

Understanding the Processes of how Small and Medium Enterprises derive Value from Business Intelligence and Analytics

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Abstract

This paper provides an in-depth study of how small and medium enterprises (SMEs) use business intelligence and analytics (BI&A) to derive business value and why so many SMEs fail to do so. A qualitative research approach based on semi-structured interviews with five SMEs in Australia was applied with the goal is to understand the process in which SMEs adopt BI&A to derive business value. This involved exploring how owners and managers lead their employees in using data and analytical processes to derive insights to make business decisions. The findings suggest that SMEs which adopt BI&A use a short and simple six-step iterative BI&A process to derive insights for business process application. In addition to the short process, a longer three phase process has been identified which progresses SMEs from solving operational issues to strategic challenges. The resulting short and long BI&A implementation process framework provides a progressive pathway for SME owners and managers to initiate and lead BI&A transformation in their SMEs to derive greater business value. The process model considers dimensions of data, analysis, business process change, social influence, level of information use and financial returns.

Keywords: Business Intelligence and Analytics, Small and Medium Enterprises, Process Model.

1 Introduction

In today's economic climate, business intelligence and analytics (BI&A) are crucial in strategising, planning, executing and monitoring business operations to improve efficiency and performance. BI&A is an overarching term for decision support systems used to collect, analyse and disseminate organisational data to improve decision-making (Fink et al., 2017). The implementation of BI&A has been simplified over time due to advances in digital platforms and BI&A cloud computing (Mikalef et al., 2020), providing more accessibility to small and medium enterprises (SMEs). However, SME research shows a low adoption rate of BI&A (Agostino et al., 2013; Llave, 2019).

Research on BI&A focuses primarily on large organisations, despite the significant contribution that SMEs make to the world economy and the potential benefits that SMEs can gain from BI&A. Llave (2019) conducted a systematic review of research on BI&A in SMEs published between 2000 and 2018, which included topics on BI&A benefits, cloud BI&A, mobile BI&A, BI&A solutions and implementation. She found that while several frameworks and models were proposed to guide SMEs on successful BI&A implementation, there is no clear indication of success. She further highlights the need to consider the unique characteristics of SMEs and not rely on models developed for large organisations. Mikalef et al. (2020) also indicate that further research is necessary to understand the processes large organisations undertake to adopt BI&A.

A small number of frameworks have been devised to explain how large organisations gain value from BI&A (Fink et al., 2017; Seddon et al., 2017). For example, Business Analytics Success Model (BASM) is a process model that describes the 'analyse-insight-decision-action' process of large organisations to derive value from BI&A (Seddon et al., 2017, pg. 237). Process models are event-driven explanations of events and patterns that describe change over time (Payne et al., 2017; Van de Ven, 2007). However, none of these frameworks have been developed for SMEs and they do not consider their unique characteristics. BASM is used as a starting point for this research to understand the process that SMEs undertake to derive value from BI&A. The research question investigated in this paper is: What processes do SMEs use to derive value from BI&A?

Three main findings are derived from qualitative case studies in five Melbourne, Australia-based SMEs. The first is that while all the SMEs had the basic building blocks for BI&A processes, many SMEs are still traditionally bound by heuristics and networking and are unwilling to venture into the use of BI&A. The second is that BI&A applications are not simply a matter of transforming resources into capabilities. SMEs need to consider the goal of the information use (organisational, managerial or strategic), the data required to achieve this goal, how to apply insights and how to inculcate cultural change in the organisation. The third major finding is that there are distinct measurable changes as the SME progresses in adopting BI&A. These findings extend the BASM model by providing greater details on how BI&A adoption takes place in SMEs.

The paper is structured as follows. The first section reviews the current surrounding contemporary understanding of SMEs' adoption of information technology, then introduces and adapts the BASM for SMEs. The second section describes the research method used in this study, while the third section focuses on the analysis of the data and concludes with the findings and recommendations.

2 Literature Review

2.1 SMEs' Adoption of Information Systems (IS)

SMEs account for 99% of all organisations in OECD countries and employ on average 70% of workers in OECD countries (OECD, 2017). This research adopts the Australian Bureau of Statistics' definition that SMEs have less than 200 employees (Statistics, 2021). However, SMEs are not homogenous in size and are instead represented by micro, small and medium businesses, as shown in Table 1.

Due to the importance of SMEs to the economy, many researchers have studied how SMEs adopt various types of information technology such as the internet, customer relationship management (CRM) and Enterprise Resource Planning (ERP), just to name a few. In a review of high-ranking journal studies on IS and SMEs, Parker et al. (2015) noted that SMEs are heterogeneous, citing that they vary in size, industry and independence versus acting as a subsidiary.

	Micro	Small	Medium	Large	
Headcount	1- 4	5 - 19	20- 200	200 +	Total
Operating Business @30 June 2020	609,276	214,454	47,649	4,160	875,539
% of Total	69.59%	24.49%	5.44%	0.48%	100.00%

Source (Statistics, 2021)

Table 1. Count of Australian Businesses by Size as of 30 Jun 2020

Due to the importance of SMEs to the economy, many researchers have studied how SMEs adopt various types of information technology such as the internet, customer relationship management (CRM) and Enterprise Resource Planning (ERP), just to name a few. In a review of high-ranking journal studies on IS and SMEs, Parker et al. (2015) noted that SMEs are heterogeneous, citing that they vary in size, industry and independence versus acting as a subsidiary. Despite these differences, researchers have found common characteristics amongst SMEs that will affect the introduction of new IS. Zach et al. (2014) summarised the characteristics of SMEs into three high-level groups: organisational, environmental and knowledge of IS. The organisational characteristics are further divided into the availability of resources (both human and financial), management, organisation structure, culture, processes and procedures (Zach et al., 2014). The environmental factors are further refined into uncertainty, markets and customers (Zach et al., 2014). Finally, the knowledge of IS subdivided into IS knowledge, technical expertise and complexity of the IS (Zach et al., 2014). Focusing on a specific information system such as ERP, Zach et al. (2014) found that SME owner-managers significantly influenced almost all aspects across the ERP life cycle, such as the system selection and customisation as well as the implementation team's work. This finding further emphasises the central role of the owner-manager of an SME in the adoption of IS.

The lack of resources also plays an important role in adopting IS. Seethamraju (2014) found that the total cost of ownership and investment costs in adopting new technology were key factors in the adoption decision. Jaouen and Nakara (2015) proposed that SMEs use bricolage as a form of strategic financial creativity, "making do by applying combinations of resources already at hand" (Baker & Nelson, 2005, pg. 333). They identified two forms of bricolage: 'necessity bricolage' to keep their business small and avoid recruitment and the second, 'strategic bricolage' aiming at success, performance and sometimes growth.

Power and Gruner (2017) highlight the lack of research into the role of decision-making style in SMEs and broadly divide the literature on IS decision-making strategies into two streams. The first stream highlights a positive relationship between performance and a deliberate decision-making style related to IS. The second stream of research identifies a positive relationship between an emergent decision-making style to IS and performance. Power and Gruner (2017) indicate no consensus in the literature on the best decision-making strategy for SMEs. In the context of inter-organisational systems, decision-making is often ongoing and

contextual and involves more intuition than rational, careful analysis and omniscient projection of future states (Power & Gruner, 2017).

2.2 Theoretical Model Relating to BI&A implementation

Early research has indicated that the use of BI&A technology has improved organisation performance (Mikalef et al., 2019). But recent research suggests that the adoption process is a complex endeavour and it is necessary to have a more in-depth understanding of how organisations need to change to adopt BI&A effectively (Vidgen et al., 2017). Mikalef et al. (2020) argue that business analytics (BA) research assumes that BA resources are easily orchestrated and mobilised effectively by organisations and that the desired outcomes follow naturally. As a result, they highlight that more research is needed to understand the structures, processes and activities necessary to incorporate BI&A resources into organisational capabilities.

