indicators can be linked to business processes because most transactional business processes rely on IT infrastructure (Beachboard et al., 2007; Smith, 2007). Once the link between IT infrastructure and an income statement element is established, the way is paved for IT performance metrics to be used to demonstrate value to senior business executives (Smith, 2007).

The Gartner Business Value model is a method suggested to identify financial metrics that can be linked to ITSM metrics (Smith, 2007), as illustrated in Figure 1.

Smith (2007) asserts that there are relationships between a set of IT metrics and business processes, and the business processes have a direct bearing on leading indicators of financial performance. The application of the Gartner business value model aims to establish the relationship between IT service and future revenue, to indicate the impact IT service has on future revenue.

Financial metrics

Metrics refer to a measurement of sorts, with financial metrics that use financial (finance or accounting) outputs to derive such measurement. Determining relevant metrics are vital in the pursuit to understand areas of improvement, evaluate achievements and defining success (Brittain and Coyle, 2009). The income statement is an indicator of the future cash flows of a company, whilst the balance sheet is an indicator of the liquidity and leverage.

Shortcomings of such metrics should be noted in that they are unable to breach the gap between the book and market value of a publicly listed company. The value of unique business processes and intellectually property, amongst others, are often not accurately incorporated (Apfel, 2008).

Leading indicators of financial performance are elements of these statements that can be linked to business processes. Establishing the relationship between the *financial metrics* tier and the *leading indicators of financial performance* tier means senior business executives need to be engaged to uncover the elements found at these tiers and the relationships between the cascading tiers (Smith, 2007).



Figure 1. A four-tier Business Value Model, Smith (2007).

Leading indicators of financial performance

Leading indicators of financial performance are instruments that indicate a company's future revenue (Smith, 2007). More commonly known as key performance indicators; these elements can be financial (working capital ratio), people (training), customer (referrals) or operational (productivity) and are scrutinised to determine any changes in the indicators of financial performance (Smith, 2007). Leading indicators of financial performance enable a simpler means of representing the value of IT than financial metrics on their own (Smith, 2007). Linking the *leading indicators of financial performance* tier to the *IT service level agreements (SLA)* tier comes from determining the business processes that support these financial performance indicators. These can be uncovered by interviewing senior executives and business process owners (BPO) to establish which business processes support the specified leading indicators of financial performance identified at the previous level (Brittain and Coyle, 2009; Smith, 2007).

Service level agreements (SLAs)

Service Level Agreements (SLAs) are agreements between customers (business process owners) and service providers (IT) which assure customers of the quality of a service (Kumbakara, 2008). SLAs define mutual understandings and expectations of the type, performance level, quality and quantity of service between a service provider and the customer (Jin et al., 2002; Kumbakara, 2008). SLAs are typically used to govern the interactions between the customer and the service provider. SLAs also provide the legal and monetary implications of violating the agreement, which is why providers should form their agreements once they are aware of the capabilities (Jin et al., 2002).

The link between the *IT SLA* tier and the *IT*

performancetier comes from SLAs that are negotiated with the business process owners. *IT metrics* can then be used to show how well the IT unit is performing to meet those negotiated SLAs (Smith, 2007).

IT metrics

Key Performance Indicators (KPIs) provide the most important performance information that enables organisations or their stakeholders to understand whether the organisation is on track or not (Ward and Daniel, 2006). One of the key concerns during development of KPIs is the ability to differentiate the more important strategy-driven metrics from the plain vanilla metrics (Webber, 2009).

At the final tier, it is important to understand the difference between IT services and IT processes. The services are what a company or its users consume, while processes are a series of activities that are performed to provide IT services to a company. Executive management is generally not concerned about the series of processes required to deliver IT services. IT services need to be described in a way that is meaningful to executives (Smith, 2007).

This leads to the research question, *how can ITSM metrics be used to indicate the value of IT to business decision makers?*

RESEARCH METHOD

The research is based on a single case study of a financial company that has implemented ITIL. A case study is an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident (Yin, 2009, p. 18). An in-depth case study was deemed appropriate to explore and develop an understanding of ITSM metrics in the context of a large financial company. The company provided subjects to interview, a wealth of documents and artefacts, and opportunities for observation. Case

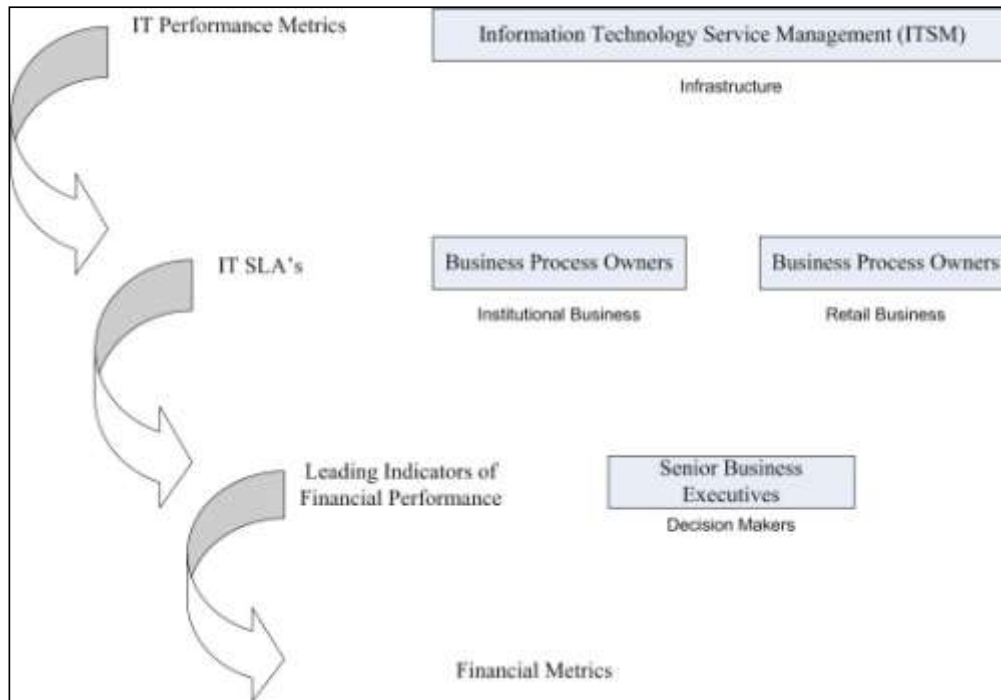


Figure 2. Gartner Business Value Model mapped to Finitute.

studies allow a variety of data collection methods such as documents and interviews to be used (Yin, 2009). Smith (2007) suggested that shareholder communication documents and interviews with business managers are appropriate methods of investigating the various business areas contained in the Gartner Business Value model. The organisation is a financial institute in South Africa referred to as 'Finitute' for confidentially reasons.

The Gartner Business Value model specifies that information be gathered from the following sources (Smith, 2007):

1. ITSM Metrics Respondents(IT) (The ITSM architect at Finitute was included as a respondent - referred to as IT1).
2. Business Process Owners(BPO) (Finitute has two distinct business operations; institutional and retail. A business process owner was selected from each business operation).BPO respondents are referred to as BPO1, BPO 2 etc.
3. Senior Business Executives (SBE) (These respondents determine which leading indicators of financial performance are considered important and can provide information about financial metrics employed at Finitute). SBE respondents are referred to as SBE1, SBE2 etc.
4. Purposeful sampling was used to select people as described by Smith (2007). People from different levels in the organisation were interviewed in an attempt to construct a landscape of reality as seen through their eyes (Walsham, 2006).

At Finitute, the business domains align with the Gartner Business Value model as shown in Figure 2.

Primary data were gathered through semi-structured interviews, with secondary data gathered from documents, such as shareholders' reports and information from the organisation's ITSM database. The interview protocol is available on request. Interviews allowed for organised, open-ended questions which allowed the researcher to confirm and clarify information during the interview as well as providing an opportunity to probe and draw information from the respondents.

There were interviews with multiple respondents at each of the three levels, data were collected from several sources including interviews, documents, etc, and then compared (Anfara et al., 2002). The strategy of using multiple data sources to build a coherent justification of themes means that triangulation was used to validate data (Creswell, 2003).

All respondents checked and verified the accuracy of their individual interview records, as well as the final report (Anfara et al., 2002). This suggests a member checking strategy to validate the report or responses contained in it (Creswell, 2003).

An illustration of how the data sets and items were mapped through the sample to the Gartner business value model is shown in Figure 3.

Each level of the model discussed indicates which set of respondents should be approached for information at that level. The data sets are mapped to the levels indicated in the model through the sample indicated earlier. Table 1 expands on the mapping of the model to the case study by indicating where the various data sets have been identified. From the mapping of the model to the case study, the individual data items can be shown by incorporating the interview sample. Table 1 indicates how the data items fit into the various data sets.

The data item descriptions can be found in the appendix labelled "Appendix B: Respondent Role Codes." Each data item code represents a respondent by the role they play in the organisation.

Each interview was recorded with the researchers' notes indicated at various points in the interviews. Senior business executives were interviewed first, followed by business process owners and the IT respondents. This was dictated by the Gartner business value model. The analysis followed the process shown in Table 2.

