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A Benefit Dependency Network for Shadow IT Adoption

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Masters in Computer Science and Business Management

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UAB – UFSC

November, 2021





TECNOLOGIAS  
E ARQUITETURA

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Department of Information Science and Technology

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## Resumo

Shadow information technology (SIT) aborda sistemas que estão ocultos mas são geridos e utilizados pelas diversas entidades de negócio. Consiste no uso de dispositivos, software, sistemas e aplicações sem a aprovação do departamento de informática – information technology (IT).

A maioria dos trabalhadores utiliza este tipo de aplicações sem o conhecimento do departamento de IT e isto cria uma lacuna na comunicação, fazendo com que o departamento de IT perca a real noção da situação da companhia, no entanto existem benefícios envolvidos. De forma a tomar vantagem desses benefícios, deve ser implementada uma mudança na maneira em que as actividades de negócio são realizadas. Os benefícios devem ser efeito directo de mudança, da diferença entre o modelo corrente e sugerido de fazer o negócio, assim como na eficiência e eficácia com que o staff desenvolve o seu trabalho com sucesso.

O objectivo deste estudo é propor uma benefit dependency network (BDN) para shadow IT e, através dos seus conceitos sintetizar as nossas descobertas e especificar conexões entre práticas de SIT e seus benefícios.

Com percepção da BDN e dos benefícios de SIT é possível ter uma melhor noção das implicações e factores envolvidos, facilitando assim o processo de tomada de decisão. Quer a organização queira atingir a inovação, aumentar lucros, reter clientes, a BDN facilita no processo de análise, de escolha e deve ser algo que as organizações devem levar a sério pois é essencial haver conhecimento sobre que benefícios existem e como os atingir.

**Keywords:** shadow IT, shadow systems, feral systems, feral information systems, benefit dependency network





## **Abstract**

Shadow information technology (SIT) revolves around systems that are hidden but still are managed by the same business entities. It consists on the use of devices, software, systems and applications without information technology (IT) department approval.

Employees use IT without the knowledge of the IT department and this creates a gap in communication, as the IT department loses the knowledge of the reality within the company. However there are benefits involved.

In order to take advantage of those benefits, change has to be implemented in the way business activities are handled. The benefits should be a direct effect of change, of the difference between the ongoing and suggested way that activities are done and the efficiency and effectiveness to which people deliver on their daily tasks.

The objective of this study is to propose a benefit dependency network (BDN) for SIT, through its concepts synthesize our findings and specify connections between SIT practices and its benefits.

With an understanding of the BDN and the benefits of SIT it is easier to have a better notion of the implications and the factors involved in order to assist in the decision making process. Either an organization wants to reach innovation, increase revenue, retain clients, the BDN helps with analysis and selection and is something organizations should take seriously, as it is essential to have knowledge on what the benefits there are and how they can be reached.

**Keywords:** shadow IT, shadow systems, feral systems, feral information systems, benefit dependency network



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## **ACRONYMS**

BDN – benefit dependency network

BoK – book of knowledge

BU – business unit

BYOD – bring your own device

CIO – chief information officer

DSR – design science research

DSRM – design science research methodologies

EA – enterprise architecture

ERP – enterprise resource planning

ESG – environmental social governance

FAQ's – frequently asked questions

IS – information systems

IT – information technology

NPS – net promoter score

PM – project manager

ROI – return of investment

SIT – shadow IT

SLR – systematic literature review

UI – user interface



## CHAPTER 1

### **Introduction**

Nowadays technology is evolving at a tremendous pace, it seems like everyday there is new software that absolutely changes the way we do and perceive things. On the other side, everyday more and more people are getting access to the smartphones, to the internet and to all the benefits it brings along. Also innovative information technology (IT) applications and services offered in the cloud, easily accesible via the internet, either for free or on a flexible pay-per-use basis are increasing rapidly (Haag & Eckhardt, 2017). All of this can and is being used by employees on laptops, tablets and smartphones to work in a more efficient way either from work or at home to help better accomplish the daily work requirements. But, while these benefits drive the digital transformation we are witnessing today, they also motivate users to turn to these solutions without their organizations approval (Gyory et al. 2012, Urbach and Ahlemann 2016). This is called shadow information technology (SIT).

SIT represents all hardware, software, or any other technological solution used by employees inside of the organizational ecosystem that did not receive any formal IT department approval (Silic et al., 2017) some examples include Dropbox, Googledrive and Whatsapp that are applications available on the cloud, which means there is no need to download or install. And while most of these applications are harmless, there is always the possibility of hackers gaining access to important company data and information (Klotz et al., 2019).

The reasons for the emergence of SIT are numerous, but there is always a need for end users to complete their job and dissatisfaction of employees with implemented software is the main reason behind the rise and development of SIT (Raković et al., 2020). SIT represents one of the biggest threats for organizational IT security (Sillic, 2019) and most of the times SIT is used to complement already established enterprise resource planning (ERP) systems, the same systems aimed to eradicate and reduce the dependency on SIT.

Some authors suggest that SIT offer an effective and efficient way for users to cope with the deficiencies of formal systems and can be used as a solution to an existing problem with implemented systems (Behrens, 2009; Furstenau et al., 2017; Györy et al., 2012; Huber et al., 2017; Klotz, 2019; Kopper et al., 2020; Magunduni & Chigona, 2018a; Gabriela Labres Mallmann et al., 2016; Gabriela Labres Mallmann & Maçada, 2019; Richter et al., 2019; Silic et al., 2016, 2017; Silic & Back, 2014). On the other hand, the negative side of SIT has also been pointed as it creates complex challenges to many organizations and IT departments (Furstenau et al., 2017; Huber et al., 2018; Klotz et al., 2019; Kopper et al., 2020; Gabriela L.

Mallmann, Maçada, & Oliveira, 2018; Richter et al., 2019; Silic et al., 2017; Sillic, 2019; Walterbusch et al., 2017). In fact, SIT is widely considered as one of the biggest challenges for the chief information officer (CIO) and IT departments (Silic & Back, 2014) due to the risks it brings like for example the loss or leak of data, compliance related issues or even loss of investment, as most of these devices and applications leave no blueprints behind, making it very difficult to assess the actual risk, while undermining the main system of a company or possible damages to organizational information and processes.

SIT is most of the times result of individual behavior and is characterized through accessing, acquiring or using the widely available tools, processes or systems that did not receive prior formal IT department approval (Sillic, 2019). Individuals rely on their own knowledge and experience to address their daily tasks how they feel is best fit for their needs while believing that the delivery of results will surpass the consequence of using SIT, and this creates risks in a multitude of ways that can unintentionally affect negatively the company dynamics and the employees work.

With the current evolution of IT and the increase of its users, organizations should not take this matter lightly as it is already being considered one of the top concerns of CIOs and IT managers (Gabriela L. Mallmann, Maçada, & Oliveira, 2018) as employees are already using SIT in a variety of ways on their daily tasks. Plus, most of them do not have the necessary know how to defend themselves in case there is an attack on their devices.

Organizations do not put enough focus on the expected benefits, even though its been proven that if they are to increase the likelihood of success from their IT investments, they must separate out the different cause of benefits before developing any implementation plan (Peppard et al., 2007) no matter what the approach is, as the goal for investing in IT should always be to improve performance in order to achieve business goals. According to Peppard & Ward, 2005, research has indicated that management does not comprehend how to identify business benefits, and that is where the need for a benefit dependency network (BDN) comes from, as it allows to clarify and highlight change requirements that will be used as a pointer to analyze the needed changes before advancing with new IT investments. It will help examine the connection between technologies, processes and people aiding management in understanding how the blend of technology and business changes will help deliver the expected benefits. The BDN appears as the appropriate tool for this level of initial research, as a catalyst to start the discussion and examine the data.

This research aims to propose a BDN for SIT, through an SLR and DSR methodologies, to specify the connections and benefits that may arise if companies start looking at SIT as a solution and not as a problem.

For this particular document, on chapter 1 we have introduced the concepts of SIT and BDN and how they are interconnected, chapter 2 we will present the theoretical background, on chapter 3 the related work will be presented followed by the presentation of the research methodology on chapter 4, chapter 5 will provide the research proposal and chapter 6 will be the discussion of our findings and in chapter 7 the conclusions will be presented.



## **Theoretical Background**

### **2.1. Shadow Information Technology**

SIT is a significant challenge for most organizations, and has major financial, legal and security implications (Magunduni & Chigona, 2018) and there are still some gaps in knowledge as there is no clear consensus as to what is the real impact that this phenomenon has in companies.

Despite promising initial theoretical insights, relatively little was done to further explore the SIT antecedents (Sillic, 2019) and this might just be where the problem lies: there needs to be a deeper understanding of SIT and its impact on organizations, more specifically how it motivates employees and on the other side just how much it really endangers a company's main system integrity. There is a big gap in knowledge and this is a matter that needs to be addressed and properly researched as it is something that needs to be better understood in order for correct and optimal actions being taken. We still lack a better understanding of how SIT is used in practice (Silic & Back, 2014) and until this subject is rightfully addressed the problems, the issues and the user non-compliance factors are going to be there.

Terms like marvel systems, rogue systems, feral information systems (FIS), feral systems, skunkworks, shadow systems, shadow information systems, shadow IT and workarounds (Lund-Jensen et al., 2016) have been used to describe this type of phenomenon. For the following section, we will provide definitions for the three most used terms: shadow IT, feral systems and workarounds.

SIT consists in system usage as individual users voluntarily deploy of one or more systems besides or instead of the mandatory system to perform a task; it occurs when users develop systems outside of the central information technology department, as they are not known supported or accepted by the IT department. It is the term used to characterize various aspects of information systems (IS) and the related work processes that are beyond management control (Lund-Jensen et al., 2016), it consists of any technological solution that end users employ instead of the central systems, while replicating the functionality and data of such systems. It describes IT instances that are covert and for which the task responsibility resides in the business units (BU's) (Klotz, 2019), consists in IT systems that are created or managed by departments without any knowledge or awareness from central IT. SIT is used to enhance business and job production.

On the other hand FIS consists in any technology that end users deploy instead of the mandated ERP; they are regarded as the users response to discrepancies between official IT systems and

actual business processes. This trend boosts SIT which is hardware, software, or services built, introduced, and/or used for the job without explicit approval or even knowledge of the organization (Haag et al., 2019). FIS are individually developed systems that users utilize in order to support their business processes.

Finally, IT workaround is a strategy of using a computer system in a manner that it was not designed to be used or using alternative methods to accomplish a work task. It is implemented when a mismatch occurs between the expectations of technology and actual working practice, by deviating from set procedures. Workarounds happen when a system is not being used as intended, however, they do not have a negative impact on the system (Lund-Jensen et al., 2016) As seen, there is a wide variety of terms to describe the shadow IT phenomenon, for this particular research work we will use the term SIT as it seems to be the most widely accepted in the literature the terminology and it also addresses more appropriately the issues that are being analyzed and studied. SIT is often viewed as a security issue, when an employee without malicious intentions, installs and uses non-approved software (Silic et al., 2017).