As such, we firstly investigate the current understanding of the adoption of BI&A by SMEs. Llave (2019) conducted a comprehensive review of the literature on BI&A implementation by SMEs and found 25 publications related to this area. However, only four publications focus on frameworks, architecture and models, whilst other papers identify critical success factors, antecedents and prototypes. Table 2 below summarises the four papers that focus on frameworks and models for BI&A adoption by SMEs (Llave, 2019).

Reference		Contribution	Empirical Testing
1	(Raymond, 2003)	Developed a conceptual framework focussing on the competitiveness of SMEs that could orient BI&A activities & projects.	Conceptual Study
2	(Sadok & Lesca, 2009)	Develop a BI tacit knowledge model based on interviews with 20 French SMEs leaders.	Model-based on interviews with 20 SMEs
3	(Mahmoud et al., 2012)	Developed a semantic-enabled Enterprise Service-Oriented Architecture (SESOA), an enterprise solution linking businesses to external systems based on Web Services and service-oriented architecture.	Conceptual Study
4	(Guarda et al., 2013)	Developed a framework that consists of 4 phases, planning, technology, intelligence and dissemination.	Conceptual Study

Table 2. Proposed Framework and Models for BI&A implementation in SMEs (Llave, 2019)

Each of the four frameworks was evaluated for comprehensiveness and appropriateness for guiding SMEs in the adoption of BI&A:

- Raymond (2003) proposed a conceptual and operational BI&A framework for detecting trends and understanding strategic issues that emerge from the global knowledge economy. However, this framework focuses mainly on SMEs' competitive advantage from scanning the environment.
- Sadok and Lesca (2009) acknowledged organisational and social aspects of BI&A implementation by developing a BI&A model based on tacit knowledge for environmental intelligence gathering. However, the model focuses on strategic decision-making without addressing operational decision-making.

- Mahmoud et al. (2012) and Guarda et al. (2013) have proposed either an architecture, framework, or BI&A tools for SME usage. These models focus on specific technical aspects of BI&A implementation but do not consider any social or organisational changes.

All four models focus on some aspects of BI&A adoption, detection and scanning (Raymond, 2003); tacit and social factors (Sadok & Lesca, 2009); and technical factors (Guarda et al., 2013; Mahmoud et al., 2012). Yet, with the exception of Sadok and Lesca (2009), few of these models have been empirically tested.

Due to the lack of suitable frameworks for SME BI&A implementation processes, the focus of the literature review moves to generic BI&A process implementation models for large organisations. For example, Seddon et al. (2017) developed the Business Analytics Success Model (BASM), Fink et al. (2017) combine the resource-based view with organisational learning, and Trieu (2017) adapts the Soh and Markus (1995) model of investments to assets to impacts. The BASM model is chosen for this paper as it takes an 'analyse-insight-decision-action' process, which is simple and can be related to SMEs.

The BASM process model (see Figure 1 below) integrates literature on problem-solving (Newell & Simon, 1972; Pretz et al., 2003), insight (Bowden et al., 2005; Sternberg & Davidson, 1995), the resource-based view of the firm (Barney, 1991), the dynamic capabilities view of the firm (Teece et al., 1997), the viable system model (Beer, 1984) and the IS literature on business analytics and business intelligence, in particular the work of Davenport et al. (2010). Compared to the four models developed for SMEs, the BASM is more holistic, showing components of people, technology and resources together with process flows in how value/benefits are created. These four components should be orchestrated to deliver the potential benefits BI&A can provide to organisations (Mikalef et al., 2020).

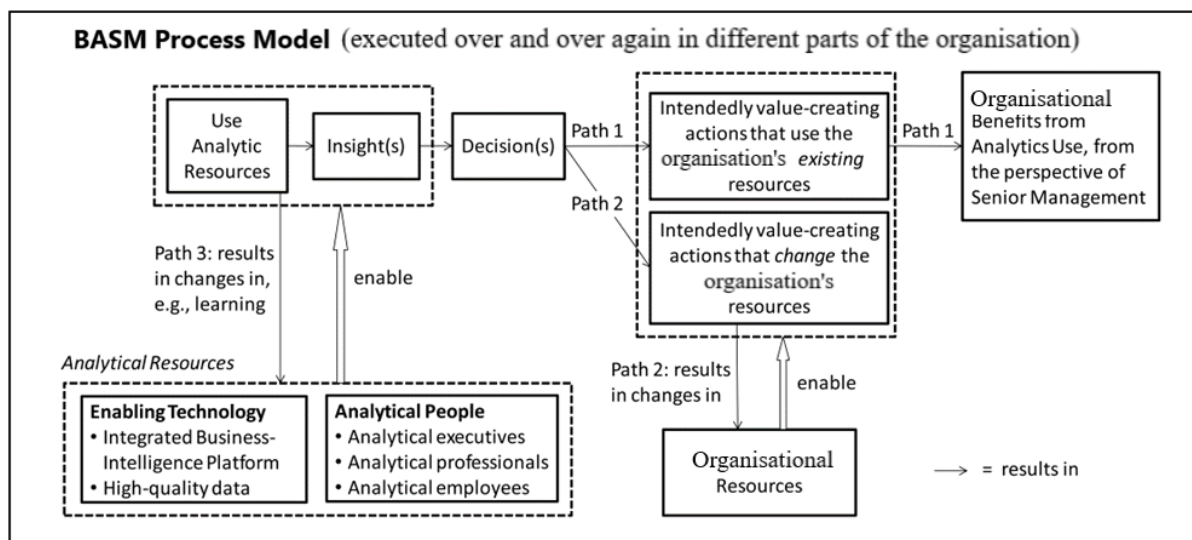


Figure 1. BASM Process Model (Seddon et al., 2017)

As shown in Figure 1, the objects in the dotted boxes reflect the three main parts of the model (constructs from Figure 1 are used in the discussion below and placed in quotation marks):

- The dotted box in the top left describes the 'use of analytical resources' and the potential 'insight(s)' gained from its use.

- The bottom left dotted box (called 'analytical resources') relates to the analytic resources, consisting of people with an analytical mindset and the technology, data, processes and governance of BI&A.
- The right dotted box relates to the use of BI&A for operational purposes (called 'intendedly value-creating actions that use the organisation's existing resources') and the creation of new organisational capabilities, typically for strategic purposes (called 'intendedly value-creating actions that change the organisation's resources').

The model further highlights three paths to value creation:

- Path 1 commences with insights leading to decisions that will create value with existing resources, focusing on the operational impact of BI&A. For example, reports and dashboards produce insights that will aid the organisation to create value.
- Path 2 can occur, in some cases, instead of Path 1. The insights will change organisational resources to create new capabilities rather than create value based on operational data described in Path 1. This path highlights the strategic impact BI&A can have on an organisation.
- Path 3 is the organisational learning that takes place while using BI&A, leading to changes in the analytical resources of the organisation. For example, the insights may trigger better data quality or more powerful analytical tools or skilled people.

The BASM model is adapted for the unique characteristics of SMEs (see Figure 2 below). The reasons for the changes are explained thereafter.