In the results section, references are made to the data item and data extract number in the format, "Data Item, Data Extract Number." An example of the code generated is shown in Table 3. In Table 3 the response would be referenced as (SBE1, 10) to

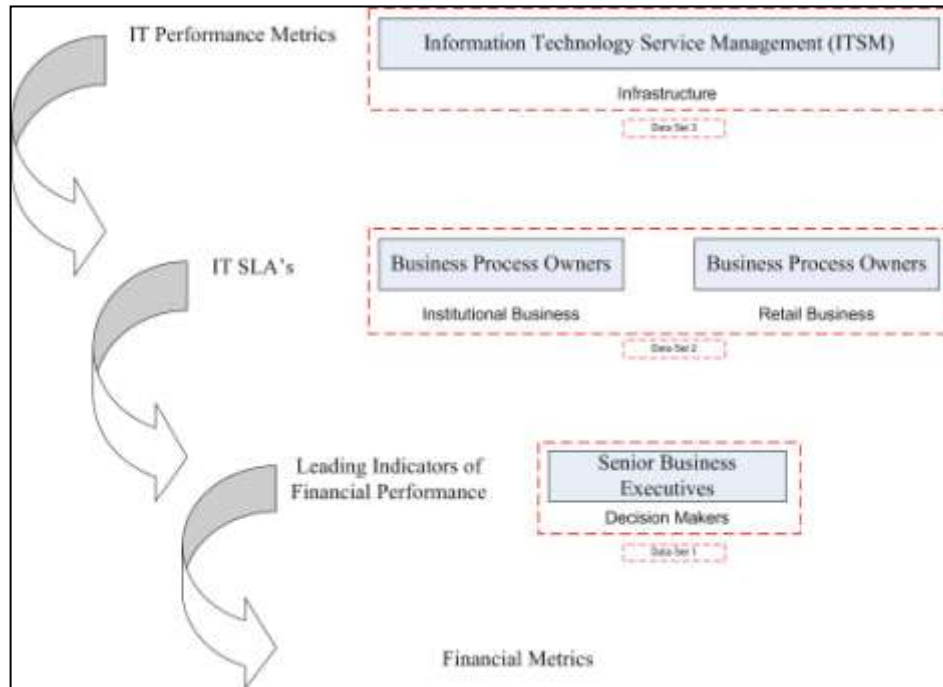


Figure 3. Gartner business value model mapped to case study structure, indicating data sets.

Table 1. Data corpus.

Data set	Interview sample					Pilot sample	
Data Set 1	SBE1	SBE2	SBE3			SBE1	
Data Set 2	BPO1	BPO2	BPO3	BPO4	BPO5	BPO1	BPO2
Data Set 3	IT1						

Table 2. Phases of thematic analysis (Braun and Clarke, 2006).

Phase	Description of the process
Familiarizing yourself with your data:	Transcribing data (if necessary), reading and re-reading the data, noting down initial ideas.
Generating initial codes:	Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code.
Searching for themes:	Collating codes into potential themes, gathering all data relevant to each potential theme.
Reviewing themes:	Checking if the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic 'map' of the analysis.
Defining and naming themes:	On-going analysis to refine the specifics of each theme, and the overall story the analysis tells, generating clear definitions and names for each theme.
Producing the report:	The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a scholarly report of the analysis.

indicate "Typical strategy cycles look at 1-3 years."

From Table 3, the code generated is "R|3[a]." The code represents the area of interest, which is derived from the Gartner business value model, the question number, which is derived from the interview protocol and a letter representing the response. The

representation of the area of interest is "R" for revenue, "D" for business processes, "S" for SLA's and "I" for IT metrics.

These were coded across the entire data set, with data collated that were relevant to each code. The codes were collated into a matrix that represents the interview protocol questions and by

Table 3. Thematic code generation.

Data Item	Data Extract number	Question number	Question	Response	Area	Code
SBE1	10	3	What period do you take into account when making strategic decisions?	Typical strategy cycles look at 1-3 years.	R	R 3[a]

extension, the Gartner business value model, which is represented in Table 4.

The matrix shown in Table 4 is the thematic map of the responses of interviewees. The results in the matrix represent the recursive process of generating codes, collating the codes into potential themes, then checking if the themes work in relation to the entire data set and to the initial codes.

RESULTS

Results of the analysis are observed at two levels, a semantic level and then an initial inductive level. The observations about the level of insight of respondents and the results related to the Gartner business value model are at a semantic level. The inductive level results are separated from the semantic level results and presented as findings stemming from the analysis.

Observations about the level of insight of respondents

The matrix presented in Table 4 shows that senior business executives gave their input along financial metrics primarily, where sources of revenue and leading indicators of financial performance were uncovered. The bulk of responses at the business process level came from business process owners and senior business executives. The comments related to SLAs shows that the appropriate level of service has been established by business process owners and IT. Table 5 illustrates the number of comments related to areas of interest.

The areas of interest, derived from the Gartner business value model, are represented in the left hand column of Table 5. Each area along with the expected comments is highlighted in a particular colour. All comments were volunteered.

The area of "Financial Metrics," along with the number of significant comments is highlighted in blue. The comments from the business process owners (BPOs) are significant, owing to the instrument looking for responses about general business activities and not necessarily related to a particular department.

The area highlighted in red: the "business processes" is in line with expectations that both senior business executives and business process owners have similar

insight about which business activities support leading indicators of financial performance.

The area of interest highlighted in green "SLA's," is in keeping with assertions from the literature, that business managers would be involved in determining the SLAs for IT servicing business activities. Business managers may include senior business executives and business process owners (Smith, 2007). No questions related to SLAs were directed at senior business executives but were brought up by these executives on their own accord. SLAs are not formalised at Finstitute; everyone has an understanding of what is expected of IT to support different business activities. SLAs are therefore implemented on a break fix basis and these are coded into the ITSM system in use at Finstitute.

Finally, the responses from the IT respondent at the level of "IT Metrics" are expected as IT metrics by themselves are significant in the IT unit and no other business managers are expected to have insight into them (Smith, 2007).

Results related to the Gartner business value model

Financial metrics

A summary of the comments by responder code at the "financial metrics" level of Table 4 indicates that most of the comments on financial metrics were by the Senior Business Executives. Revenue generators at Finstitute are primarily from investment performance, whilst the amount of assets under management (AUM) is a secondary generator of revenue according to respondents (SBE1, SBE2, SBE3). Investment performance is a measure of investment return compared to a benchmark at Finstitute. The benchmark for investment return is determined by mandates for portfolios by clients, and is usually the Johannesburg Stock Exchange All Share Index (SBE2). Fees paid by clients are a mix between being calculated on an absolute basis, or on a sliding scale based on "alpha" (SBE1; SBE2). A major cost of revenue was identified as people cost. There is a need to maintain the current number of people while increasing the assets under management. These efforts are around increasing economies of scale. There are also efforts around waste, meaning people are not doing things they do not need to be doing (SBE3).

Table 4. Matrix of thematic codes representing responses mapped to the research instrument.

		SBE			BPO					IT
		SBE1	SBE2	SBE3	BPO1	BPO2	BPO3	BPO4	BPO5	IT1
Financial Metrics	Q0	, a, a, a			, b, b					
	Q1	, a, b, c, c, c	, b, c, e, e	, d, c						
	Q2		, d, d	, e, c, c	j, a, b, b					
	Q3	, a, a, a, a, b	, d	, c						
	Q4		, b, c, d							
	Q5	, a, b, c								
	Q6		, a	, a						
	Q7	, a	, c	, b, d						
	Q8									
	Q9	, a, a, a, a		, b, b, c, c, d, b	, b, c, b					
	Q10			, a, a						
Q11										
Business Processes	Q0	, a	, b				, c, c		, f, d, e, e, e	
	Q1	, a, a, a								
	Q2	, a, b, d, e	, c, b		, k, k, k, k, k, k, k	, c, d, e, f, f, f	, c, l, l, l, a, a, a, a	, c, g, g, g, g, j, g	, h, j, g, i	
	Q3		, a, a, b, b, d, d, c							
	Q4			, a, b		, b		, a		
	Q5						, c	, a, a, b		
	Q6			, a, b, b, c, d						
	Q7		, a, a	, c	, a, a			, b, b		
	Q8							, b, c, d, e, f		
SLAs	Q0	, a, a, a				, e, g, g, h, d, d		, c, c, b		, a, a, a
	Q1		, d, e, e, e	, a, a, b, a, a, a, a	, k, k, k	, k, g, k, g, q, k, k, r, n, o, f	, c, k, k	, k, k, l, m, m	, h, h, h, j, b, p	, i, i
	Q2		, e	, b	, a, a, a					
	Q3			, b	, b	, b	, e, e	, j, j, k, m, b		
	Q4					, a, g	, g, g, h, h,	, b, b, b, b	, d, c, c	, e, f, i, f, b, g, i, g
IT Metrics	Q0									, a, a, a, b, b, b, b, c, c, d, e, f, f, g, g, g, h, i
	Q1									, a, a, b, c, d, a, a, a

Table 5. Number of comments.