## **2.2. Benefit Dependency Network**

The BDN is a core tool in constructing a benefits realization plan (Peppard et al., 2007), it provides a framework that links the investment objectives and the necessary benefits with the business changes needed to provide said benefits and IT functionality to push and allow for these changes to be made.

The development of the BDN creates a clear perception of how different parts need to cooperate in order to realize the benefits the management and organization wishes to reach, as well as allowing that the experience and knowledge of those involved to be used more rationally when it comes to planning the investment, as benefits need a firm commitment from organisations to drive the investment through organizational change (Maritz et al., 2020).

The BDN is designed to develop routes to successful implementation of IT (Rogers et al., 2008) by assuring that benefits are designed into the implementation plan. It measures various facets of the dependencies (Bettenburg & Hassan, 2013) by exploring the causes behind good performance, providing guidance to avoid known issues and optimizing the use of technology. Previous research has shown that poor change management procedures and substandard leadership are some of the reasons for the technological problems (Brown, 1994) when an organisation attempts to optimize the use of technology and most of the time that is due to a lack of awareness of the tools available to help promote change.



The benefits to an organization from IT-enabled change essentially emerge from three causes: stopping doing activities, doing what has always been done but better or doing completely new things (Peppard & Ward, 2005). Understanding the context of the investment being considered is critical to not forgetting the context for which the whole process is in place to begin with. It is important to understand what is at stake as well as what are the expected benefits before advancing with an IT investment, in order to analyze existing processes, existing personnel and plan the necessary business changes to reach the common goal whether it is to reduce costs, increase revenue or improve response time.

There has to be an understanding of the processes in place and the tasks at hand so that changes can be applied to help select the practices needed in order to achieve the desired benefits (Jabbari et al., 2018). All these factors will help management and organizations' decision making by promoting reflection on the costs and effects on the desired changes.

When designing a BDN aspects like time, money and personnel (Bettenburg & Hassan, 2013) should all be taken into account, to help better address the areas that need more focus and will be more impacted by change. This is crucial for understanding the benefits as they will indicate the viability of the IT investment.

The failure to recognize and identify these aspects and their dependencies can seriously risk the success of the implementation.

### **2.3. Clarifying the Terminology**

SIT describes the autonomous deployment, procurement or management of information technology (Klotz et al., 2019). It represents all hardware, software, or any other technological solution used by employees inside of the organizational ecosystem that did not receive any formal IT department approval and is not prescribed by the formal policy (Silic et al., 2017). It exists since the emergence of the first IT technology, however, it achieved a new facet through the development of cloud computing (Walterbusch et al., 2017). SIT is a form of decentralized computing implemented by individuals, workgroups or whole business units (Gabriela L. Mallmann, Maçada, & Eckhardt, 2018).

SIT systems refer to autonomous software systems or extensions to existing systems that a central IT department neither develops nor controls (Furstenau et al., 2017) as individuals perform work tasks depending on their needs (Gabriela L. Mallmann, Maçada, & Oliveira, 2018), an autonomy that may lead to a big diversity and incompatibility in systems that become decoupled from the rest of the organization. Individuals are key for establishing a shadow system as employees usually implement a variety of solutions, from cloud services (Dropbox,

workgroups, or whole business units can use shadow IT as a form of decentralized computing to Gmail) to self developed applications, has enabled knowledge workers to individualize their IT portfolios and use personal technologies (Jarrahi et al., 2020). And even though the concepts might seem related, SIT differentiates from related concepts as BYOD, IT consumerization, FIS and IT workaround as there are unique differences that characterize it as a relevant concept even though these approaches might seem similar and interconnected. This explains the existing misalignment as there is a big gap when it comes to understanding how SIT is used as there are both positive and negative outcomes, a consequence of the difference between the requirements from the stakeholders and the implementation of the enterprise resource planning (ERP) systems. The primary cause for the emergence of SIT is the complete or partial absence of adequate IT solutions that meet the employees' requirements (Walterbusch et al., 2017) and the pervasiveness of technology that is causing relevant changes to individuals, organizations, and society (Gabriela L. Mallmann, Maçada, & Eckhardt, 2018) that lead to many times to the implementation of SIT without involving a central IT department in order to create flexible and innovative solutions (Huber et al., 2018).

70% of ERP implementations fail to achieve their estimated benefits and the reasons for this are problems with business strategies, project delays, cost overruns and underestimation of the effort required for successful change management (Eckartz et al., 2009). This motivates business units to implement SIT: situations of misalignment of business and IT (Huber et al., 2017). And even though these systems are generally not known, supported or accepted by the official IT department (Rentrop & Zimmermann, 2012), from an organization IT management and IT governance point of view, its becoming more and more imperative to find ways to deal with this situation as most of the times these technologies use typically unfold outside the control of the organization and its IT department (Jarrahi et al., 2020). And, while receiving very limited scholarly attention, SIT is a widespread challenge amongst IT departments (Györy et al., 2012).

The existing gap allows also for the misalignment between concepts and this is an aspect that might be cause of confusion for readers and enthusiasts alike, as for example Behrens, 2009 states that SIT are "often said to have negative consequences" but, on the same article also states that it "can be just what an organization needs". On the other hand, Klotz, 2019 states that SIT helps reach "higher productivity, innovation and agility" but counteracts by also stating that SIT contributes in "security risks, integration issues, inefficiencies and loss of synergies". There is a need to better understand this phenomenon and get a better comprehension of what it implies as there should be no discrepancies while speaking about SIT. SIT often consists of

collaborative systems used by employees to communicate and share content with co-workers, clients, or external partners (Gabriela Labres Mallmann et al., 2016).

The development of a BDN not only enables the knowledge and experience of business managers to be applied more coherently to planning the investment, it creates a clearer understanding of how different groups need to work together to achieve the benefits they and the organization wish to gain (Peppard et al., 2007). The BDN approach helps make sure that the benefits and their associated changes to business process and work remain in the control of the organization. It allows the alignment of IT investments with the business strategy and highlights the fact that IT investments should not be driven by technology but rather by clear business objectives (Maritz et al., 2020). It helps firms identifying business change needs or opportunities (Ward et al., 1996) by promoting deep analysis the difference between current and proposed processes, which have an impact on how business activities are done and the way information is handled, which ideally would improve business performance.

The BDN also helps management get a better understanding of the expected benefits from an investment as well as helping sharing knowledge to those who will be applying the new processes, methods and tools on the daily basis. The principle of the BDN is that between the IT input and the desired business objectives are several necessary change management steps (Rogers et al., 2008) by ensuring that the needed changes are correctly identified and better control methods are enabled, all with the goal of managing the return of and IT investment.

Researchers have rarely analyzed the long-term dynamics that drive the persistence of SIT in detail (Furstenau et al., 2017). There needs to be a better understanding of what SIT is and how it works in order to better understand this ongoing issue and how organizations can approach it.

During the course of this investigation and research, a gap in knowledge was identified as there was no approach or study that connected the concepts of SIT and BDN in the same context and, based on those findings it was something that we wish to shed a light on, as both can benefit from each other while helping organizations and management fulfill their true potential.



## CHAPTER 3

### **Related Work**

Researchers and practitioners have discussed various governance approaches at firm level ranging from total permission, merely specific concessions, to the company wide banning of SIT (Haag & Eckhardt, 2015), but before anything it is very important to take a step back and try to understand the extent, the reach and the opinions on these solutions – as shown in Table 1.

So far SIT has received limited scholarly attention and that might be one of the reasons why it is a widespread challenge across IT departments. Companies like Accenture (2009) have been saying that the “golden ages” of SIT are ahead as this new generation gains access to the corporate world. Organizations take the blame as well for this issue due to not always providing adequate systems to employees perform their duties and also for the drastic way most of them deal whenever SIT use is identified within their branches. It is this lack of awareness and knowledge when it comes to approaching new ideas and concepts that allows the creation and growth of SIT solutions as it creates an ideal situation for shadow users to implement whatever they feel will help them the best at achieving their daily tasks.

#### **3.1. Shadow Information Technology vs Organizations**

Inadequate IT solutions lead to the deployment of SIT (Klotz et al., 2019), guided by the need of user-driven fulfilment of requirements (Györy et al., 2012), it is the rate at which informal collaborative information technology is being implemented autonomously by employees to help them perform their work (Gabriela Labres Mallmann & Maçada, 2019). It describes the circumstance of users starting to develop IT systems with their own capabilities (Tambo & Bækgaard, 2013) against corporate guidelines and hidden from official IT governance. It is developed by users with strong knowledge of local business processes, and it fills the existent void of formal IT competencies and, for this reason, it can live for a long time without receiving any attention from IT staff. SIT is often readily available and perceived as being easier to use than central systems and more cost effective (Furstenau et al., 2017). 80% of employees use software that has not been approved by the IT organization (Klotz et al., 2019) as security policies get ignored by employees and managers due to the lack of employee training (Györy et al., 2012).

**Table 1. Author's opinions on SIT**

Author	Shadow IT Impact				BDN references
	Positive	Negative	Neutral	Did not mention	
Shaw, 1997				x	-
Behrens, 2009	x				-
Eckartz et al., 2009			x		-
Rentrop & Zimmermann, 2012				x	-
Györy et al., 2012				x	-
Tambo & Bækgaard, 2013	x				-
Silic & Back, 2014			x		-
Kretzer & Maedche, 2014			x		-
Haag & Eckhardt, 2015	x				-
Gabriela Labres Mallmann et al., 2016			x		-
Lund-Jensen et al., 2016				x	-
Silic et al., 2016			x		-
Furstenau et al., 2017		x			-
Silic et al., 2017			x		-
Walterbusch et al., 2017				x	-
Haag & Eckhardt, 2017	x				-
Huber et al., 2017			x		-
Steinhueser et al., 2017	x				-
Gabriela L. Mallmann, Maçada, & Eckhardt, 2018			x		-
Gabriela L. Mallmann, Maçada, & Oliveira, 2018			x		-
Huber et al., 2018			x		-
Magunduni & Chigona, 2018			x		-
Klotz et al., 2019		x			-
Klotz, 2019		x			-
Haag et al., 2019	x				-
Gabriela Labres Mallmann & Maçada, 2019		x			-
Richter et al., 2019	x				-
Sillic, 2019			x		-
Raković et al., 2020				x	-
Fürstenau et al., 2020			x		-
Jarrahi et al., 2020			x		-
Kopper et al., 2020			x		-

SIT is an insider threat caused by members of an organization (Györy et al., 2012). It has been reported that 32% of employees say insider violations are more costly or damaging than incidents perpetrated by outsiders (Silic et al., 2017). ERP implementations failing to add value and achieve benefits, associated with the lack of trust and the dissatisfaction with current systems, the constantly improving technical knowledge of users and the growing accessibility to cloud-based IT solutions can easily influence the creation of SIT (Magunduni & Chigona, 2018a). SIT is used as a solution to the limitations and existing issues with formal systems, which are often times highly consolidated and have complex user interface (UI), and as consequence users choose to enforce solutions from third-party vendors or self-made solutions in order to make processes simpler and improve user experience. An organization evolution can be understood as emerging from all these local network interactions (Shaw, 1997). Organizations also have a share in the blame for this deviant behavior by not providing appropriate systems for employees to perform their tasks (Gabriela Labres Mallmann et al., 2016).