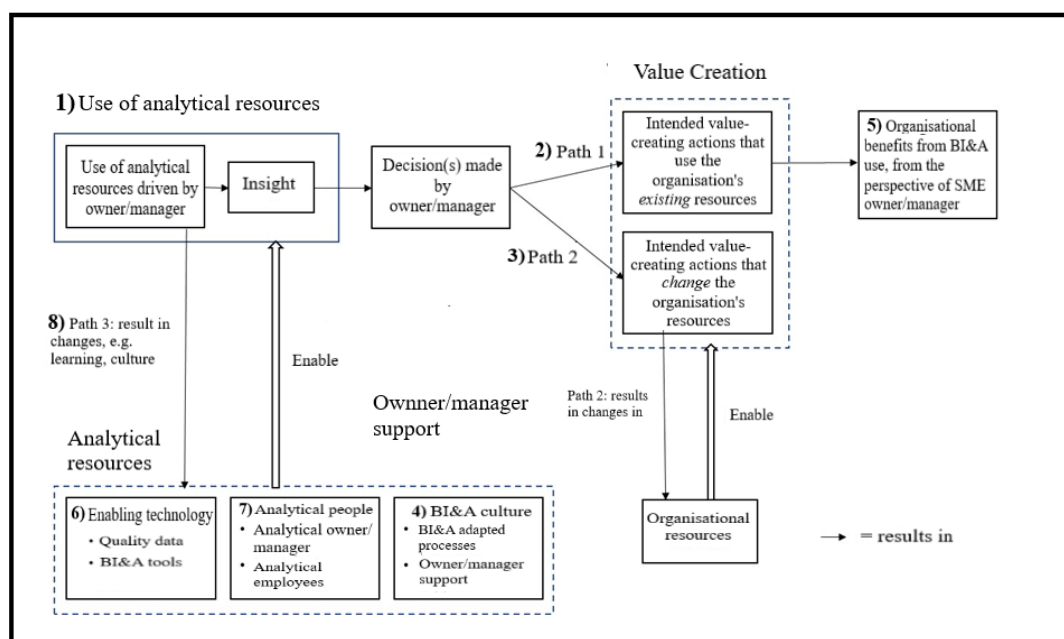


Figure 2. Adapted BASM Process Model for SMEs (adapted from Seddon et al., 2017)
(Numbers in the diagram are used in the explanation below and in Figure 3)

In an SME setting where decision-making is centralised, the 'use of analytical resources' (Figure 2, no. 1) is executed mainly by SME owners/managers. This view is supported by research on adopting information technology in SMEs, where the owner/manager plays a pivotal role (Renken & Heeks, 2019). Furthermore, the continuation of adoption and use of

technology relies on the owner/manager's perceived value of the technology (Power and Gruner, 2017). This central role of the owner/manager is reflected in the changing from 'senior manager' (Figure 1) to 'owner/manager' in 'organisational benefits from BI&A use' (Figure 2 no. 5). Lastly, the 'analytical resources' (Figure 2, no. 4, 6, 7) are expected to be significantly smaller than large organisations due to constraints in resources (Zach et al., 2014) such as systems, tools and people.

BASM depicts a flow of organisational components relating to BI&A implementation and use. However, one key aspect that is not evident in the process model is how BI&A culture can be developed in an organisation. Seddon et al. (2017) identify analytical leadership, enterprise-wide analytics orientation and evidence-based decision-making as key factors for the success of BI&A in a large organisation. These factors are captured in a BI&A culture (Figure 2, no. 4) that acts as a catalyst in creating value by providing actionable insights to decision-makers (Skyrius et al., 2016) in which senior management (or owner/managers in the case of SMEs) plays a crucial role (Davenport et al., 2010). However, in the context of SMEs, decision-making is not necessarily evidence-based (Hauser et al., 2020) and changing to a BI&A culture will require significant organisational change. Also, SMEs have limited financial resources and will not necessarily have the ability to upgrade analytical resources.

Based on the literature review and considering the unique characteristics of SMEs, the BASM model can be simplified for BI&A value creation for SMEs as illustrated in Figure 2. Therefore, Figure 2 will form the basis for investigating SMEs' process to adopt BI&A. The key changes made to the BASM model are as follows:

- The SME owner/manager is the primary decision-maker. Therefore, the use of the analytical resources is focused on the owner/manager (see 'use of analytical resources' (Figure 2, no. 1) and the 'decision(s)' process. The owner/manager should perceive the benefits of implementing BI&A (see Figure 2, no. 5).
- The 'analytical resources' also change to accommodate the characteristics of SMEs. Most SMEs do not use sophisticated information technology or BI&A resources so, 'enabling technology' (Figure 2, no. 6) is simplified. The 'analytical people' (Figure 2, no. 7) reflect the smaller headcount in SMEs and highlight the importance of the owner/manager. The most significant change is the BI&A culture (Figure 2, no. 4) to reflect the necessary changes to business processes and the SME owner/manager support.
- The three paths (Figure 2, no. 2, 3, 8) related to BI&A use will remain.

3 Research Methodology

This study employs the case study method to determine the value SMEs derive from BI&A. Case studies are an appropriate research method to study a phenomenon in context (Benbasat et al., 1987). According to Llave (2019, pg. 34), "case studies represent a key method of obtaining a more in-depth understanding of the phenomena of BI&A adoption and use by SMEs."

This research takes a cross-sectional view rather than an industry view. However, it is envisaged that cross-industry SME leaders participating in in-depth interviews would be more forthcoming in using data to outmanoeuvre their competitors if they understand that they are the only SMEs being studied in the same industry.

A convenience sampling method (Patton, 2002) was used to select participating SMEs. The following criteria were used to determine whether a SME will be included as a case organisation in the study: is the organisation classified as a small or medium SME and does the organisation have some form of BI&A implementation (to ensure a combination of organisations with mature and less mature BI&A implementation). Organisations from a mix of industries were included.

The data collection comprised semi-structured interviews and observations of the BI&A reports and systems within three medium and two small enterprises, as shown in Table 3. Eisenhardt (1989) indicated that 4 – 7 case studies are appropriate to develop theories.

SME	Nature of Business	Head-count	Perceived BI&A Maturity	SME Type	Respondent	No. of Interviews
1	Charity	22	High	Medium	CEO	3
2	Recruiter	50	Low	Medium	Director	1
3	Engineering	50	High	Medium	ERP Manager	1
4	Retail Pharmacy	13	Low	Small	Partner	1
5	Wholesaler	15	Medium	Small	CEO	1

Table 3. Details of the five SME case studies

A brief narrative of each SME is given by category below, where the nature of the business, size, types of IS and the SME participants who engaged in this research are described.

Medium SMEs

SME1 is a charity with 22 staff in Melbourne. The leading executives were the CEO, Marketing Manager, Merchandising Manager, Personal Secretary and Finance manager. They also operated a gift or merchandising department to sell gifts for fundraising. They had both accounting and customer relationship management (CRM) systems. They generally relied on vendors for IT equipment and they retained an IT contractor/employee to operate their structured query language (SQL) server and a host of management reports. The participant in our research was the CEO who joined the charity six years ago.

SME2 is a recruitment company that recruited blue-collar workers for the warehousing industry. Although the company was categorised as a medium SME with an average of between 50-70 employees, many employees were workers contracted to companies as hired labour. The management structure was minimal and they had a computerised accounting system. The workers were contracted daily and they manually tracked the labour hours to be invoiced using a paper-based approach. The respondent in our study was a recruitment director responsible for recruiting staff and potential candidates for their corporate customers.

SME3 is a local Australian engineering company that designed and manufactured transport and storage products for the mining and petroleum industries. The company had a headcount of 50 Australian staff. They had an enterprise resource planning (ERP) and a CRM system. The respondent for our study was a manager in charge of the ERP system.

Small SMEs

SME4 is a retail pharmacy serving a local community and operated independently of any franchise arrangement. They were categorised as small SMEs with approximately 13 employees. They operated several different systems: a point-of-sale (POS) system, an ordering system and a pharmaceutical dispensing system. The person interviewed was the managing proprietor of the pharmacy.

SME5 is a coffee wholesaler encompassing three lines of business. They operated three cafes, a coffee bean wholesaling business and a coffee academy offering training courses for coffee lovers and baristas. They used an accounting system as well as a system for managing labour hours. In addition, they used a cloud-based POS system to record all sales and shelf products. This SME was categorised as small with 15 full-time employees. The interview participant was the CEO of the company.