Financial metrics	SBE = 49 Comments	BPO = 9 Comments	IT = 0 Comments
Business Processes	SBE = 27 Comments	BPO = 54 Comments	IT = 0 Comments
SLA's	SBE = 17 Comments	BPO = 65 Comments	IT = 5 Comments
IT Metrics	SBE = 0 Comments	BPO = 0 Comments	IT = 26 Comments

Leading indicators of financial performance

Leading indicators of financial performance are difficult to determine at Finstitute because of the cyclical and unpredictable nature of financial markets, although some scenario planning is done based on expected lows and highs. Scenario planning for budgetary purposes takes into account a period of between 1 and 5 years (SBE1; SBE2).

AUM is based on the number of clients Finstitute has, and the amount each are willing to invest. Several future indicators of financial performance can be attributed to AUM and can be measured, including client satisfaction and perception, the length of time investors stay in a fund, and the internal rate of return of an investment. The length of time an investor stays in a fund is an indicator of clients' satisfaction and perception. The internal rate of return feeds into clients' satisfaction (SBE1; SBE2; SBE3; BPO1).

The business departments that have been identified as owning business activities that support leading indicators of financial performance are the client services centre, distribution, marketing, business development managers, institutional client administration, investment portfolio managers and finance (SBE1; SBE2; SBE3).

Clients' Satisfaction: Helping clients understand the investment philosophy at Finstitute is a business activity aimed at increasing clients' satisfaction, and compelling clients to remain invested in funds for a longer period of time. This business activity is shared by the client services centre and marketing department (SBE1; SBE2; SBE3). The client services centre achieves this with the interactions between clients and the call centre. The marketing department achieves this with the use of above the line marketing; a term used to describe advertising that is paid for by Finstitute and with events aimed at current clients (BPO2; BPO4).

Other business activities aimed at increasing clients' satisfaction and that are measured, include attempts to maintain and increase quality of the interactions with clients. These activities are achieved through the use of quality evaluation measures and clients' satisfaction surveys, and fall into the domain of the client services centre (BPO2).

Waste: The distribution department has adopted a "one touch" philosophy of maintaining clients' satisfaction. This philosophy aims at reducing the number of interactions

needed to collect clients' information and consequently, reduce waste. Minimizing the number of client interactions to issue an instruction, or make an investment perpetuates the idea that it is easy to invest with Finstitute (BPO1; SBE1).

Service level agreements (SLAs)

Business managers and IT have an understanding of the level of service expected from IT documented in SLAs; such as core processing, communication, customer relationship management (CRM), e-commerce, institutional, and IT desktop support. The expectations are around availability of the services and performance of the services during business hours. Performance relates directly to clients' satisfaction and perception for some of the consumers. SLAs are the same across applications that fall into an IT service category and have various priority levels attached to break fix times (BPO1; BPO2; BPO3; BPO4; IT1).

IT metrics

At the final level, IT metrics that are presented to the business include measures for the services mentioned. The metrics can be categorised as those that highlight when a decision needs to be made about a service (performance based metrics), and those that show an impact on clients or users of a service (tolerance metrics) (IT1).

To indicate that information was first collected for financial metrics, leading indicators of financial performance, then SLAs and finally IT metrics, the initial Gartner business value model diagram was inverted. The arrows in Figure 4 indicate that IT metrics are linked to SLAs, which are linked to leading indicators, which in turn are linked to financial metrics. The Financial metrics in Figure 4 show the sources of revenue (Investment performance, Assets under management) and cost of revenue (People Cost). The leading indicators are clients' satisfaction (linked to assets under management), scalability (linked to cost of revenue and assets under management) and waste (linked to productivity of people - people cost). At the next level, SLAs are negotiated for communication and CRM (linked to clients' satisfaction), e-commerce (linked to scalability) and core processing

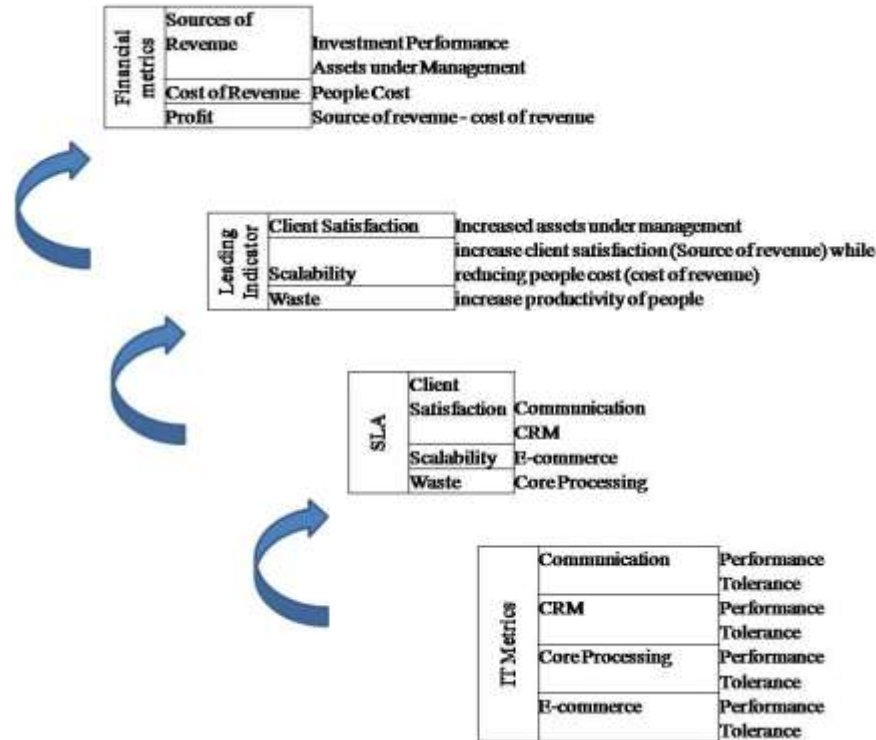


Figure 4. Gartner business value model mapped to case study results.

(linked to waste). Finally, performance and tolerance IT metrics for each service are indicated.

FINDINGS

IT benefits

Underpinning the business value that IT has is the fact that IT delivers benefits to a company. The literature indicated that IT helps increase competitive advantage, increases internal efficiencies and aides in decision making (Beachboard et al., 2007; Ward and Peppard, 2002). The case study is congruous with the reviewed literature in the ways described below.

Increased competitive advantage (profitability)

The literature indicates that competitive advantage is achieved with the use of a resource that is rare. Sustained competitive advantage is achieved when the resource is difficult to replicate or replace by a competitor (Ward and Peppard, 2002). Combining IT applications and managing them as a single service in a way that is unique and is difficult to replicate at a competitor results in competitive advantage Brynjolfsson and Hitt, 1998; Carr, 2007;

Melville et al., 2004; Ward and Daniel, 2006; Ward and Peppard, 2002). In the case of Finstitute, the application of IT resources becomes a source of competitive advantage, where it supports the “one touch” approach to dealing with clients and increases customers’ satisfaction, which in turn potentially increases assets under management in the future (BPO1).

Increased internal efficiencies (productivity)

Productivity means delivering value to a client as an output while reducing the input resources to deliver this value (Brynjolfsson and Hitt, 1998). It has been shown in the case study that internal efficiencies are achieved with the use of IT by having a direct impact on people costs, in terms of productivity and waste. The number of clients that can be serviced is increased dramatically with a marginal increase in the number of people cost required to do so (SBE3). The ITIL framework also increases internal efficiencies by arranging applications into services, and managing those services as single entities, reducing the need for systems to exist to complete similar tasks (IT1). In the case study, the concept of productivity is seen reducing waste, where delivering value while decreasing input costs around people extend to eliminating unnecessary work (SBE3).

Aiding decision making (scalability)

It has been established that IT aids decision making in the case study because IT services play an important role in the generation of future revenue. The use of ITSM and the ITIL framework allows for information about IT services to be made available to business managers through the use of performance metrics. This information aids business managers in making decisions about future requirements around human resourcing (SBE3; IT1) by giving decision makers information about which channels clients use to transact. Resources can be deployed in channels that are more popular with clients, and restrict resources in channels that are less popular. This means that Finstitute becomes geared at improving scalability in terms of human resources (SBE3).

IT managed as a service: a case study

The IT unit is responsible for service delivery and service support (Beachboard et al., 2009; Brynjolfsson and Hitt, 1998; Galup et al., 2009). The discipline of ITSM has been adopted in keeping with assertions from the literature reviewed in that IT is managed as a single entity where IT service includes managing people and technology as a service (IT1). Finstitute has adopted the ITIL framework as a guide to standardise tasks and processes around best practices. The ITIL components have been implemented using a software management suite known as ITSM, which is based on the ITIL framework and has ITIL standards and disciplines built into it (IT1).

ITIL at Finstitute

The ITIL framework is a best practice guide and as such, ITIL processes may be implemented piecemeal (Dubie, 2005; Galup et al., 2009). At Finstitute, the ITIL framework has been adopted in parts. It was decided to adopt the change control process first, as it was seen to be the easiest to implement (IT1). A roadmap was put in place to choose which other processes were adopted, and the order in which they would be adopted. The roadmap included those processes that were logical to implement because they leveraged off previously implemented processes (IT1). Another reason to adopt further ITIL processes stemmed from a recognised need, where management falls outside the ITSM discipline and shortcomings had been identified. Asset management preceded the adoption of the ITSM discipline and ITIL framework at Finstitute. Deficiencies have been identified around the management of assets and efforts have been made to bring it into the ITSM discipline (IT1). Finally, some ITIL processes, specifically around SLA

management, have been partially adopted due to the non-formal expectations around service levels that business has (IT1).