Many times SIT can be more beneficial or efficient than legacy systems (Sillic, 2019), and although some organizations explicitly allow the use of SIT, most use a range of formal risk-management tools (IT service management, IT governance and IT security management) to direct, restrict, and control the activities of BU's (Furstenau et al., 2017). Central management can permit end-users to implement SIT solutions, apply a strategy to monitor its implementation and regulate it through IT policies (Tambo & Bækgaard, 2013). IT department should try to identify solutions being used to department teams, because already identified SIT brings less risk than unknown SIT.

The use of SIT is an affective reaction to experienced frustration (Haag & Eckhardt, 2015) to unaddressed business needs and slow response to IT requests. End-users also implement SIT as a form of resistance to sanctioned systems, with some claiming its use on the need for innovation (Magunduni & Chigona, 2018). This dissatisfaction is often caused by the misalignment of IT department and other departments objectives, as SIT systems succeed in environments where top management supports the development and implementation of such systems. SIT is popular with employees and can lead to higher user satisfaction as it can provide specific functionality or familiarity (Klotz et al., 2019) as they need suitable IT solutions and help themselves by implementing SIT (Walterbusch et al., 2017). This is one of the reasons why SIT should be looked rather at the individual than at the organizational level (Sillic, 2019). SIT consists of autonomous developed and supplied systems, processes and organizational units (Rentrop & Zimmermann, 2012) that exist without the acceptance or support of the IT

department, it will often emerge if a business unit does not perceive the ability to influence the actions that a central IT department takes to fulfill its demands (Furstenau et al., 2017).

SIT has both positive and negative outcomes and is a result of the gap between the requirements from the stakeholders and the implementation of systems (Lund-Jensen et al., 2016) and a more systematic understanding of the dynamic interaction between shadow systems, risk, and power would be important for IT managers and for governance professionals in order to better address this issue and find long term solutions. SIT usage can be classified as a volitional action - the employee is deliberately doing an action - but without any malicious intentions (Silic et al., 2017).

### **3.2. The Benefit Dependency Network Dilemma**

A lot of organizations focus on the implementation of technology not on the realization of expected business benefits (Peppard & Ward, 2005). Benefits arise from changes, innovations and they surface when IT gives people the power to do things with more effectiveness and efficiency thus creating a demand of improvement on how information is used. Benefits from IT investments don't just "happen", they need a firm commitment from organisations to drive the investment through organisational change (Maritz et al., 2020), as a lot of projects fail due to the lack of proper tools to assist in the making of IT investment decisions and management issues.

Understanding the business context of the investment being considered is very important, all too often IT projects become technology projects rather than primarily business change projects and the context for the investment is soon forgotten (Peppard & Ward, 2005) and in some of these cases, the projects are brought to a halt, which is not optimal.

Benefits may be considered as the effect of the changes (Ward et al., 1996) and if any organization wishes to evolve and stay on pace with today's technology then change is something they should be ready and prepared to face.

For this research, the tool to be used is the Benefit Dependency Network (BDN), due to its capability of being able to graphically display the change requirements and considering the connections based on technology, people and processes while showing the expected benefits. It also seemed like the most appropriate tool for this level of initial analysis. The BDN provides a framework for explicitly linking the overall investment objectives and the requisite benefits with the business changes necessary to deliver those benefits and the essential IT functionality to both drive and enable these changes to be made (Peppard & Ward, 2005).



When discussing BDN as shown in Table 2, there are five concepts that can not be dismissed, per Maritz et al., 2020:

- Investment objectives – specific to the project and focuses on the outcome of the project, on what the project will achieve if successful
- Business benefits – advantages that are incurred as a result of the project. When benefits are delivered, they will lead to achieve the investment objectives
- Business changes – permanent changes to practices, processes and relationships within the organization, required in order to achieve benefits
- Enabling changes – adjustments or changes that need to be implemented for business changes to take place
- IT enablers – IT tools that must be implemented as well as IT considerations to be evaluated before introducing new technology.

Organisations need to take a holistic approach when it comes to adopting SIT. Considerations need to be taken, including decisions with regards to the skills of people, impact on the structure of the organisation, business processes and technology changes to deliver benefits and investment objectives. Each domain of the BDN should be considered prior to SIT adoption, as organisations are encouraged to find new ways to implement new technologies without completely relying on existing technology as a BDN model approach can assist in identifying organisational technology considerations.

**Table 2. BDN concepts**

<b>Concept</b>	<b>Definition</b>
Investment objectives	Outcome of the project
Business enefits	Advantages incurred as result of the project
Business changes	Permanent organizational changes
Enabling changes	Non-permanent organizational chnages
IT enablers	Technological requirements

**Table 3. SIT Concepts according to authors**

<b>References</b>	<b>SIT definition</b>
Behrens, 2009	Systems that replicate the data and functionality of formally sanctioned systems
Györy et al., 2012	Phenomenon of user-driven fulfilment of requirements
Rentrop & Zimmermann, 2012	The supplement of official IT by several, autonomous developed IT systems, processes and organizational units
Fürstenau & Rothe, 2014	Decentralized units with central governance
Kretzer & Maedche, 2014	An IS that extends an existing IS but is maintained significantly less by the IT department than the IS that it extends
Silic et al., 2016	Systems, processes and organizational units developed without awareness, acceptance, knowledge and support of the IT department
Mallmann et al., 2016	Systems used by employees to communicate and share content with co-workers, clients, or external partners
Lund-Jensen et al., 2016	An alternative to the existing system formally supported by the organization
Silic et al., 2017	Represents all hardware, software, or any other technological solution used by employees inside of the organizational ecosystem that did not receive any formal IT department approval and is not prescribed by the formal policy
Steinhueser et al., 2017	The voluntary use of private device by employees without formal approval of the IT department
Walterbusch et al., 2017	Business process supporting IT solutions and tools that replace or extend the IT functionalities officially provided by the IT department
Gabriela L. Mallmann, Maçada, & Eckhardt, 2018	A form of decentralized computing implemented by individuals, workgroups or whole business units
Magunduni & Chigona, 2018	An IS computerized that is developed by individuals or groups of employees to help them with their work
Silic, 2019	Use of information technology solutions and systems without prior explicit organizational approval
Klotz, 2019	IT instances that are covert and for which the task responsibility resides in the BU's, without alignment with or awareness of the IT department
Jarrahi et al., 2020	Systems outside the organizational IT ecosystem
Fürstenau et al., 2020	IS hidden from managers and official IT units
Kopper et al., 2020	Covert IT systems

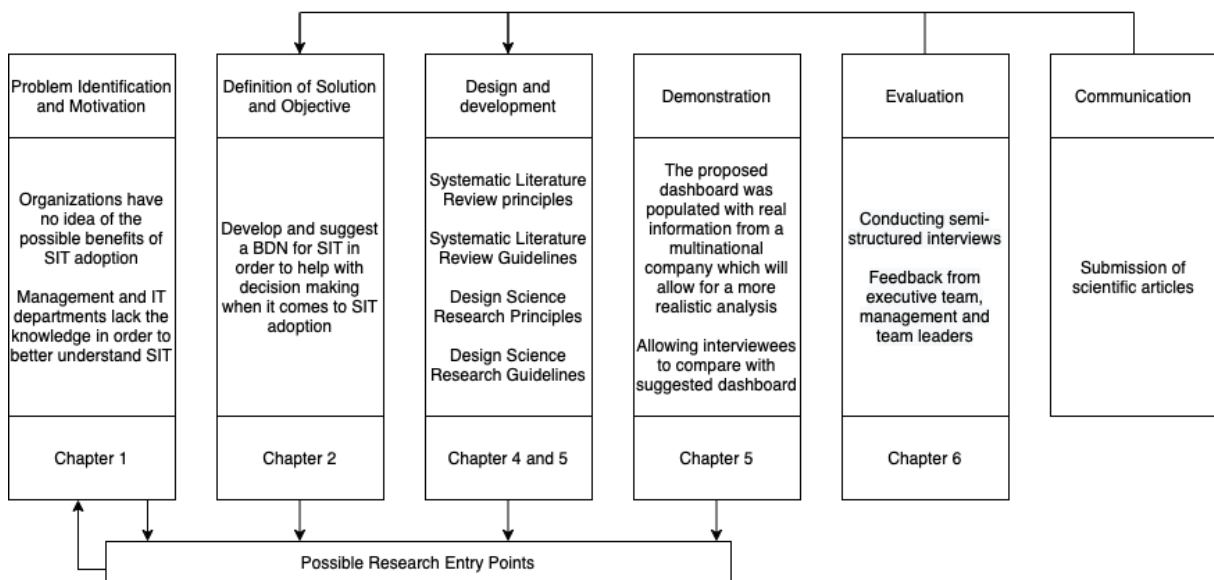
## CHAPTER 4

### Research Methodology

The Research Methodology embraced for this investigation was the Design Science Research (DSR), as we aim to design, build and evaluate the network we pretend to analyze.

DSR is the appropriate choice as it seeks to extend the boundaries of human and social capabilities by creating new and innovative artifacts that enable globalization, integration, increased productivity and rapid adaptation (Hevner et al., 2004). The goal is to develop a framework for better understanding, executing and evaluation of the research, as well as measure the impact on the organization.

**Figure 1. DSRM Process Model Followed**



To reach this objective a Design Science Research Methodology (DSRM) is the right option, as it attempts to develop and acquire information that bring effectiveness on a real-world context, as displayed in Figure 1. The DSR approach consists of three elements: conceptual principles, practical rules and procedures to perform and conduct research (Peffer et al., 2007). Above is the representation on the DSR process utilized in this research.

Hence the goal of this research is to try increase the efficiency of the organization (De Sordi et al., 2011), the principles followed were according to table 4. As the principles themselves are not considered sufficient to justify the applicability and value in design science, the DSR guidelines proposed by Hevner et al., 2004 as show on Table 5.