All five SME case studies are based in metropolitan Melbourne and initial interviews were face-to-face. An interview guide was developed to source data in two parts. Part 1 investigated the SMEs' current 'analytical resources' (see Figure 2, no. 4, 6, 7). The questions in Part 1 focused on the factual information of the company, including size, nature of business and types of computer systems employed. Part 1 also explored the availability of data in their systems and the impact on business processes. This was followed by investigating the case organisation's decision-making (the 'Use of analytical resources' (Figure 2, no. 1) and 'Decision(s)' constructs in Figure 2). Most interviewees were not familiar with the specifics of BI&A. Hence, the thrust of the interviews focused on the management and usage of data to derive insights to gain business value. During the interviews, concrete examples of operational, tactical and strategic decisions (see the 'Value creation' construct in Figure 2 and Figure 2, no. 5) were sought.

Part 2 of the interview related to their BI&A journey to determine if they had evolved their systems (Figure 2, no. 6), processes (Figure 2, no. 2, 3, 8) and culture (Figure 2, no. 4) over time. These topics allowed participants to elaborate not only on the process of BI&A implementation but also on the intertwining factors associated with the process. It also allowed interviewees to relate their stories/experiences from their viewpoint without influencing them unnecessarily (Walsham, 2006).

The interviews ranged from 45-60 minutes, depending on the extent of BI&A implementation of the SME. Most of the findings were audio-recorded. But there are instances where the interviewer relied on notetaking; for example, when a CEO logged into a system during the interview to show the type of reports that they used to track performance. In addition, exhibits such as yearly work plans and charts, which functional managers in the SME used to track key performance indicators, were collected. The interviews were conducted between August 2019 and February 2020.

Data were analysed using an interpretative research approach (Klein & Myers, 1999; Walsham, 1995). Figure 3 illustrates the analytical process by providing examples of the coding categories that emerged in each of the four steps.

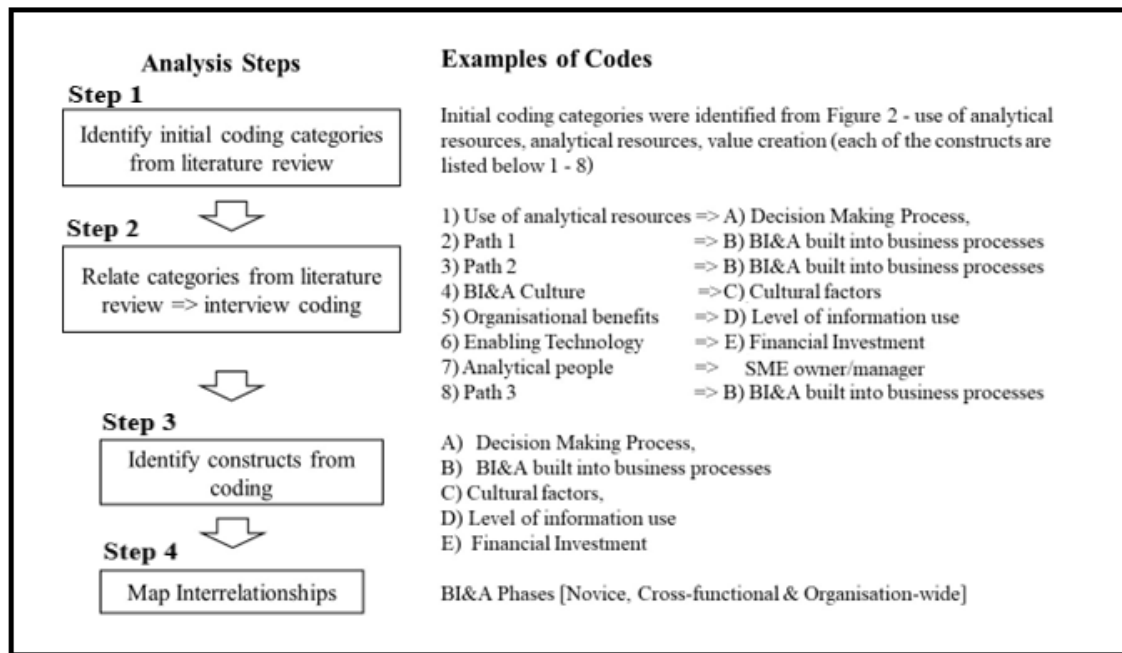


Figure 3. Data Analysis of Codes (process adapted from Niemi and Pekkola (2019))

Categories from the literature (Figure 2 no. 1-8) are linked to categories A-E, which in turn is connected to TABLE 4 columns A-E)

The interview themes were first searched as initial coding categories derived from the literature review based on the BASM constructs in Figure 2. These initial coding categories are numbered 1 – 8 in Figures 2 and 3 (see Figure 3, steps 1 and 2). The initial constructs in Figure 2 (as defined by Seddon et al. 2017) were simplified and contextualised to the second-order constructs A – E (see Figure 3, step 3). Through subsequent iterative re-analyses, constructs and interrelationships were coded into the second-order constructs A – E (See Figure 3 A-E). Paths 1, 2 and 3 were related to construct B ('BI&A built into business processes') and played a key role in identifying how SMEs orchestrated their resources to create value. The emergent interrelationships were then mapped into appropriate pairs and generalised as interrelationships between the associated constructs leading to the identification of three BI&A phases (step 4).

One of the interesting findings was that very few of the interviewees knew what BI&A was even after describing the term. The SME organisations included in the study varied from SMEs that implemented simple BI&A tools to those that did not consider using any BI&A tools.

4 Findings

Five main constructs were identified through the iterative coding (Figure 3) of the interviews and observations from the five SME owners and managers. The five constructs map the interrelationships of BI&A use in SMEs. These constructs are the decision-making process (Figure 3, A, Table 4 Column A), BI&A built into business processes (Figure 3, B, Table 4 Column B), types of BI&A culture (Figure 3, C, Table 4 Column C), level of information use (Figure 3, D, Table 4 Column D) and financial investments (Figure 3, E, Table 4 Column E).

The value of 'BI&A built into business processes' (Figure 3, B, Table 4 Column B) is a summarised integration of the use of BI&A (no function, some functions and organisation-wide). However, the first order construct of Path 1, Path 2 and Path 3 (Figure 2, nr 2, 3, 8)

provided a means to describe how SMEs orchestrate the resources and thus create value for the organisation. Each of the paths has a specific value that it creates. In Path 1, the BI&A decision provides value through the existing operational resources of the SME. Path 2 improves the organisational resources, which provide strategic value to the SME. Finally, Path 3 leads to organisational learning that enhances the analytical resources of the organisation. The path construct is used in the descriptions of all the constructs below.

Subsequent mapping of the first level attributes (five constructs) through cross-case analysis identified three distinct implementation stages. Finally, the five SMEs are categorised based on the three identified stages (Figure 3, BI&A phases, Table 4 Column F). The implementation phases are further elaborated on in the discussion section. Each of the constructs is now described in more detail.