IT metrics at Finstitute

The ITIL framework provides for a number of metrics that measure variables in the IT unit of Finstitute. Metrics may be categorised as operational, performance and tolerance metrics (Coyle, 2007; Steinberg, 2006). At Finstitute, these metrics are used to provide information to business at various levels as follows:

1. Operational metrics are used internally by the IT unit on a daily basis.
2. Performance metrics are used to give information to business process owners (BPOs) to support their decision making processes.
3. Tolerance metrics are used at a senior business executive (SBE) level for strategic decision making purposes and provide information that highlights areas of concern or interest (IT1).

The following section expands on how performance and tolerance metrics are linked to leading indicators of financial performance.

The Gartner business value model related to the case study

From the analysis results it can be shown at a simple level that IT performance and tolerance metrics have a link all the way to financial metrics. From the literature reviewed, performance metrics can provide information that forms the basis of making business decisions. These may include information on any number of items including where to deploy human resources, or highlight areas of concern in the event of increased business volumes. Increasing business volumes while maintaining the same amount of input resources is also known as scalability or increased productivity (Brynjolfsson and Hitt, 1998; Steinberg, 2006). From the case study, it was found that scalability and waste have been identified as having an impact on future revenue (SBE3). Performance metrics can be used to show the extent that using IT services such as core processing reduces waste by reducing the number of checks that people need to do and can be offloaded to IT systems (BPO1; SBE3). In another instance, performance metrics can be used to demonstrate the extent that the IT service, e-commerce, is used to reduce the number of people needed to field calls in the client service centre by directing clients to get statements and other low level information from the website. Performance metrics can be used to demonstrate IT value to business managers in the departments that

directly rely on IT services (BPO4; SBE3). It goes to the scalability. Five years ago we had 10 000 clients and 10 000 calls, today we have 120 000 clients and 15 000 calls" (SBE3, 27).

Tolerance metrics are those that indicate impact on clients (Steinberg, 2006). The level that this may be presented is where leading indicators of financial performance have been identified. From the case study, clients' satisfaction is one leading indicator of financial performance (SBE1; SBE3). Tolerance metrics refer to those times when an IT service is unavailable. In the area of clients' satisfaction, the impact of the CRM IT service being unavailable when it is needed means that clients' satisfaction and perception is reduced or becomes immeasurable (BPO4). In this way, tolerance metrics can be used to indicate what level of discomfort clients suffered because of an IT service being unavailable. Most importantly, at the leading indicators of financial performance level, the value of IT investments into redundancy, hardware and people, among other things, can be demonstrated by showing the impact of these investments on future revenue (BPO4; IT1; SBE1; SBE3).

DISCUSSION

From the results obtained it appears as if ITSM metrics can be useful in the daily operations of an IT unit. Extending this usefulness beyond the IT unit is possible when managing IT as a service, as it provides the opportunity to describe the IT unit in terms of the impact it has on business.

The application of the Gartner business value model establishes a set of links between the services provided by the IT unit and financial metrics that decision makers consider important indicators of future revenue. With the inclusion of ITSM metrics in the final tier of the model, the magnitude of this impact can be indicated. The impact the IT unit has on future revenue effectively interprets the benefits that IT brings to a company in a language that is familiar to the intended audience.

How can ITSM metrics be used to indicate the value of IT to business decision makers through the application of the Gartner business value model?

In the institute case study it was shown that by identifying a set of leading indicators of financial performance and tracing them through business activities to the IT services these indicators rely on, business decision makers can begin to see where the IT unit has an impact on company performance. The study uncovers a dimension to IT metrics in the form of benefits IT brings to the company.

The benefits are directly related to areas that are

significant to decision makers. At institute, these are scalability (aiding decision making), productivity (driving internal efficiencies) and ultimately, profitability (increased competitive advantage).

Application of the Gartner business value model provides an opportunity to highlight areas where a chasm exists between IT and businesses, as well as helping business managers determine the appropriate service levels expected from IT by being able to link the business activities that rely on IT to financial metrics that are significant to senior executives.

The institute study also showed that the implementation of the ITIL framework in its entirety is not a prerequisite to using ITSM metrics to indicate business value. It shows that the categories of metrics that are pertinent to various levels of business are more important to indicating value than the framework they are embedded in. In the institute case study, the categories that metrics are arranged in have different values to various business managers. For senior business executives making strategic decisions, metrics that are categorised as tolerance metrics are most pertinent. For business process owners, performance metrics are most pertinent. Operational metrics are pertinent internally to the IT unit. The time period that leading indicators of financial performance at institute are expected to be valid for is beyond the rigid time periods used when evaluating IT using economic theory (SBE1; SBE2; SBE3). This is in keeping with literature that asserts that value needs to be interpreted in a way that takes the specific audience perspective into account and that there is a need to evaluate IT beyond timeframes that are expected when using economic theory (Bakos and Kemerer, 1992; Serafeimidis and Smithson, 2002). From this, it can be deduced that interpretive theory is more applicable than economic theory when evaluating IT as a service.

CONCLUSION

Contribution of study to business

The case study allows the business perception of IT as a resource to be changed. IT may be perceived as an input resource where opportunity exists to improve productivity and profitability by applying downward pressure on IT costs. This is related to the large costs associated with IT. The application of the model changes the perception by linking IT performance, specifically those around service and infrastructure, to financial measures that are significant to business decision makers. The business benefit of the study is the uncovering of information at the various tiers described in the Gartner business value model. By demonstrating the influences IT services have on leading indicators, the demonstration of IT value is possible.

Opportunities for further Research

As an exploratory investigation, this case study opened the door to applying the Gartner business value model to other companies that manage IT as a service, and are trying to use IT metrics to indicate IT value to business decision makers.

The voluntary nature of the research means that some business areas were not explored at all at institute. An opportunity exists to further explore other business areas and identify the associated IT services.

The study was limited to giving the IT manager tools indicating value to business; the interpretive evaluation theory should be extended to ways these tools should be used to demonstrate value to business. This study does not go so far as to tackle the *methods* used to demonstrate value of IT. The same considerations of the different lenses various audiences have when viewing performance or tolerance metrics should be made when considering how these metrics are used when attempting to demonstrate the value of IT to individual decision makers.

Conflict of Interests

The authors have not declared any conflict of interests.

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Full Length Research Paper

Building sustainable business intelligence systems by integrating user-centred methodologies in re-engineering

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This paper entails an analysis of the influence of adopting user-centred design in business intelligence (BI) application development. The purpose of the research is to answer the following question: does the integration of user-centred methodologies into BI re-engineering translate to the development of a sustainable BI system? A combination of research methods was applied in the pursuit of answers to this question. This paper surmounted the hurdles of user-developer alienation, through undertaking application development while involving all stakeholders throughout all the stages of development from initiation to implementation, ensuring a collaborative environment and collective idea evolution. While the financial benefits of such stakeholder collaboration were not directly or promptly discernible, the paper covered details of the non-financial benefits easily discernible – such as application acceptance and a sense of ownership among users, which essentially projects to longer life spans for application products. Comparing the findings, in summing up, the research confirmed that, indeed, user-centred design does lead to sustainable BI systems. Further validity and reliability tests undertaken indicated that the findings could well be deemed both accurate and reliable.

Key words: User-centred design, enterprise reporting, sustainable business intelligence, re-engineering.

INTRODUCTION

BI, the first aspect of this research, is considered one of the latest innovations dominating information technology (IT) investments made by businesses (Lawton, 2006). Its value for business is predominantly expressed by the fact that it casts light on information that serves as the basis for carrying out fundamental decisions in a particular enterprise (Olszak and Ziemba, 2007). User-centred design, the second aspect of this research, is an

approach which focuses on usability in the entire development process and life cycle of computer-based information systems (Gulliksen et al., 2003). Users can be defined as the consumers or 'users' of a product (Wallach and Scholz, 2012), and for this research referred to personnel whose organisation role was defined as system analysts. System analysts were herein defined as users because they both utilise the BI product

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themselves and represent end-users supported by the BI product (Wallach and Scholz, 2012).

The value of BI is compromised by the challenges that arise from a BI implementation that is not entirely understood by the users who make the decisions (Hocevar and Jaklic, 2010). While many reasons have often been identified for this, it was the perspective of this research that such problems originate from the lack of collaboration between application developers and users. This perspective contends that even technical superiority, alone, does not guarantee success and acceptance of an application product.

The active roles of users in the user-centred design approach, performing one or multiple roles as users, testers, informants, co-designers or design partners (Nesset and Large, 2004), are consequently seen to lessen the distinction between users and developers, leading to better understanding and cooperation. The central argument to this research, derived thereof, is that integrating user-centred methodologies in BI application development is likely to translate to the success and sustainability of the application. Sustainability herein refers to the ability of a system to evolve or remain relevant and useful as other details around it change (den Bergh et al., 2008).