**Table 4. DSR Principles**

<b>DSR Principles</b>	<b>Explanation</b>
Abstraction	This research consists on the creation on a BDN for SIT in order to give a better understanding of the benefits organizations can get from SIT adoption.
Originality	The proposed artifact is not in the body of knowledge (BoK)
Justification	The justification is based on the methods proposed for its evaluation. Qualitative interviews were conducted with executive team members, managers and team leaders of the proposed artifact. With this contribution it was possible to add value to the artifact.
Benefit	The development of a BDN which will display possible benefits of SIT adoption, which will allow decision makers to obtain useful information so aid in the decision-making process while attempting to improve the performance of the organization.

**Table 5. DSR Guidelines**

<b>Guideline 1: Design as na Artifact</b>
The artifact proposed by the research is a BDN for SIT adoption
<b>Guideline 2: Problem Relevance</b>
Need to have a BDN to help analyse the benefits of SIT adoption for an organization
<b>Guideline 3: Desing Evaluation</b>
Semi-structured interviews
Evaluated and suggested by interviewees who are in charge of decision making
<b>Guideline 4: Research contribution</b>
A new artifact not present in the body of knowledge
<b>Guideline 5: Research rigor</b>
The main principles, practices, and procedures of SLR and DSR were adopted, to increase the credibility of the artefact and the consequent contribution of the research.
<b>Guideline 6: Design as a Search Process</b>
The result obtained is the departure from unknown. Combination of good practices and relevant guidelines for prototype development
<b>Guideline 7: Communication of Research</b>
Plus, the submission of the article to a journal/conference with high credibility and respect in the scientific community.

A questionnaire was to be carried out in the evaluation step of the proposals, the questions are presented in Table 6. With them it was possible to enlight the interviewees with the definition of SIT and BDN first, then with the concepts of BDN before asking for their opinions on the suggested BDN and what changes would the suggest.

**Table 6. Questionnaire approach**

<b>Steps</b>
Present the interviewee with SIT and BDN definitions
Present the interviewee with BDN concepts
What outputs should be expected from SIT adoption based on the shown BDN concepts
Show suggested BDN table and ask interviewee what their opinion is on the relationships presented and what changes would they suggest



## CHAPTER 5

### **Research Proposal**

As we aim to design, build and evaluate the BDN we proposed, the DSR was the appropriate choice as it seeks to extend the boundaries of human and social capabilities by creating new and innovative artifacts. To better assess our research question on the benefits of SIT adoption, a questionnaire was designed to better help us validate and strengthen our proposed BDN, which was conducted in a growing north american fintech company that for confidentiality reasons we will call ReaLife. A case method fitted this study since it would allow the exploration of benefits of SIT adoption in a real-world context and, through that create theory. The fintech industry in particular was selected due to the need to reduce risks and maximize potential of SIT on an environment that is highly regulated and also is extremely competitive and innovative. There is a need for growing fintech companies to stay in pace with the ever-growing demands of clients and technological advances as more and more people are starting to rely on these solutions to reach their financial goals. ReaLife was created in the early 2000's and quickly gained notoriety on the north-american market, with a strong tradition of providing platforms and solutions for their clients to manage their fees, statements, financial reports and investments. The company is currently going through an expansion as they plan to enter the european market by buying an already established european fintech and merging both companies into one. This process so far has exposed the huge differences in how the business is handled differently on both continents as there is a feeling that european policies are stricter and more demanding than the ones existing in North America. The merging process is supposed to take over a year and there already have been identified many gaps in the company's infrastructure and system integrity when it comes to outside resources that seriously put company information and data at risk if it is not handled properly.

Data was collected from interviews and observation. As shown in Table 7, we conducted 15 semi structured interviews, which took place on a 2-week period between October and November 2021. We consulted experts from mostly the IT units from both european and north american side and their roles include the COO, team leaders, heads of department, senior analysts, development leads, system architects and solutions analysts. The interviewees professional IT experience ranged from 5 to 30 years and interviews lasted anywhere from 30 to 45 minutes. All interviews were recorded and stored in a case database.

The first step of each the interview was to present the definitions of SIT, BDN and also the five concepts of BDN. After that the proposed BDN was shown and the interviewee was asked about

their input on the outputs shown on the BDN and which would they possibly want to add and how would they interconnect (Appendix A). This approach allowed us to obtain important aspects that we had not been able to identify through our research and that were useful to help validate our BDN. It was also important to get an idea of what were the interviewees personal experiences with SIT in other to get a better understanding of how much impact it makes and how big of an issue it really is in the workplace.

We made sure that interviewees had early access to the definitions, the BDN and the questions, to allow them to understand what the topic of the questionnaire would be and also allow us to clarify any questions they might've had on the subject prior to the interview. Our interviewee's credibility was also confirmed by asking them for specific examples and events when they had directly come face-to-face with SIT.

**Table 7. Interviewees Roles in ReaLife**

<b>DSR Interaction</b>	<b>Area</b>	<b>Role</b>	<b>Experience (years)</b>
1	IT	Project Manager (PM)	20
2	IT	Solutions Analyst	15
3	Client Success	Team Leader	20
4	IT	Head of Operations	11
5	IT	PM	30
6	IT	PM	5
7	Client Experience	Team Leader	12
8	IT	Head of Security	n/a
9	IT	Systems Administrator	23
10	IT	Executive Team	n/a
11	IT	Head of Services	n/a
13	IT	PM	n/a
14	IT	Strategy	n/a
15	IT	Data Analyst	n/a



## 5.1. First Design Scientific Research Iteration

A Systematic Literature Review (SLR) is a way to identify, evaluate and interpret research that is believed of relevance, to address a research question or phenomenon of interest while creating a firm foundation for advancing knowledge – by facilitating theory development -, clarifying areas where there is a gap in knowledge or uncovering a need for research. Reason why we believe that using an SLR will help us synthesize research results in order to create a summary of current evidence and findings that can contribute to evidence-based practice, thereby making the available evidence more accessible to decision makers and thus, creating information of scientific value.

SLR's are scientifically considered the highest level of evidence, reason why for this research our approach was to assess the existing documentation on the concepts we were looking into in order to summarise all the empirical evidence, identify the gap in current published research and suggest areas for future investigation while providing a background and solid foundation for those research activities.

They should be concept-centric, provide evidence that a phenomenon is existent, can be identified by other researchers, ensuring that relevant literature was obtained, identify critical gaps in knowledge and motivate researchers to close the breach.

A knowledge gap was identified while researching SIT and BDN concepts as there was no research that established any type of link between these two concepts.

The goal was to define a review protocol that would enable specification of the research question being investigated, what methods would be utilized for that same research, identify as much related literature as possible, having a search strategy that allows readers to fully access it, have clear inclusion and exclusion criteria, specify the information to be acquired, inform the readers about the subject learned, motivate the research topics and explain already existing documentation.

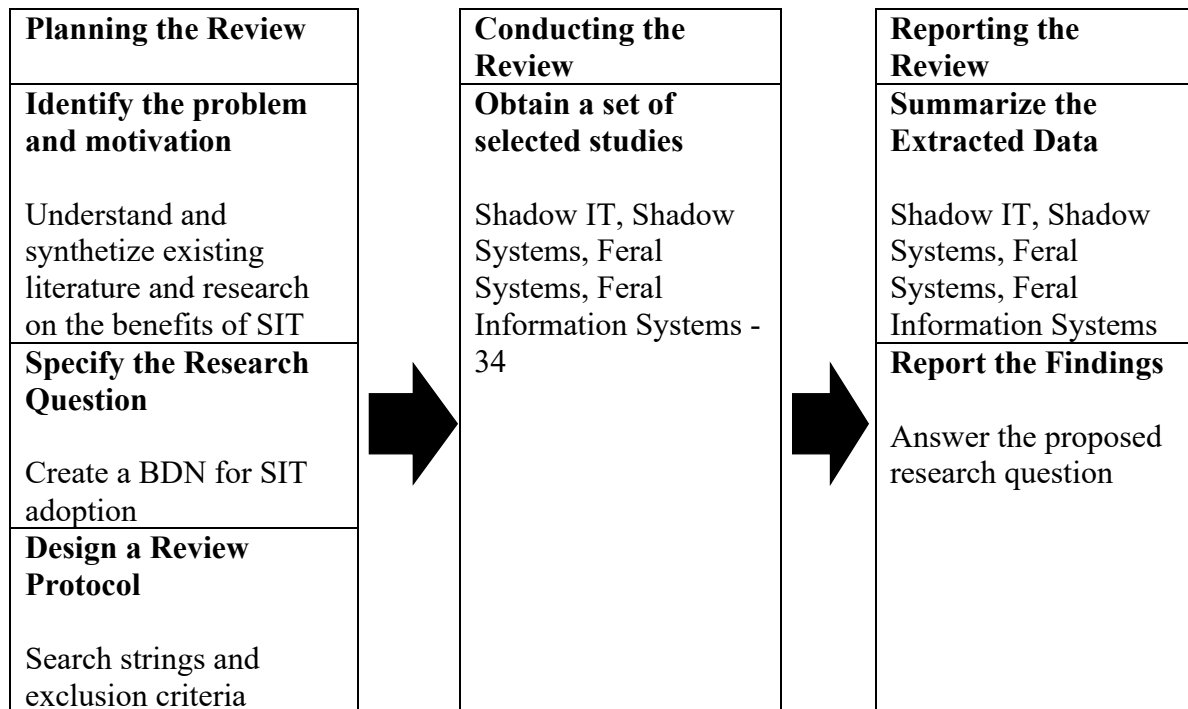
The performed SLR adopts Kitchenham's (Kitchenham, 2004) phases and guidelines, and is complemented by the centric approach from Webster and Watson (Webster & Watson, 2002). The following phases were included as shown in Figure 2:

- **Planning** – it is essential to identify the need for a review, and to define the research questions that such review will address, while also producing a review protocol that defines the basic review procedures.

- **Conducting** – obtain studies that will be the object of the review, through the review protocol.

- **Reporting** – writing the results of the review, and make them available for interested parties.

**Figure 2. SLR Methodology**

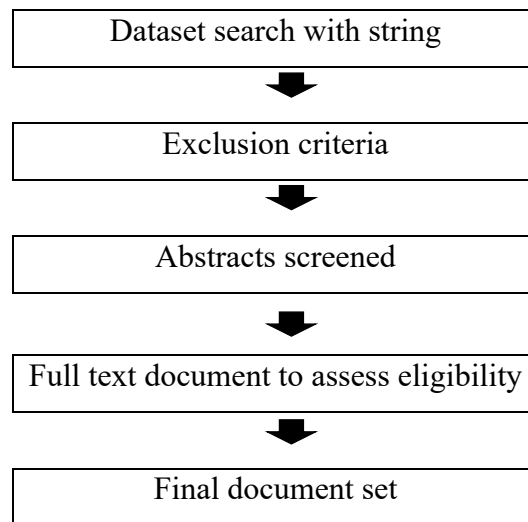


The Review Protocol, as shown in Figure 3, begins with a literature search, through the search string that will be used in chosen datasets, on an attempt to get the maximum possible results for studies, documents, articles, books and journals that may address the proposed Research Question.