SME	Enabling technologies	[A] Decision-making process	[B] BI&A built into business process	[C] Types of BI&A Culture	[D] Level of Information Use	[E] Financial Investment	[F] BI&A Phase
1	CRM*, Accounting, SQL server#	Rational	Organisation-wide	BI&A Culture	Strategic	\$\$\$\$	Organisation-wide
2	Accounting, Resumes	Heuristic	No	Individualism	Operational	\$	Novice
3	ERP**, Customer Support	Rational	Some functions	Influencing	Management	\$\$	Cross-functional
4	POS***, Accounting	Mixed	No	Individualism	Operational	\$	Novice
5	POS***, Labour, Accounting	Rational	Some functions	Influencing	Management	\$\$	Cross-functional

Table 4. Details of Five SMEs from interviews and observations

*CRM = Customer Relationship Management, **ERP = Enterprise Resource Management, ***POS = Point of Sales, #SQL server = database, \$ = low investment amount, \$\$ = medium investment, \$\$\$ = Significant high investment (elaborated in section 4.6)

4.1 Enabling technologies

All of the SMEs have invested in IS which comprises the "Enabling Technology" construct of BASM (see Figure 2). These IS included accounting, POS, CRM and ERP systems. Accounting systems were necessary for all SMEs, as all companies in Australia are required by statutory laws to file their annual accounts and tax statements (ATO, 2020). Some SMEs have additional IS related to the nature of their business. For example, the pharmacy (SME4) and wholesaler (SME5) have a POS system and SME4 have a pharmaceutical dispensing system. SME1, a charity, has a CRM system but did not use a POS system as they sell products and services online. SME3 has an ERP and a separate system for customer support. SME2 is a recruitment agency with an accounting system and access to job portals. All these systems are transactional processing systems (TPS) that facilitate business processes and, in most cases, offer BI&A capabilities.

SME1 is the only organisation that extensively invested in dedicated BI&A technologies (see Column E in Table 4) above those provided through TPS. For example, SME1 uses an SQL database and Microsoft Excel® to develop many reports for management decision-making. Although the other SMEs also have access to information in their respective TPS with its related BI&A functionality and basic BI&A tools such as Excel®, very few have the full suite of BI&A technologies to integrate the data between their TPS and other systems for a bigger business picture. It was surprising that SME3 has a separate CRM when it already has an ERP system.

In most cases, distinct standalone software can be customised to meet the functional requirement of the SME than a generic software package. But customised systems lose their ability to integrate the data to form a holistic view. Hence, for an integrated view of two or more functions, additional database systems and BI&A tools such as SQL, Excel, or Power BI are required to join data for broader and deeper insights.

4.2 Decision-making process

The first construct (Table 4, Column A) is about how decisions were made in the SME. Although all SMEs have access to TPS data and therefore have the necessary data, not all SMEs invest significantly in BI&A technologies. This decision to invest in further BI&A technologies can be directly related to the decision-making style of the owner/manager and whether they believe that data should be the basis for decision-making. Zach et al. (2014) made a similar finding regarding the adoption of ERP.

Scott and Bruce (1995) identify four decision-making styles in practice. These are heuristics/intuition, rational decision-making, networking (deferring to others for decision-making) and an avoidance decision-making style. Only rational decision-making can lead to advanced analysis skills using BI&A tools and data (Davenport et al., 2010; Seddon et al., 2017). Using Scott and Bruce (1995) as a guide, three main categories of decision-making styles were identified from the interview data (see Column A in Table 4): (1) heuristics and working memory, (2) rational decision-making using data and, in some cases, simple BI&A tools such as Microsoft Excel® for sorting of data and simple calculations and (3) a mix of (1) and (2).

An example of using heuristics instead of BI&A methods is the director of SME2, a recruitment SME. While she has access to data from job websites (equivalent to TPS data), she prefers heuristics and networking. This type of decision-making style does not match a typical BI&A mindset that will lead to adopting and implementing BI&A tools. She describes it as follows:

"Seek.com [an Australian job application system] is a barrel (resume database), everyone who wants a job will put their resume in that barrel... I do not want to take from the same barrel... for local positions, I will use word of mouth. My mobile is very useful for me in using my network and contacts. It is bound to get better results, although it requires more effort... The people who come for interviews will tell me the good things they want me to hear... I will paint the worst picture of the job and will look at their reaction, not interested in what they say. Based on that, I have a feeling [heuristics] of whether they will suit the position or not."

Gigerenzer and Gaissmaier (2011, pg. 454) define heuristics as "a strategy that ignores part of the information, to make decisions more quickly, frugally and/or accurately than more complex methods." The aspect of personal networking provides SMEs with more access to resources, capabilities, complementary skills and knowledge that are not available internally (Gronum et al., 2012). Networking allows SMEs to increase information, commercialised

knowledge and skills (Olsen et al., 2012; Teirlinck & Spithoven, 2013). SME4 (the retail pharmacist) tends to use a mix of heuristics and networking. The retail pharmacist commented that he gets a lot of information from sales representatives on the benefits of the pharmaceutical products they are promoting and, given their sales interest, he relied on his networks to provide an unbiased view of the effectiveness of the available products. Hence although TPS data is available, the pharmacist relies on his network and does not use BI&A tools.

Amongst other SMEs, there are owners/managers who use simple BI&A tools on the data in the TPS. For example, the coffee bean wholesaler (SME5) owns a few cafes employing 15 full-time staff. The owner-manager described the use of data as follows:

"In terms of [an] accounting system, we use [name of a POS software]. On the point of sales, we use a POS system ... So, basically, [name of a POS Software] will record all the data, we will be able to assess every single shelf item we have at home, on our mobile phone... We make a lot of decisions based on the data. For instance, like, if we look at the data, if items are not selling well, they will be off the menu next season. We do everything based on data... we only believe in data because data never lies."

SME 5 uses POS data to track items that sell, stock, monitor customer demand and profitability. SME1, 3 and 5 use rational analysis as their main decision-making method.

This section reveals that SMEs use a range of decision-making styles, with SMEs 1, 3 and 5 leaning more towards rational decision-making related to BI&A tools. Whereas SME 2 uses heuristics and networking and SME 4 uses both styles depending on the type of decisions.

We found that the expertise gained from experience in using data for making decisions for operational purposes (Path 1, Figure 2, no. 2) and strategic purposes (Path 2, Figure 2, no. 3) increased the knowledge of owner/manager and other analytical people (Path 3, Figure 2, no. 8). The owner/manager perceive value from the use of data, which then lead them to invest in improving the quality of analytical resources. Hence, we speculate that there should be a feedback loop from 'organisational benefit' (Figure 2, no. 4) to analytical resources as the experience and expertise of analytical people (Figure 2, no. 7) are developed.

4.3 BI&A built into business processes

This second construct (Table 4, Column B) focuses on decisions being applied to business processes, which relates to Path 1, Path 2 and Path 3 of BASM. Throughout this analysis, the path construct is used to show how resources are orchestrated. Therefore, the focus in this section is on a summarised singular integration of BI&A.

The integration of BI&A into business processes ranges from simple to complex. There are three levels of BI&A integration into business processes (see Column B of Table 4): no BI&A application in business processes, BI&A adapted processes in some functions (this can be in marketing or financial functions) and lastly, organisation-wide use of BI&A, which include most major business functions, such as marketing and finance, operations, customers or supply chain.

The first category, no BI&A built into business processes, is related to a heuristics decision-making style of the owner/manager, where decisions are made in an ad-hoc manner and not based on data. For example, in SME2, the recruitment director relies on heuristics and personal networks for decision-making. Decisions are made spontaneously and not incorporated into a

standard business process. It reflects a personal and individual management style dependent on personal intuition and contacts.

The second category is where SMEs use BI&A insights in some functional processes (SME3 and SME5) which is classified in 'some functions' in Table 4 Column B. For example, SME5 uses the data in POS to determine what products to introduce or discontinue under the sales function or how much stock to hold under the supply chain function. These functions that have been BI&A enabled are accessing some reporting capability in the POS or extracting data into a spreadsheet. SMEs at this stage are starting to realise the benefits of employing BI&A in their business processes and are slowly extending BI&A to other functions where it is feasible.