Problem statement

Involving potential or actual users of the system in development initiatives is often largely overlooked, while it is often later discovered that beliefs, interpretation, perceptions and requirements differ markedly between developers and users. This virtually means that users will be expected to acquire a system that may be unknown to them. The implications of this are then numerous and serious, including huge costs required to train users, costs incurred in system redevelopment, prolonged system adoption periods, and failure of the system to meet user needs. When this happens, a BI system ceases to be a decision enabler and becomes a decision constraint. This is precisely the problem.

LITERATURE REVIEW

User-centred design in BI might be a relatively little-researched topic, particularly in an African context. Some consider user-centred design to be relatively young (Karat and Karat, 2003); however, considerable headway has been met in advocating user-centred design and usability studies – which is hard to say for BI. With this advance, though, it has been noted that activities undertaken to emancipate the position of users have not necessarily abided by the actual user-centred design approach (Orr and Nissen, 2006).

A few perspectives have arisen in the attempt to explain this phenomenon called 'business intelligence'. Some

express it as a management aspect, some as a technological aspect, and some as a product aspect, while other definitions comprise both technical and organisational elements (Watson et al., 2006). Some have offered more generic meanings which are equally valid, so it therefore means different things to different people.

BI has evolved for use in at least two different contexts: as a system and as a process. As a system, BI has been equated with decision support systems and enterprise information systems (Gray, 2005). As a process, BI has been defined as a process of turning data into information, and information into knowledge, and then into plans that drive effective business activity (Eckerson, 2003). While there are merits to both perspectives, a more complete view of BI is that it can be described as both a process and a system.

BI has evolved beyond simply an IT issue, and requires organisations to consider the people and business issues involved (Betts, 2005). The first extensive, detailed works in this line of research surfaced as a consequence of the large-scale adoption of Enterprise Resource Planning (ERP) systems (Caglio, 2003). To date, researchers have shown more interest in ERP systems than BI, with the exception of a few such as Rom and Rohde (2006).

Stodder (2013) reiterates the rise in BI and the importance of analytics. He mentions that, due to this trend, it is critical that business and IT bridge their cultures, and improve communication and collaboration. While there is a wide berth between business and IT, the best result can only be achieved if the two organisational entities work together. That argument resonates with this research, and encourages an attitude shift in BI environments from sectional isolation to that of collaboration.

As identified by Pekkola et al. (2006), there still remains a wide gap between methodologies addressing user participation and information systems development methodologies. The numerous user-oriented methodologies (such as user-centred design, and others such as participatory design, co-operative design and Joint Application Development), discuss how to involve users in the system design, yet there is a tendency to merely follow design guidelines such as the Waterfall Software Development Life Cycle, which are usually not aligned with user participation methodologies. The problem here is a lack of flexibility in application development, as entities continue to adopt methodologies that are outdated and no longer return as positive results as when they were developed.

The organisations that have BI also have a competitive advantage, but how an organisation defines BI success depends on what benefits that organisation needs from its BI initiative (Miller, 2007). The BI success may represent attainment of benefits such as improved profitability (Eckerson, 2003), reduced costs (Pirttimäki et al., 2006) and improved efficiency (Wells, 2003), as well as a reduction in the amount of time and effort required to deliver a product.

In early 2012, the Gartner group predicted that by

2017, chief marketing officers will outspend chief information officers on technology purchases (McLellan, 2012). Gartner's research indicated that high-tech marketing budgets were growing at more than twice the rate of IT budgets. Should this estimation be accurate by any account, IT cannot afford to wait to improve communication and collaboration with marketing and other business functions, because the value to be realised from the BI investment will have a substantial bearing on technology departments. Not only is such collaboration potentially financially rewarding, it will also prevent the expensive, insecure, difficult and harmful proliferation of non-IT-managed shadow systems – a malpractice which is already known to be taking place in some organisations.

RESEARCH DESIGN AND METHODOLOGY

Owing to its depth of context and the ability to explain phenomena in detail, the interpretivist paradigm was adopted for this research. Interpretivism offers practicality in the sense that those active in the research process socially construct knowledge by experiencing the real-life or natural settings – which allows the researcher to further the understanding of certain phenomena by releasing findings based on first-hand experiences. The positivist paradigm was not chosen because of its lack of subjectivity.

The mixed methods approach, in research, was utilised in data gathering, to leverage the benefits of both qualitative and quantitative methods and improve the quality of research. The quantitative and qualitative methods both have specific weaknesses, but even greater strengths. In any case, no single research methodology is intrinsically better than any other. The use of the mixed methods approach allowed the application of triangulation – which offers multiple options according to which one can answer the research question. Mixed methods allow a broad interpretation and inclusion of issues and strategies surrounding methods of data collection, in terms of questionnaires, interviews and observation.

This research being based on an actual information systems development project, qualify it as an action research project. The aspects that firmly make this an action research project are (a) the need to add knowledge; (b) collaboration; and (c) the need to address an immediate organisational concern.

Data collection

Questionnaires, interviews and observation were utilised in the data collection. The actual data collection activities were preceded by sending a consent form to the potential survey respondents. The consent form served to inform the research respondents clearly of their right of choice in the following aspects: (a) to participate or not; (b) to answer only the questions they want to; (c) to withdraw their responses at any point; and (d) to assure them of their privacy and confidentiality – which is a rather contentious issue in an era of identity and financial breaches in the IT fraternity.

The purposive sampling method was used for participant selection. The choice of the company can also be classified as purposive sampling as it was deliberately selected as the host of an actual projects that motivated this research. The duration of this research was also detected on by the same project, which was a period of 7 months. The company was a large retailer in the Fast-Moving Consumer Goods (FMCG) industry. 11 people were identified as potential participants. The profiles of the participants traversed all levels in the BI department, including technical

managers, business managers, BI system users, system analysts and developers. Seven of these were available for participation. A further 26 people identified as potential participants were BI practitioners from other companies, not directly involved in this initiative. They were BI users, system analysts, developers, technical and business managers and consultants. As external participants, they were selected based on their prior experiences with undertakings of the same nature as this research. Of these, 15 were available for participation. In total, therefore, 22 participants made up the survey sample.

The pilot survey interviews were carried out on five participants, comprising three system analysts and two developers – all employees of the company on which the research was based. The pilot survey was undertaken by means of the distribution of random semi-structured questionnaires.

One of the aspects commented on in the pilot survey was the length of the questionnaire. The pilot respondents noted that the survey should preferably not exceed 20 questions, and should not take more than a few minutes to complete, as the length would affect the response rate. Respondents also noted that their prohibitive work and social schedules meant that only a few people would manage to undertake the survey more than once.

Surveys were conducted in the form of questionnaires, and distributed after the pilot research. The survey participants could not all respond at the same time; therefore, the spontaneous interviews carried out permitted the application of questionnaire-related feedback. Spontaneous interviews varied widely in length, averaging between 5 and 10 minutes. Both open- and closed-ended questions were employed in the questionnaires.

Execution of data collection instruments

The questionnaires were distributed using three methods: paper-based (printouts), online (through LinkedIn) and e-mail. The online and e-mail methods were further split into either Microsoft Word attachments or a link to the survey hosted by www.surveyplanet.com. A total of 75 questionnaires were distributed, and 26 responded – which gave a completion rate of approximately 34.67%. The response rate at the company was 73.33% (11 responses out of 15) while online surveys had a response rate of 25% (15 responses out of 60). This is acceptable, considering that online surveys may only be expected to achieve a response return of around 10%.

Informal interviews were carried out in various locations, including outside while walking, in the canteen, in the lift/elevator, and while making coffee. Invitations to the interview were sent to employees of the company by using the corporate e-mail calendar that is part of Microsoft Office 2010, by telephone, and physically, by asking the participants directly. The interviews were recorded on a mobile phone and then stored on a personal computer. The interview questions were based mostly on the responses from the questionnaires and on the principal topic under research. This made interviews quite easy, due to the similarity to the open-ended sections of the questionnaires.

During the interviews it was also important not to limit the participants or steer them in a certain direction too much, because that would defeat the intention of getting their actual perceptions on the subject matter.

The observation method was used in conjunction with unstructured interviews, which exposed the researcher to so many casual observations that some cues needed to be disregarded.

USER-CENTRED BUSINESS INTELLIGENCE RE-ENGINEERING

Detailed herein are the activities undertaken in the BI re-engineering

project, and the conjunction points with user-centred design. The project lifecycle was tailored into a custom user-centred design cycle, so that activities at each stage of the project could be identified in the standard user-centred design cycle, as set by ISO 9241: 210 (2010), and the user was considered as a functional component of the application.

Justification for re-engineering

This research was based on a BI re-engineering initiative proposed by the company's executive committee, and it was, precisely, a platform migration from IBM Cognos 8.4 to Microsoft SSRS 2008 R2. Substantial analysis of the benefits of each of the two platforms was undertaken, and the following seven reasons were identified as justification for the migration:

- i. IBM Cognos has massive licensing requirements, while SSRS is shipped free with the Microsoft SQL server package.
- ii. The company already had SQL server licenses for their databases that were not fully utilized; therefore, making use of reporting services shipped with those licenses, would extract a great deal of value from them.
- iii. Cognos 8.4 was already outdated, and the upgrade to Cognos 10 or higher was overdue. With the current experience, though, the upgrade did not promise enough Return On Investment (ROI) potential.
- iv. Many users reported unsatisfactory performance from the IBM Cognos report deployments.
- v. Some uncertainty has also been introduced regarding products support, and whether the Cognos product will remain as currently packaged or will require other tools to work with it. The SQL server, meanwhile, remained a single integrated platform with visible continuity.
- vi. There are more Microsoft BI developers than Cognos developers, possibly due to the higher popularity of Microsoft products.
- vii. Microsoft applications are quite open, in terms of connectivity, customization and integration with other applications, while Cognos is more difficult to connect to other applications.