The used keywords to obtain our first set of documents were “*Shadow IT*”, “*Shadow Information Systems*”, “*Feral Systems*” and “*Feral Information Systems*”, through the main search string ((*shadow IT*) OR (*shadow information systems*) OR (*feral systems*) OR (*feral information systems*)). The datasets were SCOPUS, SpringerLink, IEEE, ACM and WoS. An exclusion criteria of english only documents and peer reviewed only documents was also used, in order to filter the obtained documents.

After the first set of documents was obtained, they were analyzed in order to specify their relevance to the investigation and filtered according to the following: the first filter consisted on all documents that had they forementioned keywords on all fields, our second filter consisted on all documents that had the keywords in the title, on ur third filter we removed all doubles

**Figure 3. Steps for the Review Protocol**



and meta, on the fourth filter we used an inclusion and exclusion criteria consisting of only english written documents and peer reviewed documents only, the fifth filter filtered the obtained set of documents by free articles only. After reading the documents and getting a better understanding of the available information obtained, it was decided that a sixth filter would be added in order to allow us to do backward snowball through some documents believed essential and to the existing references on such, believing that those prior documents would bring more value to our investigation.

After applying the search string and keywords accordingly as defined in the listed datasets, a total of 171 documents were obtained. After reading titles, a total of 89 documents was obtained. And, after reading abstracts to help even more on specifics for the investigation and realising some documents were not written in english, the number of documents reduced to 34. It should be noted that there were 38 articles that were removed as they were not related with SIT but with the use of shadow systems in geometry, 19 articles were duplicates and 20 other articles were added through the process of backward snowball – bringing to a total of 54 articles analyzed as displayed by Table 8.

Some literature provides contradictory findings about SIT, and while it is generally associated with risks, it is also argued that it could be beneficial to companies (Magunduni & Chigona, 2018), most benefits are related with increased creativity, innovation and improved business performance by helping users interact with systems that meet their particular needs by working around the limitations of existing information systems or processes in an organization (Furstenau et al., 2017), as it supports users to increase performance and are innovative and

**Table 8.** Research database results

		SCOPUS	SPRINGERLINK	IEEE	ACM	WOS	TOTAL
SHADOW IT	1 <sup>st</sup> filter	504	89	21	126	25	<b>765</b>
	2 <sup>nd</sup> filter	52	3	3	0	0	<b>58</b>
	3 <sup>rd</sup> filter	51	0	3	0	0	<b>54</b>
	4 <sup>th</sup> filter	50	0	3	0	0	<b>53</b>
	5 <sup>th</sup> filter	11	0	3	0	0	<b>14</b>
SHADOW SYSTEMS	1 <sup>st</sup> filter	619	6	4	19	17	<b>665</b>
	2 <sup>nd</sup> filter	37	0	0	2	0	<b>39</b>
	3 <sup>rd</sup> filter	22	0	0	2	0	<b>24</b>
	4 <sup>th</sup> filter	20	0	0	1	0	<b>21</b>
	5 <sup>th</sup> filter	18	0	0	1	0	<b>19</b>
FERAL SYSTEMS	1 <sup>st</sup> filter	70	0	0	1	1	<b>72</b>
	2 <sup>nd</sup> filter	10	0	0	0	0	<b>10</b>
	3 <sup>rd</sup> filter	0	0	0	0	0	<b>0</b>
	4 <sup>th</sup> filter	0	0	0	0	0	<b>0</b>
	5 <sup>th</sup> filter	0	0	0	0	0	<b>0</b>
FERAL INFORMATION SYSTEMS	1 <sup>st</sup> filter	80	0	1	0	4	<b>85</b>
	2 <sup>nd</sup> filter	12	0	1	0	0	<b>13</b>
	3 <sup>rd</sup> filter	2	0	0	0	0	<b>3</b>
	4 <sup>th</sup> filter	1	0	0	0	0	<b>1</b>
	5 <sup>th</sup> filter	1	0	0	0	0	<b>1</b>
		<b>Backward snowball</b>					<b>20</b>
		<b>TOTAL</b>					<b>54</b>

flexible (Huber et al., 2017). SIT can be a source of creativity and innovation (Klotz et al., 2019).

The use of SIT boosts employees productivity and enables faster and better collaboration and communication (Gabriela Labres Mallmann et al., 2016) as it helps the circulation of information more instantaneously, more agile, faster, dynamic and practical, all without the need of formal permission (Gabriela Labres Mallmann & Maçada, 2019).

Some of the benefits that are connected with the use of SIT, as shown in Table 9, are related with the creativity surrounding the systems, the perceived innovativeness of the systems and the stability and order brought about by the system (Behrens, 2009). This translates into an elevated level of motivation by the employees that also raises productivity. If the employees feel like they are using the correct tools for their tasks, then they will more likely perform it on the desired levels, with applications like Skype, Facebook video calling and Google Talk being the main being used by co-workers to collaborate and communicate at work. There is a clear tendency to use mainstream apps, as they are better known, easier to use, have a friendly interface and most of its issues and bugs are well documented on the internet. All these factors contribute to an adoption of SIT as a way to both facilitate the tasks and improve performance,

with some estimates finding that shadow systems account for more than 80% of IT systems deployed by end users (Haag et al., 2019) as they can be very efficient and effective when used in place of the formal and standard systems already present (Silic & Back, 2014).

Enterprise Architecture (EA), can also benefit from SIT when planned accordingly and can have a significant impact if addressed from correct point of view (Tambo & Bækgaard, 2013):

- Current: SIT can beneficially be included to obtain a better global image of inventory and processes
- Change: overlooked SIT systems can have serious impact on success and outcome of change; existing SIT systems can be converted or included in official EA; users can respond to poorly aligned EA by making SIT systems
- Future: several studies suggest that future successful organizations are the ones who will create opportunities for SIT systems and reduce central control over IT.

Engaging users in system development will eventually lead to fast adaptations to market changes with maximum insight and minimum cost, by creating local engagement, rapid adaptation and inexpensive innovation; making SIT too good to pass on, so organizations will eventually have to address it or risk allowing more non-regulated and non-controlled development of systems in order to keep pace with market driven rapid innovation requirements (Tambo & Bækgaard, 2013). All this gathered information allowed us to create a BDN model oriented to SIT adoption as shown in Figure 4 which will be used as reference to validate this research's theory.

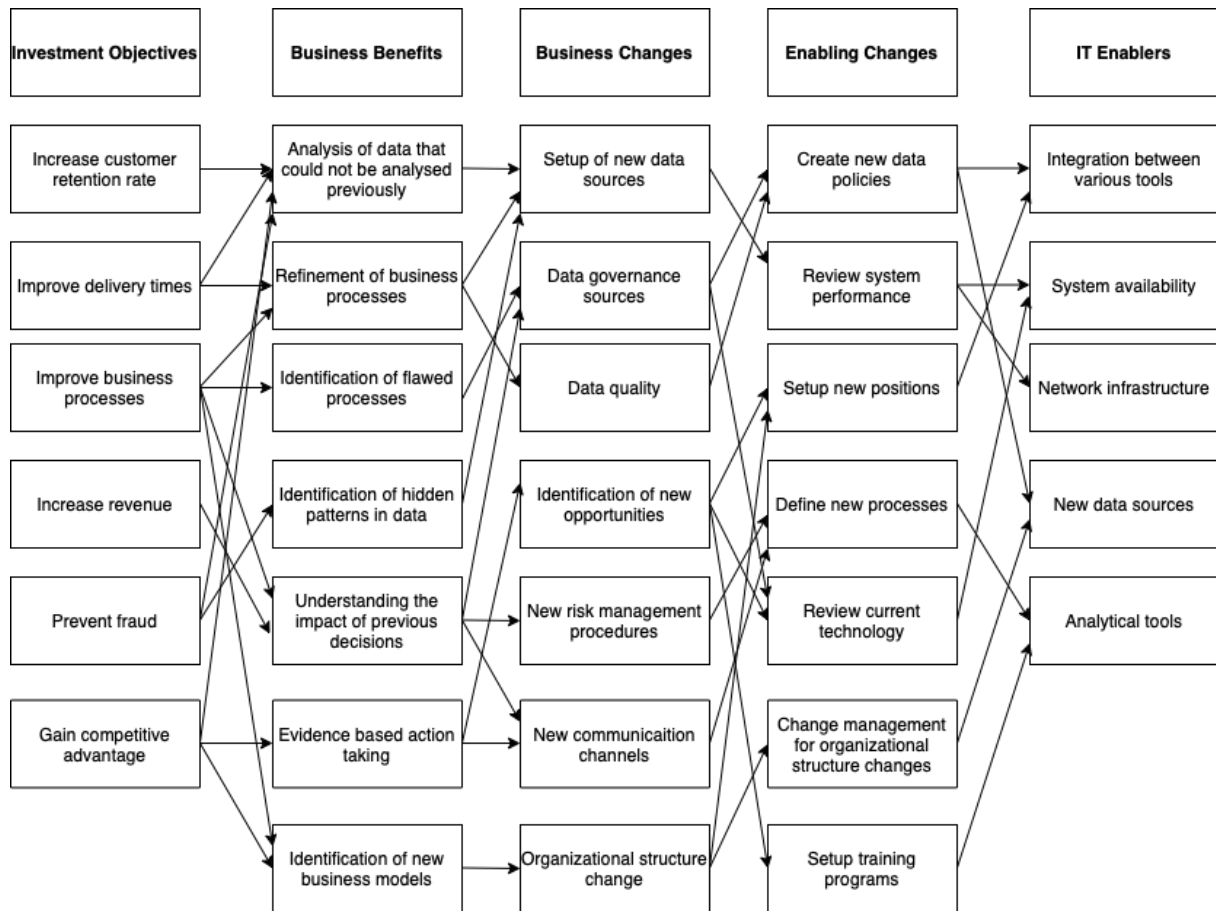
For the interview process and to better help understand and visualize all contributions, a color scheme was selected according to the input received from interviewees, where any new addition would be represented by the color green, any removal would be represented by the color red and any change to a currently existing field would be represented by the color yellow.

In order to validate contributions and avoid having artifacts with no correlation whatsoever, after the interviewees gave their opinions on the proposed BDN they were also asked if they agreed with input provided by their peers. We assumed that whenever a change was confirmed by more than three people, it would be considered valid and therefore added to the final artifact.