The last category uses BI&A in processes organisation-wide with overarching performance monitoring over many business processes. For example, the CEO of SME1, the charity, explained:

"Internally, we asked many questions, for example, what are early indicators of problems? I brought the moving average metric from the stock market and tweaked it to the correct corresponding period moving average. Customer complaints are also a very important source of information for us to improve. We also debated and agreed on the 'importance' hierarchy of information and business rules. Quite earlier on, I created an organisation wide KPI [key performance indicators] dashboard and over time, each manager/department had its own KPI to watch out for. Every campaign was tracked for the degree of success as any new initiative."

As the quote indicates, the CEO of SME1 developed an overarching dashboard that displayed key performance indicator (KPI) data to measure organisation-wide business processes. According to the CEO, this was achieved through many iterations of small BI&A projects over five years. These improvements are examples of Path 2, where a more holistic view was used to develop new strategic directions. This was made possible through changes and modifications to the analytical resources of the organisation.

In summary, we can relate the three levels of BI&A integration in SMEs to the three paths in BASM. The first category signifies that no BI&A adoption has occurred where the SME is still functioning with heuristics and networking, resulting in no BASM paths. When BI&A is introduced and integrated into some functional business process, Path 1 is initiated where the organisation's current resources are actioned. The iterative success of these integrations will result in greater knowledge and skills in transforming data into insights (Path 2), leading to actions that will change the organisation's resources. This improved knowledge and skills will initiate Path 3 in building and improving the organisation's analytics resources (analytical people and BI&A culture).

We have also found that the expertise gained from experience in Paths 1 and 2 enhances and increases knowledge by analytical people (Path 3) for better decision-making. Hence, there should be a feedback loop from 'organisational benefit' (Figure 2, no. 4) to 'analytical resources' as BI&A experience and expertise of analytical people (Figure 2, no. 7) are developed. At the same time, the BI&A culture (Figure 2, no. 4) can be further developed.

4.4 Types of BI&A culture

The original BASM did not include the construct of BI&A culture. In our adapted BASM, we have included BI&A culture as part of 'analytical resources' (Figure 2, no. 4). The previous section indicated an interrelationship between the decision-making process (Table 4, A) and the inclusion of BI&A in business processes (Table 4, B). Similar interrelationships can be

identified between the decision-making process (Table 4, B) and organisational culture (Table 4, C). Cultural growth is a gradual process and the coding suggests three different levels of culture (Table 4, C): individualism, influencing and BI&A culture.

We code individualism (defined as: decision making by an individual) in the interview data as the owner/manager making decisions using mainly heuristics. Decision-making in SMEs is typically centralised and the information is also localised to the owner/manager (Zach et al., 2014). An owner/manager can be the catalyst for change or the main obstruction. A clear example of an SME owner/manager operating in such a manner is the owner of a retail pharmacy (SME4). Below, he explains his decision-making style and culture:

"I also do the book-keeping side of the business. Keeping an eye on when I do the monthly BAS statement [taxation-related process]. Just seeing figures in the BAS reports. I don't micro analyse things. From a business sense, mainly ordering stock, maintaining stock level, decisions to introduce new stock to our shelves, also services as well."

Influencing is a cultural aspect where the SME owner/manager is personally convinced of the benefits of BI&A and has practised BI&A techniques to a sufficient level to demonstrate and influence other employees in the organisation. This type of behaviour increases the analytical resources (Figure 2, no. 4, 6 and 7) related to Path 3. Both SME3 and SME5 exhibit such characteristics by introducing controls where employees enter the correct information into the TPS. This influencing can also be associated with Path 2, where activities change the organisation's resources to achieve more reliable information.

BI&A culture is the highest level of 'culture' and is defined as a shared understanding and desire to make better business decisions through data usage, BI&A principles and tools. This is best illustrated by the CEO of SME1 when he described the 5-year journey of implementing BI&A by training, motivating and prodding his employees. This journey is an example of both Path 2 and 3 in the BASM model (Figure 2). The following quote from the CEO of SME1 indicates how the organisation moved from individualism to a BI&A culture.

"When I first joined as a CEO 5 years ago, department managers used their intuition and it was not backed by information. I had to inculcate them with a culture of philanthropy and fact-based decision-making... Other than information issues, obstacles were power struggles and differing opinions and attitudes, basically people. These result in different ways of measuring results. Eventually, when I started standardising business rules and measures as well as changing some business processes, there was some employee turnover."

The quote from the CEO of SME1 highlights some employee opposition to BI&A. These employees subsequently left the organisation. However, the CEO set an example by reorganising the departments and placing the IS directly under his control. He also personally coached the team and jointly debated the KPIs to where managers took responsibility for certain KPIs. He also made a conscious decision to use Microsoft Excel® as a simple BI&A tool to achieve simplicity and accessibility to all employees.

Davenport (2010) views culture as an accumulation of attributes and behaviour of individuals over time and is a combination of pushing back on inappropriate behaviours whilst encouraging correctness which, in this case, is making decisions based on data. Although the pushback resulted in three management staff departing simultaneously, it paved the way for the CEO to hire new people who were receptive to the CEO's analytical decision-making style. The five-year journey, as narrated by the CEO of SME1, highlights the gradual cultural change

in implementing BI&A as an innovation. The CEO began by trying to understand the data of the organisation and proceeded to work with functional managers, ultimately reaching a point where the entire organisation accepted KPIs and was on board with using data analysis for decision-making.

Though BI&A culture is intangible, it plays an important part in all three paths of the BASM. The original BASM describes the process being executed iteratively in different parts of the organisation. What is not depicted in the BASM model is the growth of the BI&A culture initiated by the SME owner/manager spreading to other employees resulting in new/modified business process changes brought about by BI&A insights. The findings suggest that BI&A culture begins with SME owner/manager and grows with iterative execution of the three paths.

4.5 Level of Information Use

The level of information use is not explicitly apparent in the BASM model. Information use is primarily generated within Path 1, focusing on operational level information use. As information use increases, Path 2 is activated to improve organisation resources. As subsequent iterations increase the use of information, Path 3 is triggered to change the organisation's analytical resources, leading to the strategic use of information. These identified levels of information use are not new. Decision support literature has identified three levels of IS: transactional processing systems for operational information needs, management IS for management needs and executive support systems for strategic needs (Olsen et al., 2012; Teirlinck & Spithoven, 2013; Weill & Broadbent, 1998). The 'level of information use' codes how information is used in the SMEs using these three levels (see Table 4, D).

Table 4 shows the list of five SMEs with two of the businesses (SME2 and SME4) using information for operational purposes, two (SME3 and SME5) for management information purposes and one (SME1) for strategic objectives.

An example of operational use is the retail pharmacy (SME4), where the owner-manager relies on the POS system to check stock levels and product sales when restocking. This use of information relates to Path 1, where the organisation's resources (in the POS) are used to optimise another organisational resource of stock for sale.

Management goals are a higher-level goal than operational goals as it considers many variables, usually from different but related sources of information. An example of using information for a management goal is SME5 which incorporates information from different sources such as their POS system, accounting system and labour management systems to manage their wholesale and retail functions. Therefore, while Path 1 remains the same, Paths 2 and 3 become more critical in achieving a higher goal and more organisational and analytical resources (Path 3) will be required.

The use of information for strategic planning relates to longer-term challenges regarding competitive forces and the external environment. For example, the charity CEO (SME1) introduced industry metrics to benchmark their organisation against comparable charities. Regarding risks from the external environment, the CEO identified lower interest rates as an external strategic issue, as it deters people from donating. Moreover, SME1 has invested in a BI&A system that firstly stores internal data, collects external data and generates reports through a SQL server. The ability for SME1 to generate reports and insights on its performance and gather external data provides it with extensive information to plan strategically.

Developing an information system that combines many aspects of internal and external information can be seen as the highest state of Paths 2 and 3, where superior analytical and organisation resources are required.