The development process

The development process followed basic steps that started with prototyping, which was compassionately referred to as the Proof of Concept. The same tools used in actual development were used to deliver the Proof of Concept, the primary of which were the following: Microsoft Visual Studio 2008, SQL Server Reporting Services, IBM Cognos 8.4 (for reporting), MDX Studio 4.0, WinSQL, SQL Developer 1.5.5 for Oracle PL/SQL 11g, IBM Informix (database management environments) and JavaScript and HTML 5 (graphical user interface development).

After prototyping, the next venture was report development, which was then followed by the graphical user interface development, both of which were carried out iteratively.

Figure 1 is a screenshot from the BI Development Studio, and it is part of the Proof of Concept. Although the screenshot only shows a single report, the initial Proof of Concept consisted of numerous reports, each with a drill-through to another, as well as sales-based colour application in the columns.

Report and user-interface development

The user-driven product functions refer to aspects, operations, functionalities or features of the product, that were added on request of the user. Such additions formed a major part of the user-centred

project, the bases of which are the principles of participatory design. With their involvement in the whole design cycle, the end-user assumed the role of the voice of reason – the people responsible for safeguarding their and their fellow users', interests.

A major part of the project was the determination of requirements with the input of users. In being a re-engineering project, the bulk of the functions already existed in the Cognos platform, and the users required that these be maintained. SSRS, however, is an entirely different platform from Cognos, and delivering these requirements introduced complexities at a totally new level. Users, however, were predominantly unaware of the complexities introduced by seemingly basic requirements. Some of these seemingly simple requests by users that translated to many lines of code included the following: drill-through (the ability to query further aspects of an application, or related application, by clicking on an item on a specific application); colour variances (the alternation of colours returned, dependent on set conditions, numerical or textual); selective PDF/Excel output; divide by zero error handling (situations where a calculation leads to a zero-valued denominator, which raises an error upon execution); field concatenation; lookups; and, date range limits.

Iterative development and testing

The development team and the analysts held regular sessions, in which iterative development requirements were discussed, while all successful stages were noted on a shared platform. All stakeholders were aware of the status of each piece of work. Considering that business champions, who were also present in all these meetings, were aware of the cost implication of non-responsiveness, the turnaround time for each task was exceptionally low. That was one set of indicators of the influence of user-centred design; it eliminates time wastage where user input is required.

User testing was undertaken at every stage of development, changes raised during testing were factored into development, and then the product was moved back to testing, until it passed that level of testing, and only then would it move to the next level. This cycle continued until the end of the development cycle, when the product was deemed correct and accurate – at which point a change control was logged (a request to implement the report in the production environment). The change control was then followed by a move of the report and user interface to production environments (Figure 2; Table 1).

DATA ANALYSIS AND FINDINGS

In this section are details of the findings from the data-gathering exercise. Also included are details of the reliability and validity tests undertaken to assure the integrity of the survey instruments.

On the survey distributed to users, classification by respondents indicated that 8 out of 13 questions achieved scores above the 80% mark, and 5 out of 13 in the 60-80% range, which suggested the perceived positive benefits of user-centred design. Classifying the same survey responses per respondent, 5 out of 11 participants classified above 80%, and 6 out of 11 in the 60-80% range. On the survey distributed to developers, classifying the responses per question indicated that 2 out of 13 questions achieved scores above the 80% mark, 9 out of 13 in the 60-80% range, and 2 out of 13 in the 40-60% range. Classifying the same sample per respondent indicates that 2 out of 11 participants

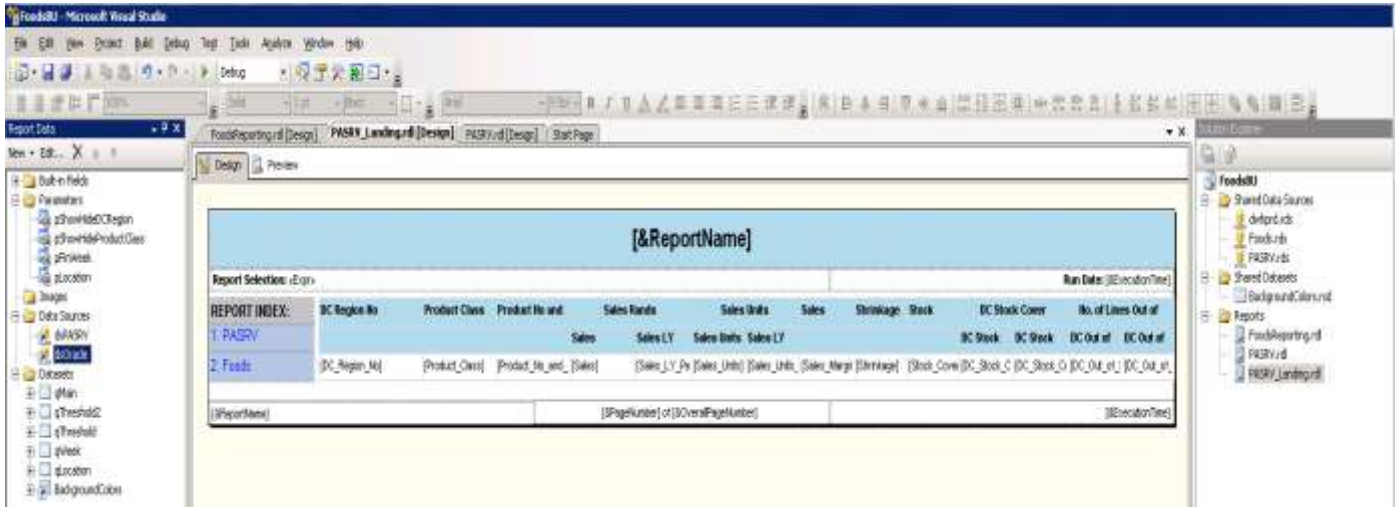


Figure 1. Report Proof of Concept (design view). Source: Own source.

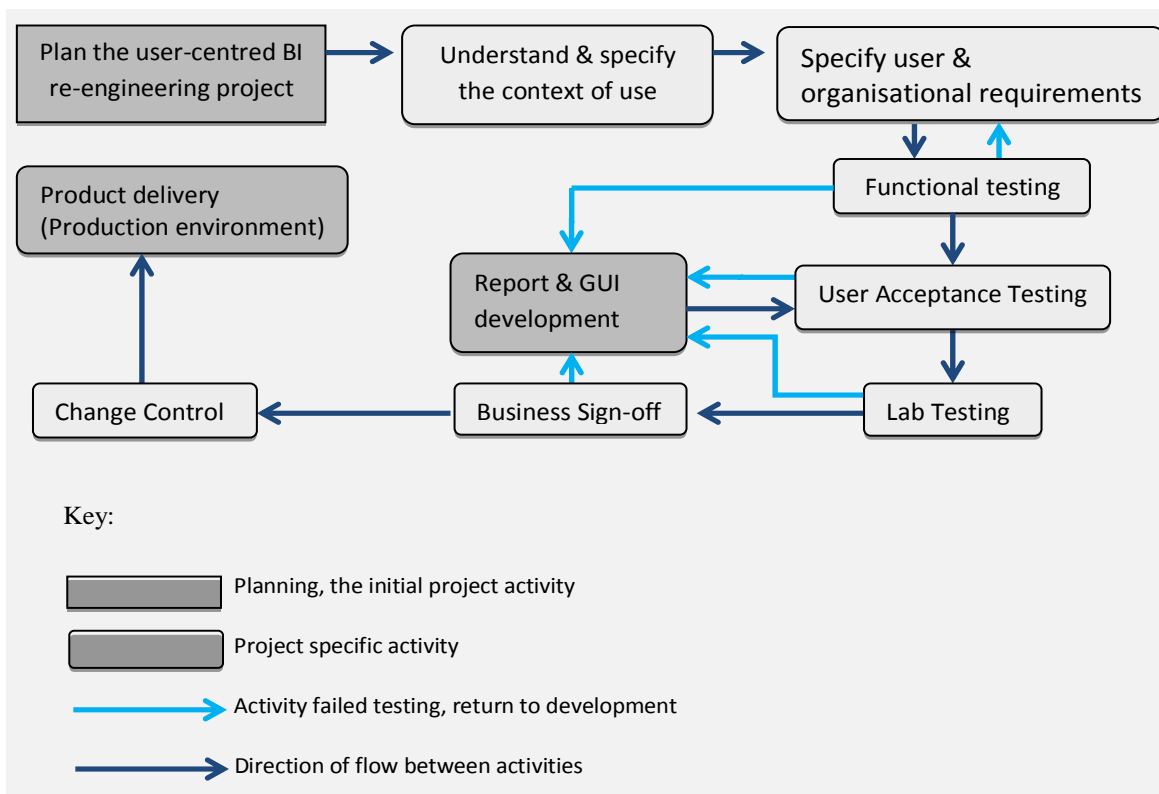


Figure 2. The actual iterative development process. Source: Own source.

classified above 80%, and 9 out of 11 in the 60-80% range. The above statistics suggest that users find user-centred design more favourable than do developers. Developers have a number of concerns, among them being a belief that user-centred design stifles their initiative, slows down progress, increases project time

overheads, and is not always the best strategy. A margin of error can be allowed, considering that the users' survey was completed in full – thereby allowing accurate reflection of the results, while there were omissions in the developers' survey – which influenced the results, even though missing results were disregarded in the

Table 1. Application of the ISO 9241: 210 (2010) principles of user-centred design.