**Table 9. SIT benefits**

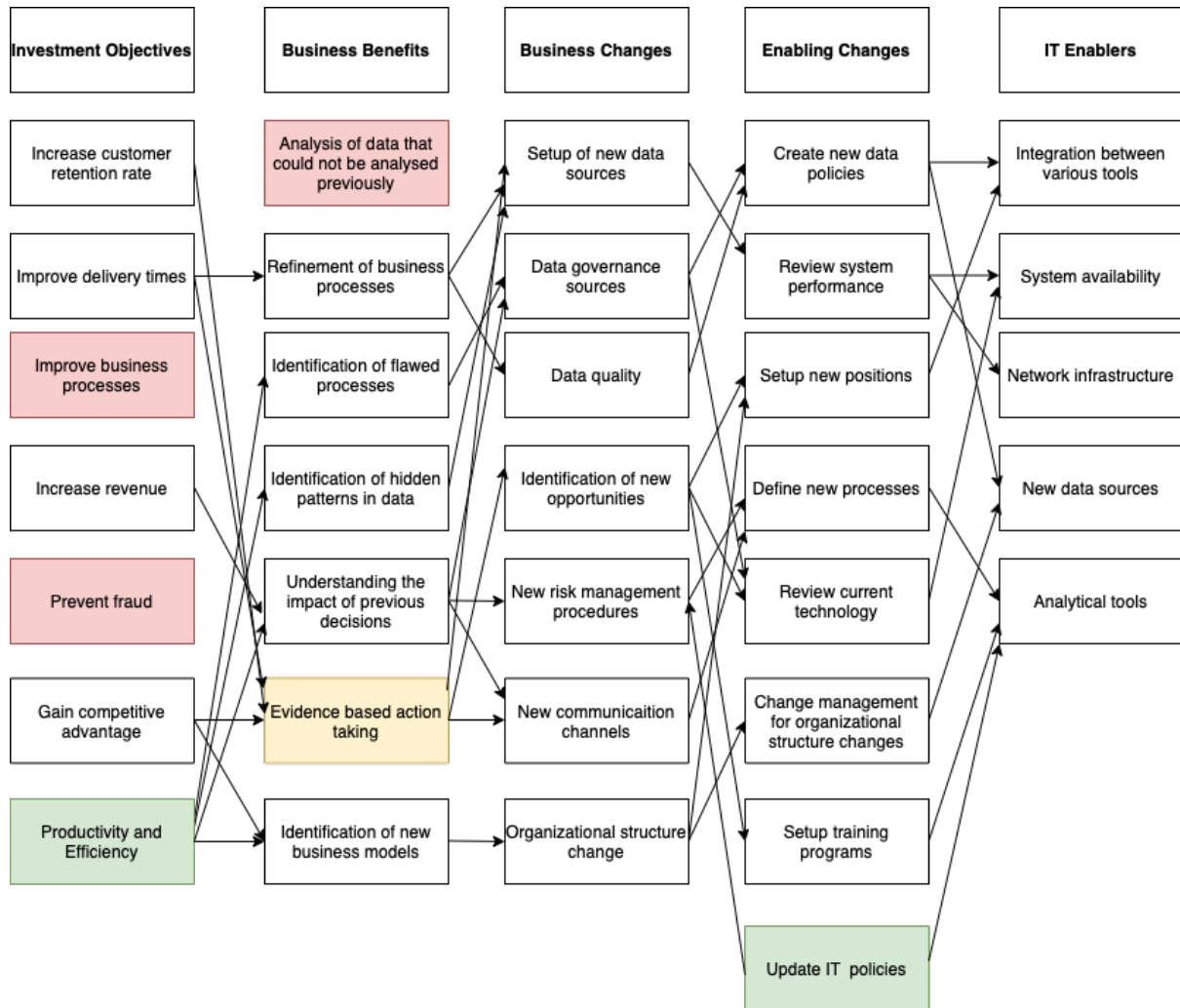
Author	Concept
Behrens, 2009	Creativity surrounding the systems, the perceived innovativeness of the systems and the stability and order brought about by the system.
Györy et al., 2012	Enhances the employee's freedom and boosts their effectiveness.
Silic & Back, 2014	Very efficient and effective when used in place of the formal and standard systems already present.
Silic et al., 2016	Important source of innovation.
Gabriela Labres Mallmann et al., 2016	Boosts productivity and enables faster and better collaboration and communication. Instantaneous, agile, faster, dynamic, immediately, practicality, and speediness of information.
Silic et al., 2017	Efficient and effective.
Huber et al., 2017	Supports users to increase performance and are innovative and flexible.
Furstenau et al., 2017	Creativity, innovation and improved business performance.
Magunduni & Chigona, 2018	Beneficial to companies.
Richter et al., 2019	Increased employee responsiveness and decision-making speed.
Gabriela Labres Mallmann & Maçada, 2019	Helps the circulation of information more instantaneously, more agile, faster, dynamic and practical, all without the need of formal permission.
Klotz et al., 2019	Source of creativity and innovation.
Kopper et al., 2020	Increased agility, productivity or innovation.

**Figure 4. Proposed BDN for SIT adoption**



From the twenty-three people originally contacted to take part in this process, eight were not available to meet on the two weeks that interviews were conducted due to scheduling conflicts. One of the interviewees' suggested only one change so we considered that contribution invalid. Our first interview was with a Project Manager (PM) that has over 20 years of experience in IT. He agreed with the proposed BDN but suggested as displayed in Figure 5: adding Update IT policies to the Enabling Changes column; adding Increased Productivity and Efficiency to Investment objectives; merging the fields Analysis of data that could not be analyzed previously and Evidence based action taking into the latter; removing Improve business processes from the Investment Objectives column; removing Prevent fraud from the Investment Objectives column.

**Figure 5. Proposed BDN after first DSR iteration**



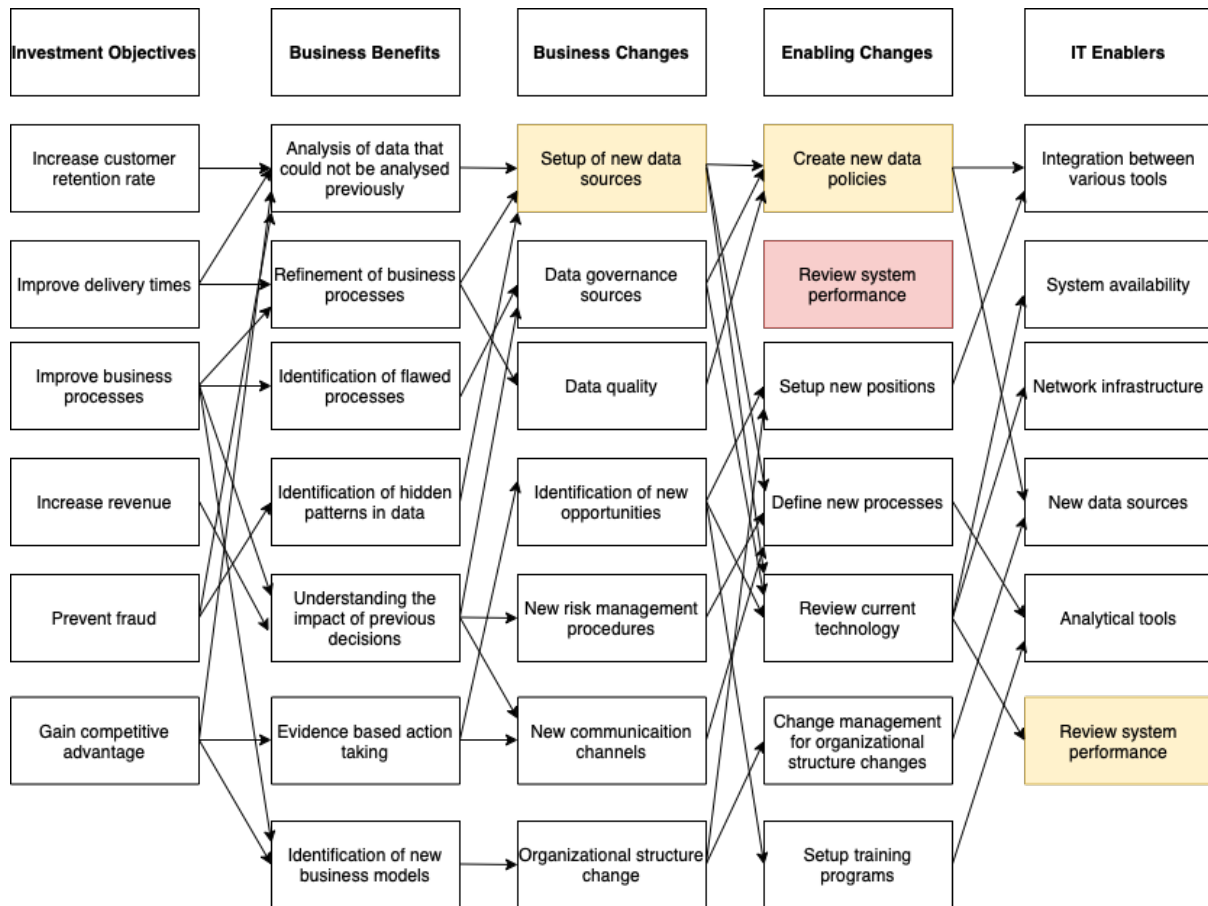
## 5.2. Second Design Scientific Research Iteration

The second interview was with a Solutions Analyst with over 15 years' experience in Client Success while working mostly in the communications industry. He is familiar with SIT but does not have much experience with it due to the strict policies in place in the telco environment.

His suggestions, per Figure 6 were: Review system performance should be an IT Enabler as it is one of the first steps taken before implementing new solutions, it is a verification process; setup of new data sources – in Business Changes – should be linked with Create new data policies and Define new processes, all related with implementation.