4.6 Financial Investment

The term 'investment' suggests that additional financial resources are required, which would relate to improvements to the enabling technology (Path 3). Therefore, financial investment (Table 4, E) is a key construct in this study as BI&A enabling technologies are expensive, as are additional resources that lead to a higher total cost of ownership. According to Dholakiya (2016), many SMEs are hesitant to implement BI&A due to concerns about cost and effort. The cost of existing TPS is not included in this evaluation, as their primary purpose is to facilitate the daily operational business processes. The financial investment for each SME is reflected in Column E of Table 4.

The three levels of financial investment are not explicit in BASM because it eventuates in multiple iterations of the three paths in an SME. For example, as the SME owner/manager experiments with a BI&A tool for the first time with an individualistic culture (Table 4, Column C), a low financial investment (\$) is required for additional software licenses. This experimentation is in line with the concept of 'necessity bricolage' in which SMEs make do with whatever they have to achieve new goals (Jaouen & Nakara, 2015). A medium investment (\$\$) is needed when the SME embarks on the Path 2 or 3 of BI&A enabling technologies, requiring more hardware and software (Table 4, Column C). Ultimately, the complexity of gathering, cleaning and joining disparate functional data at the organisational level requires significant high investment (\$\$\$\$). The value of insight increases with the need to disseminate the insight to appropriate employees with legitimate access. With the above overview, examples from the case organisations are discussed below.

SME4 had the lowest level of BI&A investment, where the retail pharmacist worked individually to gauge customer demand and restock the retail pharmacy. There was hardly any additional investment required beyond the existing POS systems where sales records and trends were recorded. With respect to the BASM, Path 1 is carried out with very minimal forays into Paths 2 and 3 as there was little incentive to invest in better BI&A tools.

The mid-level financial investment is when the SME owner/manager works across functions to solve management-level problems. In the case of SME5, the coffee wholesaler invested in a shared server to store data from various systems (POS and an online labour vouching system) to gain and share further insights. This is an example where Paths 1, 2 and 3 were initiated to increase experience, expertise, confidence and achieve net financial gains given the investment size. Jaouen and Nakara (2015) refer to this as 'strategic bricolage' which aims to boost success, performance and sometimes growth. The next example with the highest level of investment is SME1, which was achieved over five years in multiple phases. The CEO was able to justify and build the BI&A infrastructure over multiple financial years. These include enhancing the reporting module of CRM and upgrading IT systems to develop performance dashboards. The CEO shared that he could define performance metrics and justify to the charity board the IT resources to achieve those measures.

The above findings support the iterative and gradual investment strategy put forth by Llave et al. (2018), where initial success stories and organisational learning improve future BI&A investment decisions. Table 4, Column E shows that financial investment costs and returns are

incremental. For example, as SMEs move from operational to management and then strategic levels of information use, they have to invest more in the technology. While BASM does not consider the factor of financial investment, such matters are considered by owners/managers of SMEs. A lack of financial resources is an enduring constraint for SMEs investing in IS (Zach et al., 2014). The SME owner/manager is the same person possessing both the cost/benefit information and making the executive decision to invest, which is reflected in the BASM model for SMEs. What is of significance is that iterative executions of prior BI&A projects will increase knowledge of both likely cost and benefit (an example of Path 3). This also reinforces the suggestion that there should be an 'enabling loop' from organisational benefits to 'analytical people'.

5 Discussion

5.1 Three Stage BI&A Implementation Model

In this section, we discuss three BI&A implementation stages derived from the identified constructs (Table 4, Columns A-E) and how they relate to the three paths of BASM. While this is not a longitudinal study, more mature BI&A practitioners (e.g. SME1) have narrated the journey they have taken and the challenges they overcome along the way. In addition, the less mature practitioners offer a snapshot of where they are in their BI&A evolution journey. Table 5 below shows three stages of BI&A implementation in SMEs in conjunction with the three BASM paths. Each of these stages (novice, cross-functional and organisation-wide) is now explained in more detail.

Dimensions		Novice	Cross-functional	Organisation wide
A	Decision-making process	Heuristics to Simple BI&A	Simple BI&A	Reports and dashboards
	BASM	Path 1	Path 1,2 & 3	Path 1,2 & 3
B	BI&A built into business process	NA	Some functions	Organisation wide
	BASM	Path 1	Path 1,2 & 3	Path 1,2 & 3
C	Types of BI&A culture	Individualistic	Influencing	BI&A Culture
	BASM	Path 1	Path 1,2 & 3	Path 1,2 & 3
D	Level of Information Use	Operational Goals	Management Goals	Strategic Goals
	BASM	Path 1	Path 1,2 & 3	Path 1,2 & 3
E	Financial Investment	\$	\$\$	\$\$\$\$
	BASM	Path 1	Path 1,2 & 3	Path 1,2 & 3

Table 5. Relationship between three-stage BI&A Implementation Model and BASM 3 Paths

From a BASM perspective, Path 1 is where a novice (SME owner/manager) will start engaging in BI&A through many areas identified in the constructs. As organisational benefits are achieved with data from a single function, the SME owner/manager moves on to a cross-functional stage to apply BI&A to a combination of data from different functional areas. Higher management goals are sought at this juncture and employees need to be persuaded to use BI&A. Paths 2 & 3 are likely to be triggered, where additional organisational resources will

be needed to cater to more users. Insights gained should be applied to other functional areas and investment needs to be increased to enable the pooling and sharing of information. All three paths are triggered where the organisational resources are improved along with BI&A knowledge and skills. Similarly, all three paths are used in the third organisation-wide stage, but with a strategic goal for information use and organisation-wide integration of processes.

Novice

Two SMEs (SME2 and SME4) are in the novice phase of BI&A implementation. The owners/managers use a heuristic decision-making style that can include some simplistic BI&A analysis. These owners/managers work individually to solve operational goals and they do not need to justify their decisions to others in the organisation. In addition, both owners/managers (of SME2 and SME4) showed a preference for personal networks. This finding is supported by Gudfinnsson et al. (2019), who found limited motivation for SMEs to invest in BI&A efforts. The owners/managers do not perceive value from the use of BI&A, although they have the TPS that generates data for BI&A.

Cross-Functional

Two organisations (SME3 and SME5) are classified in the cross-functional phase of BI&A implementation. In this phase, the main characteristic of the organisations is that the owner/manager uses a rational decision-making style and relies on data for making decisions. The owner/manager drives the changes at the organisational level, such as integrating their BI&A insights into some functional business processes (Table 4, Column B), influencing BI&A culture (Table 4, Column C) and using BI&A to solve problems at the management level (Table 4, Column D). In this category, the SME owners/managers have put the organisation on the path of implementing BI&A.

Organization wide

Only SME1 is at the organisation-wide stage in BI&A implementation. This organisation integrates BI&A applications into organisation-wide processes (Table 4, Column B) and addresses challenges and concerns at a strategic level (Table 4, Column D). The SME owner-manager has also instilled a BI&A culture (Table 4, Column C) throughout the organisation via numerous discussions with the management team, designing and using an overarching performance dashboard to monitor organisation-wide business processes (Table 4, Column C). The organisation can then introduce new campaigns in the future to achieve strategic customer acquisition goals (Table 4, Column E) and increase donor lifespans. This was accomplished by a gradual process of building a BI&A culture through motivating, training and incentivising BI&A targets and performance metrics. BI&A culture encompasses data orientation (Kiron & Shockley, 2011), analytical decision-making (Popovič et al., 2012) and information infrastructure (Prethus, 2014). A BI&A culture promotes an inclusive environment where information processes are understood and supported. The impetus for leveraging BI&A applications comes from the management and users rather than the availability of technology (Skyrius et al., 2016).