Principles of UCD (ISO 9241-210, 2010)	Application in the BI re-engineering initiative
Design is based upon explicit understanding of users, tasks and environments.	There was a conscious drive to understand the needs of users and their environments.
Users are involved throughout design and development.	Representative users are actively involved from the beginning, continuously, throughout the entire development process.
The design is driven and refined by user-centred evaluation.	User evaluation started from prototyping, and continued throughout the development and adoption cycles. It took on a 'participatory' mode, whereby unit and functional testing was undertaken by members of the development and testing teams, followed by functional and acceptance testing by users.
The process is iterative.	At the end of each development task, testing was undertaken by various stakeholders, and the product was sent back to development whenever any issues were found, or if the product did not meet user requirements.
The design addresses the whole user experience.	The user-centred design approach was not adopted only in user-interface design, but in reporting development as well. The user experience included the experience of the user with cost values, text fonts, validation on selections, and all other aspects of the product.
The design team includes multidisciplinary skills and perspectives.	The project team consisted of individuals from diverse professional backgrounds, with varied skills and perspectives. The design team consisted of ten individuals, with focus meetings held daily at 10 am.

Source: Own Source.

calculations.

Frequency tables drawn from NVivo indicate that the most frequently used words by the respondent users were the following: 'users' (21 times), 'reports' (18 times), 'requirements' (15 times), 'involvement' (14 times) and 'information' (11 times). Four of these five words featured in the developers' most frequently used words as follows: 'user' (74 times), 'development' (33 times), 'requirements' (22 times), 'information' (15 times) and 'involvement' (12 times). An interesting outcome is that four of the top five most used words are common between the users and the developers. This suggests a particular interest in those words, and the words themselves resonate with an inclination towards collaboration.

The following are the word trees that depict the frequency and usage of the words by the respondents (Figure 3).

The word 'user' was the most frequently used for both the developers' and the users' group. While the survey results reveal that developers show a deeper aversion to 'user-centred design', overall there is preference for 'user-centred design', as its influence is recognised since this group mentioned the word 3.5 times more than 'users' (74 times, as compared with 21 times for 'users').

The word trees provide a narrative of the issues that underpin this research, and they mirror the thoughts and ideas of both parties – most of which can be narrowed

down to both a lamentation over the state of user-centred design, which has been found to be lacking in many instances for numerous reasons, and expressions of support for the adoption of collaboration between business (users) and IT (developers) (Figure 4).

Validity and reliability of survey instruments

Reliability refers to the consistency with which a measure produces the same results with the same or comparable populations (McDaniel and Gates, 2004). For this research, internal consistency was deemed important, because analysis and deduction was to be carried out on the data, and the deduction can only be accurate if internal reliability is ascertained. Internal consistency was measured using Cronbach's Alpha and computed using SPSS. Cronbach's Alpha is the most widely used measure to assess the internal consistency of a scale (Huck, 2004). The method was deemed to be particularly attractive – not only for its value in ascertaining the reliability of a test instrument, but also because it requires only one set of results (Gliem and Gliem, 2003). This was very positive, as it turned out to be extremely difficult to distribute the survey instrument a second time at the researcher's organisation.

The Cronbach's Alpha (reliability) calculations

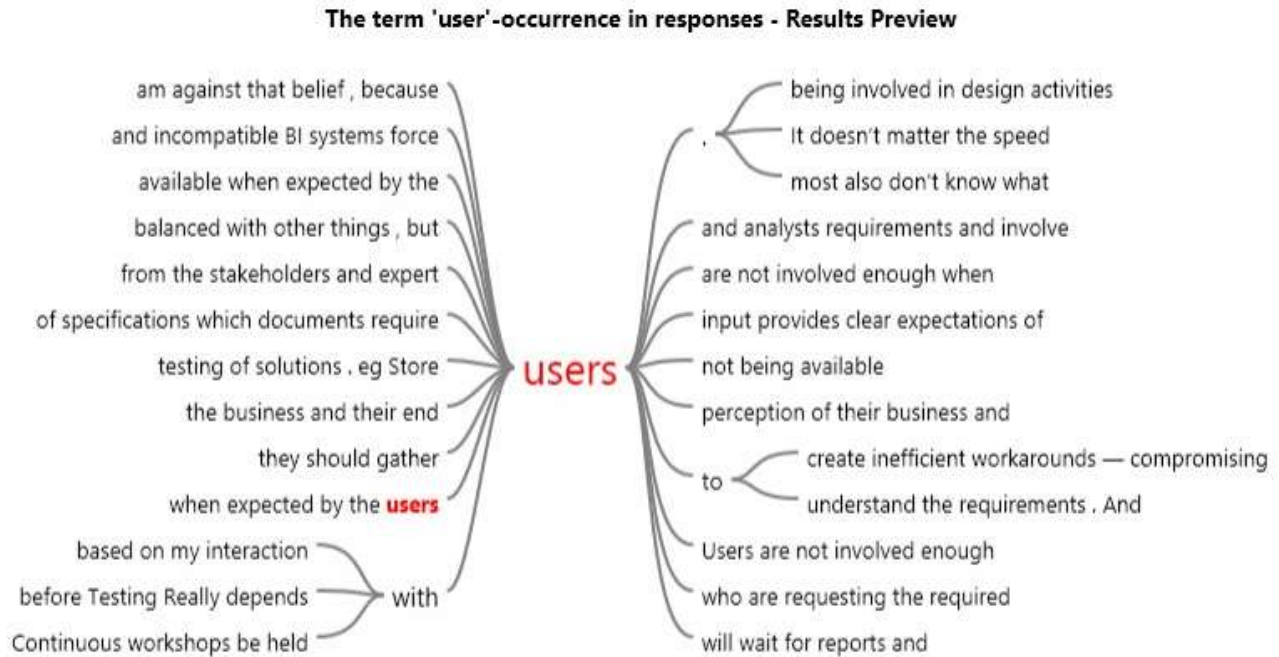


Figure 3. Users' word tree. Source: Own source.

undertaken on the survey results from developers, as well as from users and analysts, are as below.

The script for the computation of Cronbach's Alpha:

```
RELIABILITY
/VARIABLES=Qtn1 Qtn2 Qtn3 Qtn4 Qtn5 Qtn6 Qtn7
Qtn8 Qtn9 Qtn10 Qtn11 Qtn12 Qtn13
/SCALE('Reliability test') ALL
/MODEL=ALPHA
/STATISTICS=ANOVA FRIEDMAN
/SUMMARY=COV CORR.
```

Having tested the survey instrument's reliability, it is also important to ascertain the validity of the data (Table 2). Although reliability is necessary, it is not sufficient to validate an instrument, because an instrument may be reliable, but not valid. Validity refers to the degree to which a measure reflects the characteristic of interest (McDaniel and Gates, 2004), or simply the accuracy of the instrument (Huck, 2004). Since it addresses the issue of whether what the researcher was trying to measure was actually measured, it is, therefore, concerned with the integrity of the conclusions generated from the research. A minimum of five participants per variable is generally recommended to apply validity tests (Munro, 2005).

Validate Data

* Validate Data.

```
VALIDATEDATA VARIABLES=Qtn1 Qtn2 Qtn3 Qtn4
Qtn5 Qtn6 Qtn7 Qtn8 Qtn9 Qtn10 Qtn11 Qtn12 Qtn13
/VARCHHECKS STATUS=ON PCTMISSING=70
PCTEQUAL=95 PCTUNEQUAL=90
/CASECHECKS REPORTEEMPTY=YES
SCOPE=ALLVARS
/CASEREPORT DISPLAY=NO.
```

Result from SPSS:

Warning

Some or all requested output is not displayed, because all cases, variables or data values passed the requested checks.

A Cronbach's Alpha of 0.7 is generally considered acceptable (Kline, 2005). Yet, other literature suggests that an alpha of less than 0.6 indicates unsatisfactory internal consistency reliability (Malhotra and Birks, 2007) – which implies that internal consistency of above 0.6 is satisfactory. In considering this, therefore, it can be deduced that the survey instruments were reliable and valid.