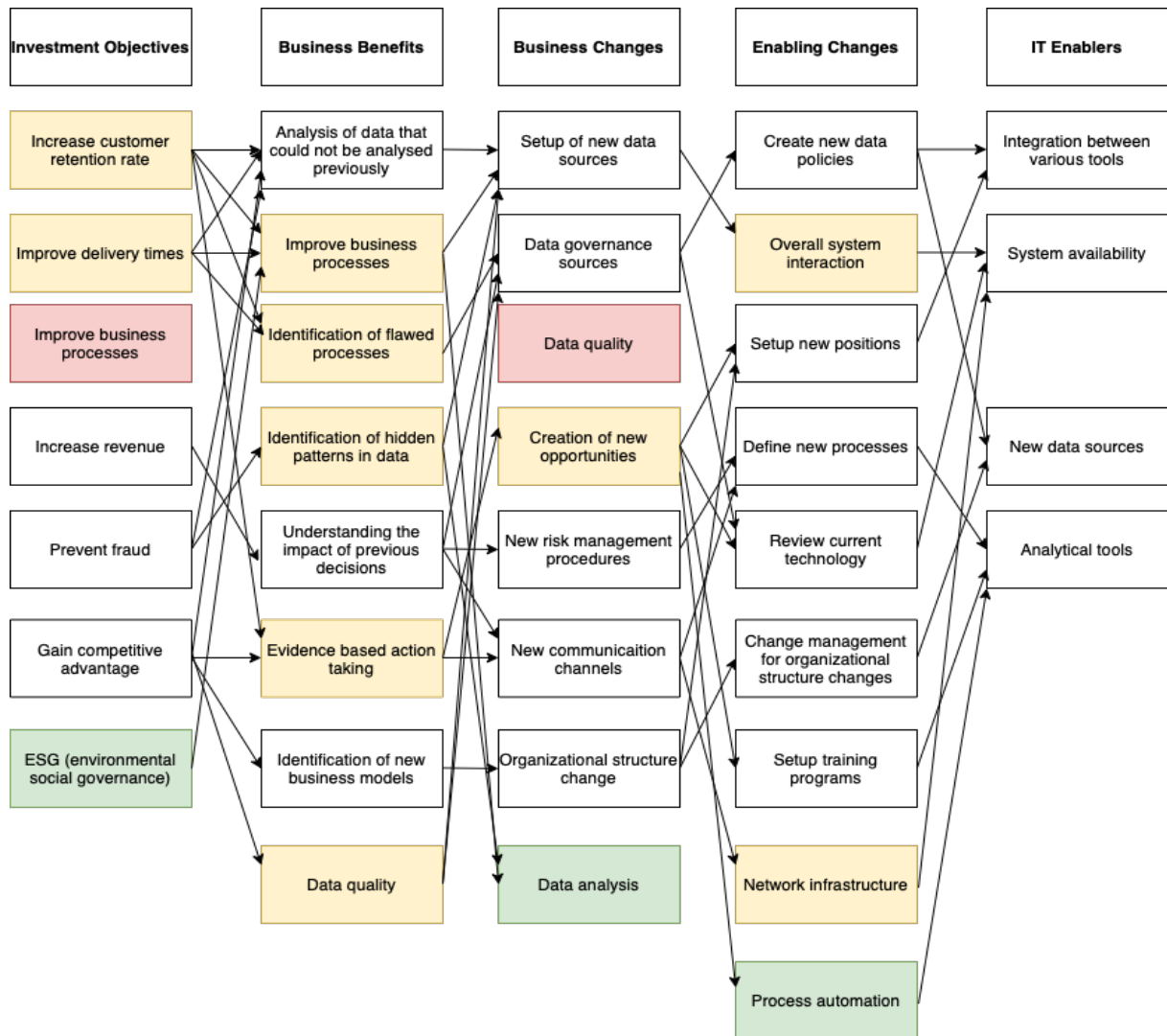
**Figure 6. Proposed BDN after second DSR iteration**



### 5.3. Third Design Scientific Research Iteration

This interview was done with a team leader with over 20 years' experience in IT consulting and business management. His recommendations as shown in Figure 7, were: Network Infrastructure as an Enabling Change; adding Process Automation as an Enabling Change; evidence based action taking, refinement of business processes and identification of flawed processes linked with Increased customer retention rate; identification of flawed processes linked with Improved delivery times; replacing refinement of business processes with Improved business processes; adding Environmental Social Governance (ESG) as an Investment objective linked with Improved business processes; adding Data analysis as a Business Change, linked with Identification of hidden patterns in data and refinement of business processes; replacing Data governance sources with Apply Data governance; Data quality as a business benefit, linked with Setup of new data sources and Apply data governance; replace Identification of new opportunities with Creation of new opportunities and replace Review system performance with Overall system interaction.

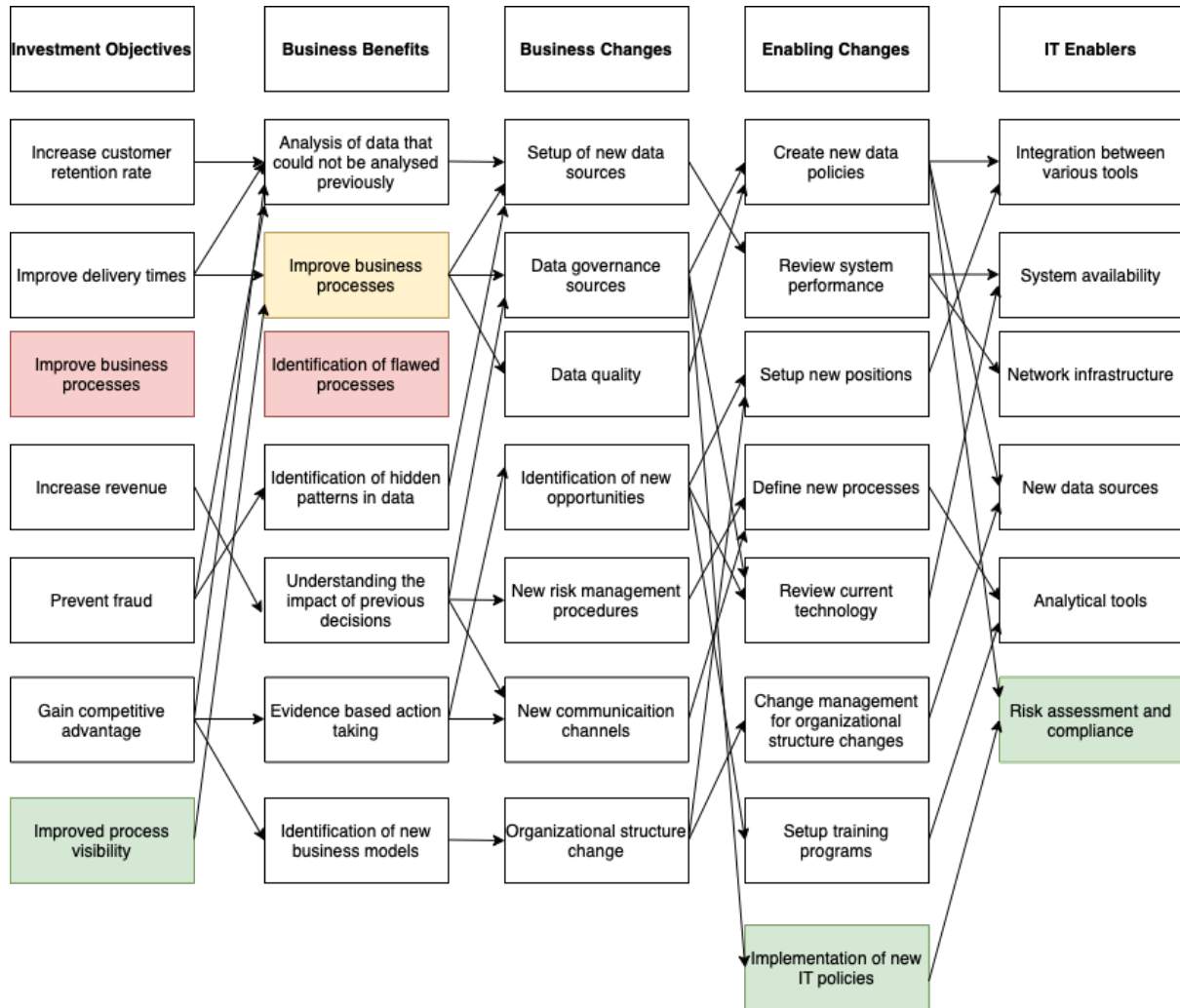
**Figure 7. Proposed BDN after third DSR iteration**



**5.4. Fourth Design Scientific Research Iteration**

The interviewee has an 11-year experience in IT and is currently a head of IT operations. As for the suggested BDN, as shown in Figure 8 he suggested adding Risk assessment and compliance to the IT Enablers column; adding Implementation of new IT policies to the Enabling Changes column and connect with the latter; merging Define new processes into Create new data policies; merging Refinement of business processes and Identification of flawed processes from Business Benefits column into Improve business processes which would go from Investment objective column into Business benefits column; add Improved process visibility as an Investment objective – to be linked to Improve business processes.

**Figure 8. Proposed BDN after fourth DSR iteration**



### 5.5. Fifth Design Scientific Research Iteration

The interviewee has over 30-years experience in IT and currently works as a PM and was familiar with SIT. While analyzing the proposed BDN, as displayed in Figure 9, he suggested: adding Setup of backups to Enabling Changes, to be linked with IT Enabler System availability; adding Non-IT Enablers and Business Understanding to the IT Enablers column; adding IT support, Setup of backups to the Enabling Changes column; adding Organizational control as a Business Benefit.

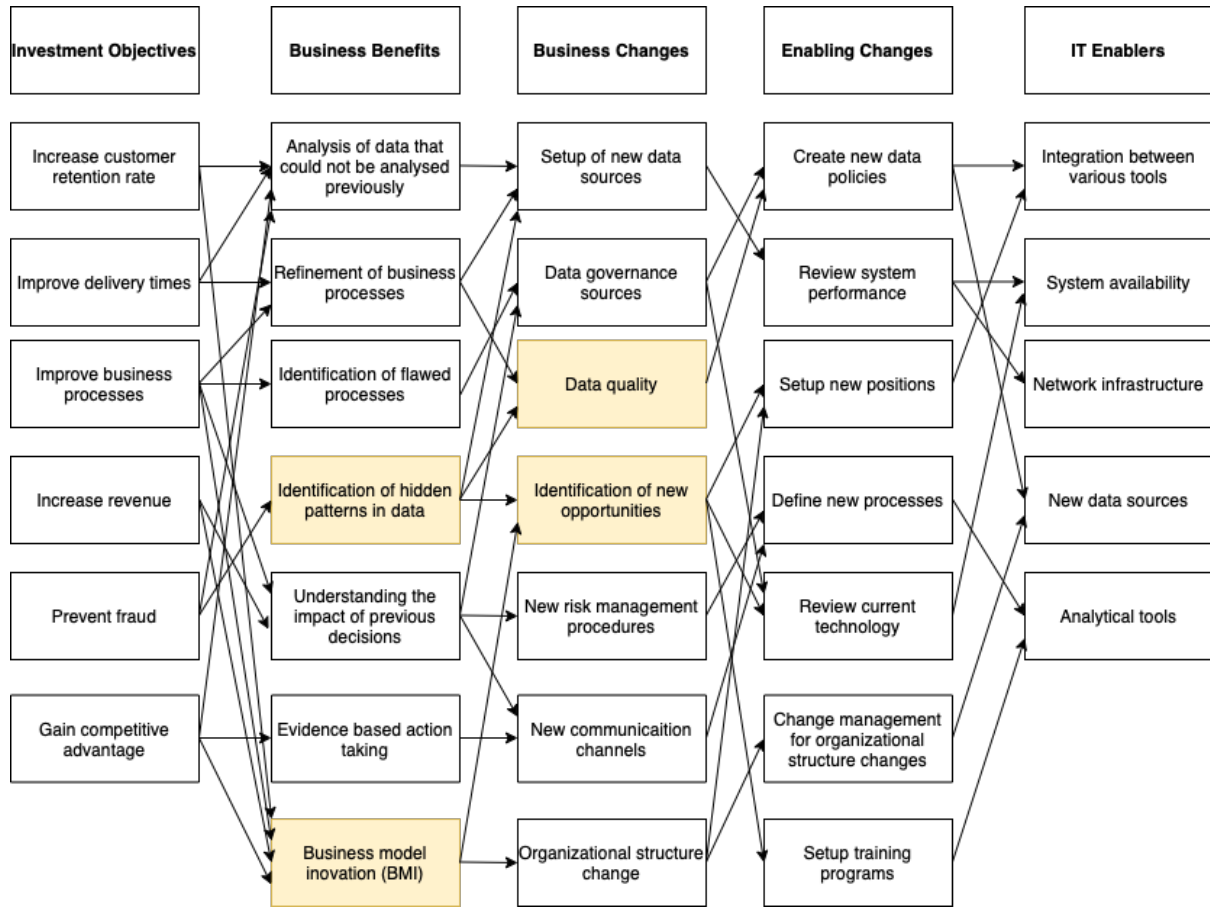
**Figure 9. Proposed artifact after fifth DSR iteration**