Progression from one stage to another

One advantage that SMEs have is their smaller and flatter organisation structure and simpler business processes (Zach et al., 2014). The owners/managers take the championing role by acting on an individual basis and then translating into a gradual cultural organisational

change. The direct outcome of this transition is that BI&A insights are applied on an individual, function and organisation-wide basis. The lack of resources in SMEs is clearly expressed by a lack of a central data warehouse or database amongst less mature BI&A implementers. Buying these technologies is expensive and is only viable if the organisation has instilled an organisation-wide BI&A culture to appreciate such an investment. Hence, amongst the five dimensions, cultural change factors and extent of BI&A insights in business processes signal the key transition phases in BI&A implementation in SMEs. The narratives from the CEO of the mature SME demonstrate a progression in skills through influencing, guiding and coordinating employees in using analytical tools and integrating insights into the business processes.

Transitioning an SME from a novice to an organisation-wide stage is a lengthy process, as indicated by SME1 (5 years). Some managers had strong opposition to this new BI&A culture and left the organisation as a result of internal member disputes. Gartner (2008) indicated that obstacles are more significant outside technology areas, such as sponsorship, politics and data quality rather than in deploying BI&A infrastructure, tools and applications.

The findings related to the SME BASM Process Model (see Figure 2) indicate that the key to any change on an organisational level is 'decision(s) made by the owner/manager'. This decision initiates Path 3 to create the 'analytical resources' of 'enabling technologies (Figure 2, no. 6), 'analytical people' (Figure 2, no. 7) and most importantly, a 'BI&A culture' (Figure 2, no. 4). Most SMEs can initiate Path 1 as they have the necessary operational data in their IS. When owners/managers perceive a value at an operational level, they can action Path 3 to improve or instigate the 'analytical resources' of the SME. Path 2 is mainly related to the use of BI&A for strategic purposes (Seddon et al., 2017). Only one SME (SME1) was able to use BI&A for strategic purposes. The stage of the cross-functional value indicates that an additional path can be added to the BASM model as these organisations derived managerial value from the use of BI&A which can result in changes in organisational resources.

5.2 Assessment of the Adapted BASM

From the findings of the five SME case studies, the adapted BASM can only serve as a conceptual model viewed at a macro level. Theoretically, it offers a simplistic view of how analytical insights can translate organisational resources to analytical capabilities resulting in organisational benefits. Therefore, we propose that BASM be revised to include a feedback loop from the organisational benefits to the analytical resource (see Figure 4 below). Success from iterative BI&A projects will increase BI&A technology, processes, goal setting and investment in BI&A knowledge and skills.

We believe the proposed revisions to BASM improves the original in three areas:

- Clearer identification of the ideal BI&A champion in an SME organisation should be the owner/manager.
- Stronger importance placed on BI&A culture that the SME owner/manager must cultivate.
- Presence of a feedback loop from 'organisational benefits' to 'analytical resources'. Every BI&A project, whether successful or not, will bring best practices or lessons learned for improvement.

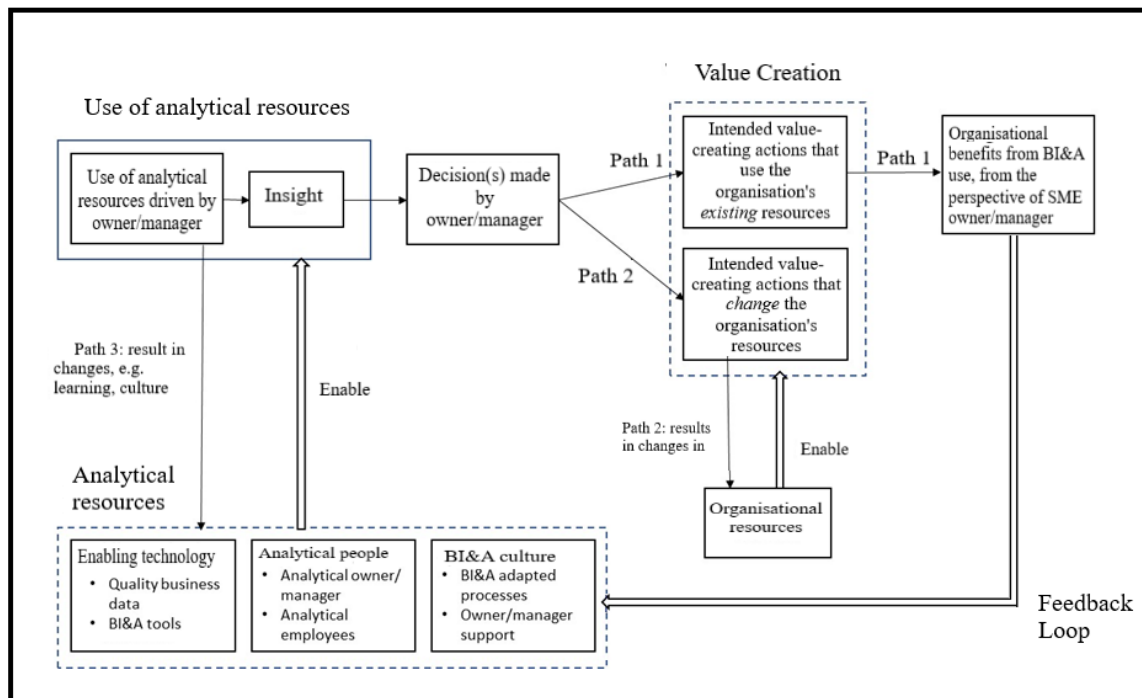


Figure 4. Revised BASM for SME based on study findings

However, as a high-level conceptual model, the revised BASM lacked depth and did not address the practical challenges SMEs face regarding goal prioritisation, skills and resources. Therefore, we propose that the three-stage implementation model can augment the macro-level conceptual BASM, identifying SMEs' issues and challenges regarding goals, skills, process improvements and BI&A tool investments.

6 Conclusion

The paper describes how SMEs adopt BI&A and proposes an improved BASM as a theoretical model for exploration. Llave (2019) identifies a lack of research into the use of BI&A by SMEs and calls for more research in this area. This paper investigates and adapts the BASM model based on the unique characteristics of SMEs and data collected from 5 SMEs using BI&A. The findings reveal three stages SMEs go through in adopting BI&A. The analysis further highlights the importance of the owner/manager as the champion of BI&A and the importance of developing a BI&A culture. Owners/managers of five SMEs from various industries were interviewed to ascertain how they use BI&A to derive business value. We found that the BASM model can be adapted for SMEs as a high-level conceptual process model, but the adapted BASM model lacks sufficient details on the changes that SMEs need to make to adopt and use BI&A. Three stages can be identified: novice, cross-functional and organisation-wide. Therefore, we propose the three-stage implementation model to extend and augment the revised BASM to better understand SME owners/managers' concerns during adoption.

This study contributes to both theory and practice. In theory, this paper adapts the BASM process model for SME BI&A adoption, considering the unique characteristics of SMEs. Furthermore, it adds the element of BI&A culture and a feedback loop that enhances the quality and proficiency of analytical resources.

In practice, the outcomes of this study will benefit SMEs that are considering using BI&A to derive business value in SMEs. The findings provide a clear and coherent road map that allows SME owners/managers to optimally use BI&A to realise benefits for their businesses. The three stages also indicate practical and incremental steps to achieve operational, management and ultimately strategic goals from BI&A. SMEs embarking on this journey can plan their implementation and have a greater understanding of the three stages of BI&A value creation.

Case study research suffers from limitations, especially with a small number of cases. Hence, there may be concerns about generalisability. However, Stake (1978, pg. 6) posits that such studies can produce a "naturalistic generalization" in which the results of this study may be applied to SMEs adopting BI&A in decision making and business processes across different levels of the business to achieve specific goals. Further research is needed to determine if the findings can be generalised more broadly. The SME BASM Process Model constructs and sub-constructs can be quantitatively validated to test and measure their strengths and correlations.

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