FINDINGS AND DISCUSSION

Some of the envisaged improvements include prototyping solutions, having solutions tested from the end-user perspective, as well as developers growing other skills

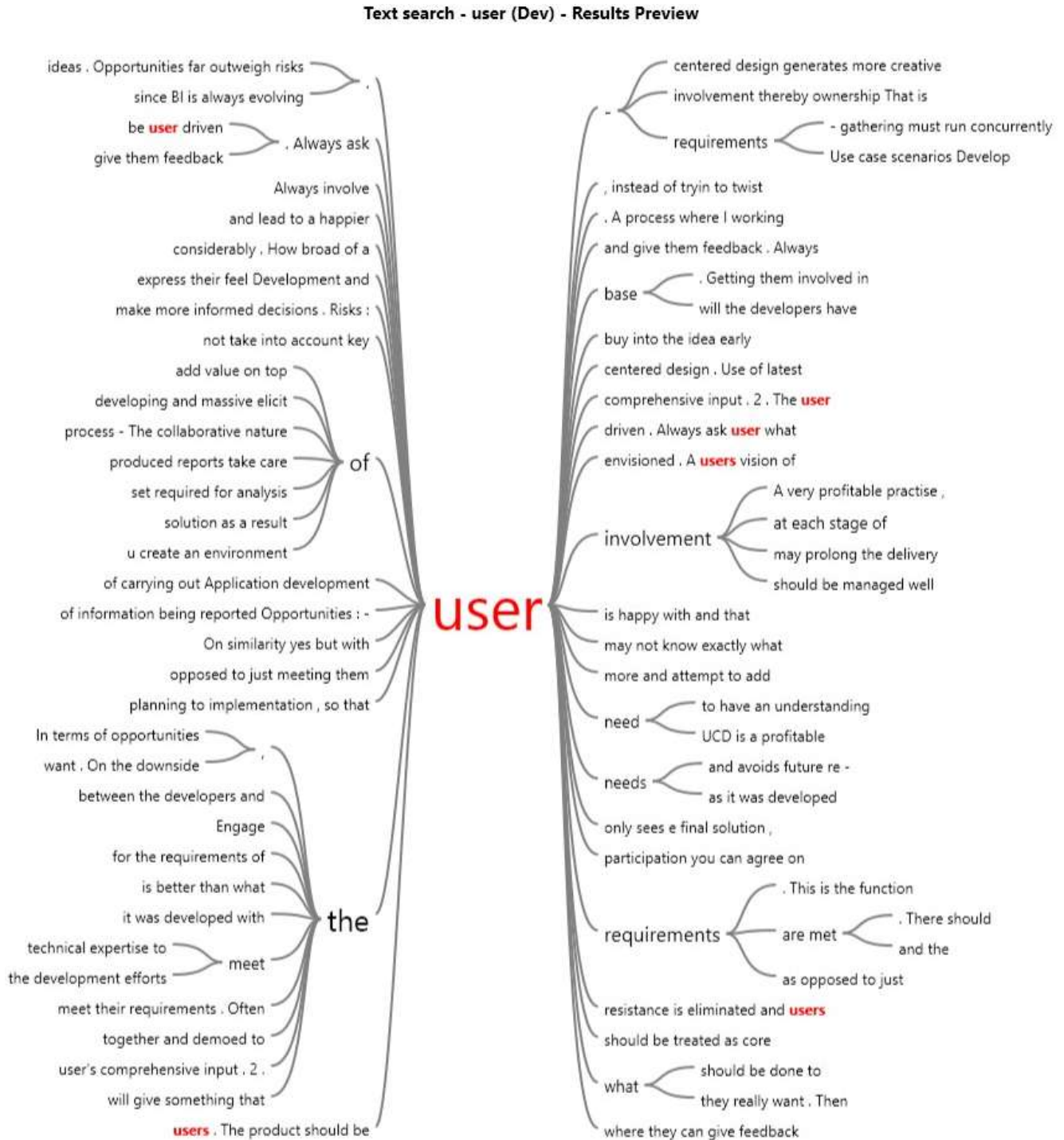


Figure 4. Developers' word tree. Source: Own source.

Table 2. The results of Cronbach's Alpha reliability test for users and developers.

Test group	Cronbach's Alpha	Cronbach's Alpha based on standardised items	No. of items
Users	.708	.782	13
Developers	.653	.663	13

Source: Own source.

outside of their primary role – such as interpersonal skills to enable them to fit into cross-functional teams.

The viewpoints raised by developers were not so different, except that developers showed an inclination towards technical solutions for current user-centred design problems. Some of the solutions envisaged are as follows: (a) the adoption of agile development methods; (b) the adoption of the latest technologies (which would most likely provide more enhanced platforms for solution development); and, (c) the adoption of products that are the best fit for the requirements of the user, rather than trying to twist existing products to fit the requirements. Developers, similar to users, also cited user involvement and regular meetings (or focus groups) as methods that are relevant to improving the quality of BI reporting.

There was an overwhelming opinion that user involvement practices in BI development projects in general, are not being undertaken religiously – and not sufficiently, either. The level of acceptance of the product indicated that user-centred design can be reliably deemed to greatly improve application sustainability. The user response indicated that they believed that user involvement in this particular research was sufficient; therefore, this research can be classified as a user-centred application development project, and the results be deemed to be a true reflection of the influence of user-centred design in a BI initiative.

It can further be deduced from the survey that users are considered (by both developers and themselves) to be generally more conservative than futuristic, as their input in application development is mostly based on past experiences, rather than future expectations. While analysing a current application, a user is believed to more likely identify issues that should be addressed, rather than what functionality or evolution the application should take in the future. It is for this reason that some developers believed that user-centred design might be counter-innovative.

The opportunities identified, though, far outweigh the risks. Users are expected to accept ownership of the application, which reduces the overheads on development teams, and the elimination of user resistance in future project plans. The collaborative nature of user-centred design offers more creative design potential; that is, meeting users' needs can be ascertained, because an understanding of the application means that users will be in a better position to correctly interpret report data. Moreover, the involvement of users may actually raise awareness of opportunities they did not realise were available. This implies that, contrary to the earlier findings, user-centred design may lead to innovation – should it be undertaken prudently.

As technology continues to evolve, future studies could be on the new technologies. Concepts such as cloud-based BI, self-service BI, mobile BI, big data and predictive analytics are potentially the standard of the future. Embarking on studies to explain the phenomena

to BI consumers could potentially have considerable impact in the way the technologies are adopted and used by the host organisation. While these concepts all offer attractive opportunities for further studies, even bigger potential could lie in offering BI service from a business rather than a technology perspective. All these indicate that the opportunities for further study are altogether limitless.

LIMITATIONS OF THE STUDY

Not only did a relatively small number of participants in the survey make it harder to generalise the findings to the larger community, but it also made statistical analysis harder. However, as statistical analysis was carried out in conjunction with qualitative analysis, it warrants that the greater the number of respondents does not equate to higher validity. Furthermore, reliability and validity tests carried out indicate that the survey instruments and the survey data were both above the thresholds, therefore can legitimately be deemed accurate.

In addition, this study does not outline the actual time and human resources required to attain a comprehensive and effectual user-centred focus, particularly as organisations vary in size, maturity, core business and resources structure. As such, it will be particularly useful in organisations with structured technical and business teams, but evidence has not been gathered to indicate whether or not it will be equally applicable to unstructured organisations. Differences in organisational complexity and dedicated human resources make it nearly impossible to determine actual measures required to attain user-centred focus, and this study was no exception to this.

This research relied on self-reported data, as with many studies of this nature, which cannot be independently verified. Therefore the researcher was compelled to take the opinions of the survey sample at face value, be they in questionnaires, interviews or focus groups. Self-reported data is exposed to such limitations as selective memory (remembering or not remembering experiences or events that occurred in the past) and exaggeration (representing outcomes or events as more significant than is actually the case). Self-reported data is, however, not expected to have distorted the outcome of this study, as triangulation of methodologies was undertaken. The inclusion of the practical aspect in the study also provided a verification mechanism for all data acquired from survey samples.

Conclusion

The evidence of success of a BI reporting application is acceptance and adoption by users. Getting users to accept an application is often a long and daunting task which is not always successful. The adoption of the BI

application covered in this research was unhindered, and received positive reviews from all stakeholders. The process pursued, and the quality of the product, were lauded – both of which were the culmination of a process of collaboration and iteration. This research has offered a practical base for the integration of user-centred design and BI, which has largely been non-existent, particularly in an African context. While it has been found that neither user-centred design nor BI is new or novel concepts, they have been covered in theory but not practised in Africa. This research has not only substantiated the relevance of UCD in a real-world setting, but also set precedence for further and more exhaustive studies.

The input from the survey sample indicated that all stakeholders (both users and developers) would like user-centred design to be adopted as the development strategy. It also showed that not only are users willing to assume ownership of applications should collaboration be undertaken, but also that they would like to see continuity of the BI application as an ongoing concern. This research provided further insights in the field of BI; it is crucial that technical resources (developers) acquire interpersonal skills to facilitate better communication and relationships with business teams. Furthermore, it is imperative that the traditional cultural chasm between business and IT teams be broken to eliminate the animosity between the two. It would also be prudent that organisations establish BI projects at an organisational rather than departmental level, which ensures that projects are not exposed to the dynamics of inter-departmental relationships, while nurturing collaboration?

Altogether, user-centred design is clearly prudent practice. However, it comes at a price. User-centred design alone is not enough, and requires combination with the relevant technical expertise to meet the users' needs. Such needs are not always an easy feat to achieve, as some users have extremely demanding and complex requirements. Yet, this research found that the complexities are a cost far outweighed by the prize. It can be concluded, thus, that the integration of user-centred design does lead to the development of sustainable BI applications.

Conflict of Interests

The authors have not declared any conflict of interests.

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