**5.6. Sixth Design Scientific Research Iteration**

Our interviewee has had over 5 year experience in the IT field and is working as a PM. He has not had many encounters nor issues with SIT in the past be he does understand what it entails and the risks it brings. He starting by mentioning that all fieds presented in the BDN were valid but he also had some suggestions as displayed in Figure 10: renaming Identification of new business models into Business model innovation (BMI); linking Indentification of new opportunities with identification of hidden patterns in data and identification of new business models; linking Data quality with identification of hidden patterns in data; linking Identification of new business models with Increase revenue and Increase customer retention rate.

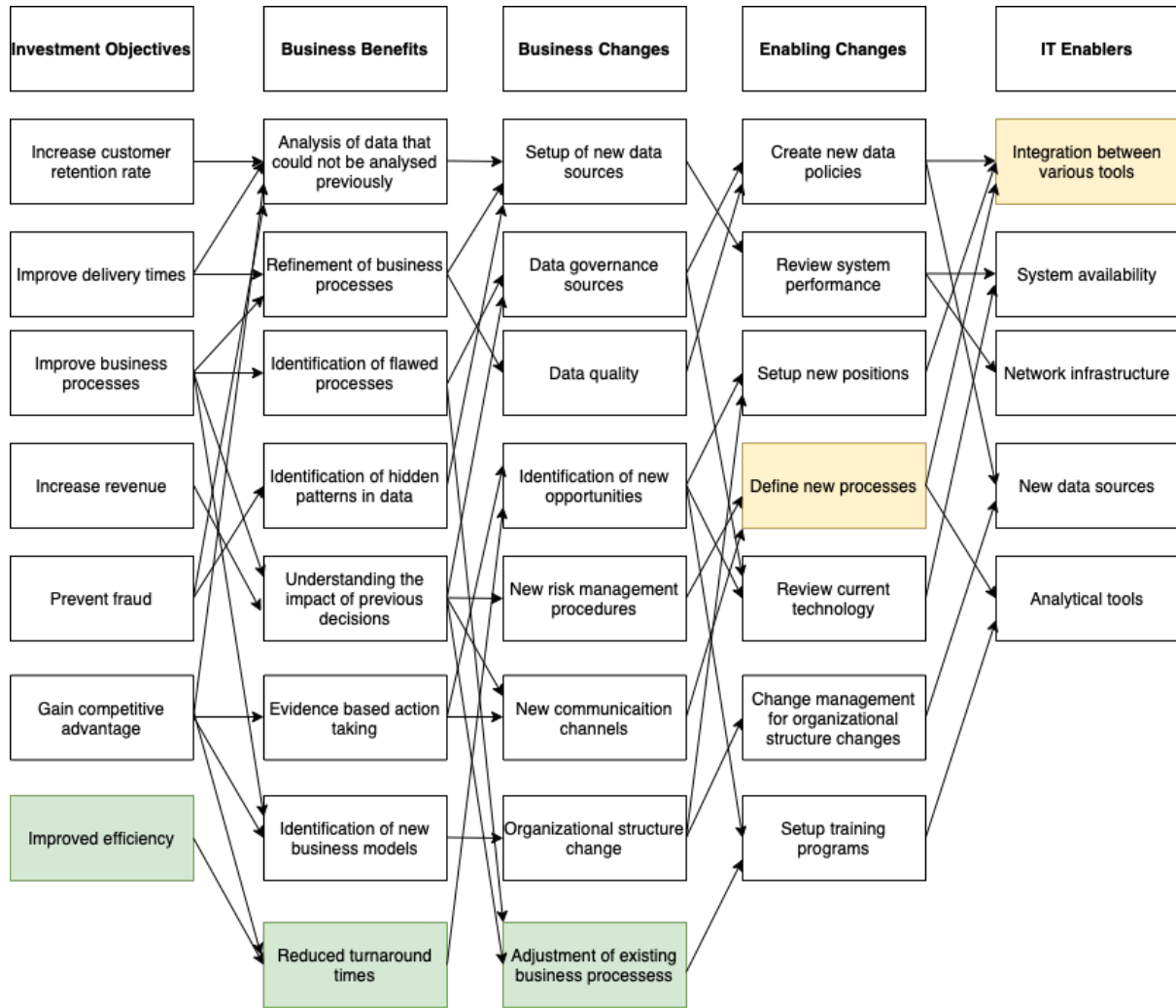
**Figure 10. Proposed BDN after sixth DSR iteration**



### 5.7. Seventh Design Scientific Research Iteration

Currently a team leader and with over 12 years of experience, this interviewee was very familiar with SIT, including experiencing first hand as a in-house developed tool went all the way to being accepted and utilized by the whole company, even though it was a lengthy process. Upon analyzing the proposed BDN, he suggested as demonstrated in Figure 11: adding Reduced turnaround times as a Business Benefit; adding Improved Efficiency as an Investment objective; adding Adjustment of existing business processes to Business changes column; linking Adjustment of existing business processes to Setup of new training programs; linking Define new processes with Integration between various tools.

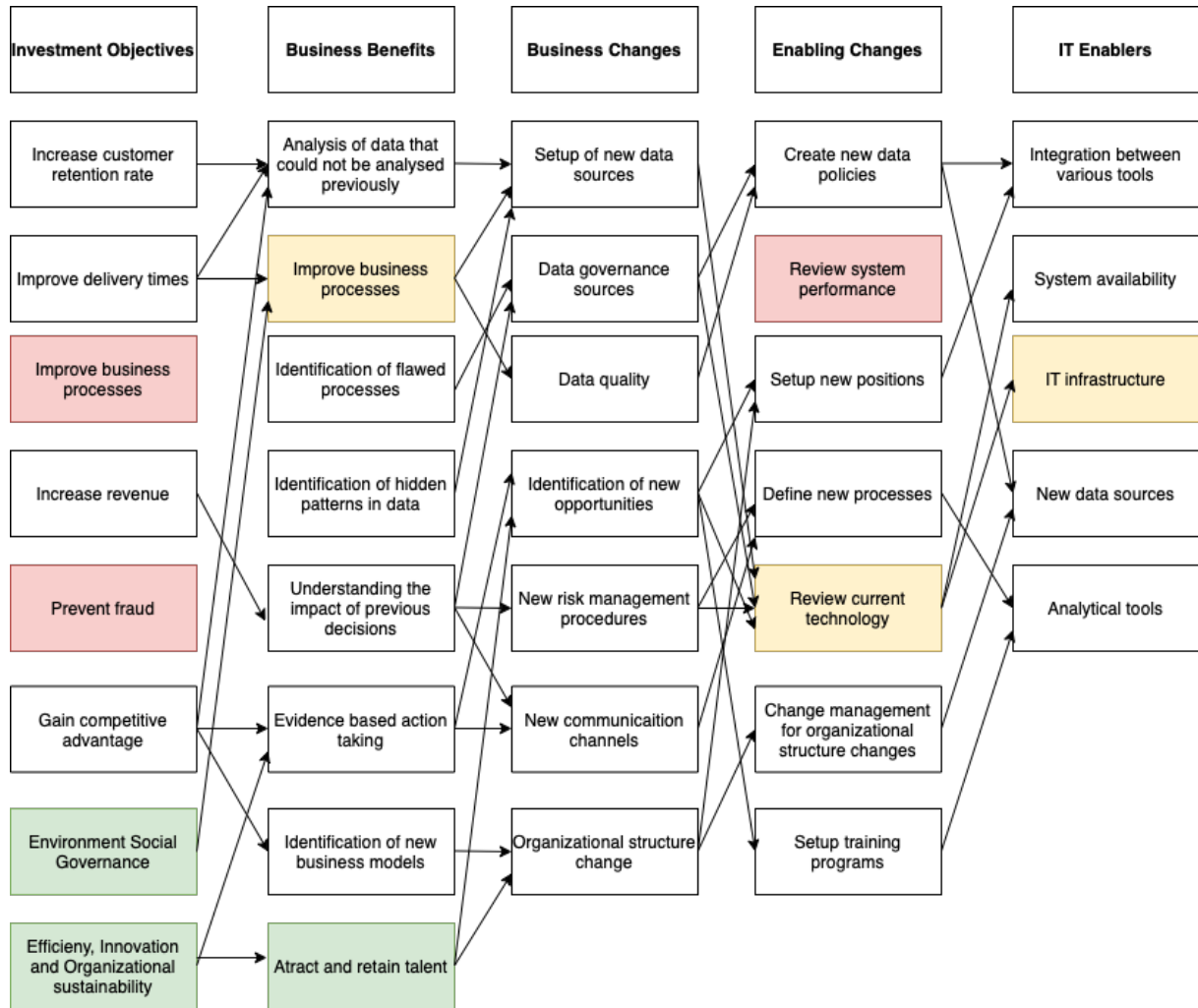
**Figure 11. Proposed BDN after seventh DSR iteration**



### 5.8. Eighth Design Scientific Research Iteration

This interviewee currently works as head of IT Security and oversees all company operations and is very familiar with SIT and its consequences for the users and for the company. When discussing the proposed BDN, he suggested as shown in Figure 12: removing Refinement of business processes as it is not a Business benefit and replace it with Improve business processes; remove Prevent fraud from Investment Objective; adding Efficiency, Innovation, Organizational sustainability and ESG as Investment Objectives; adding Attract and retain talent to Business benefits and linking it to Organizational structure change and Identification of new opportunities; replace Network infrastructure with IT infrastructure; merge Review system performance into Review current technology; linking Review current technology with Setup new data sources, New risk management procedures, Data governance sources and Identification of new opportunities.

**Figure 12. Proposed BDN after eighth DSR iteration**

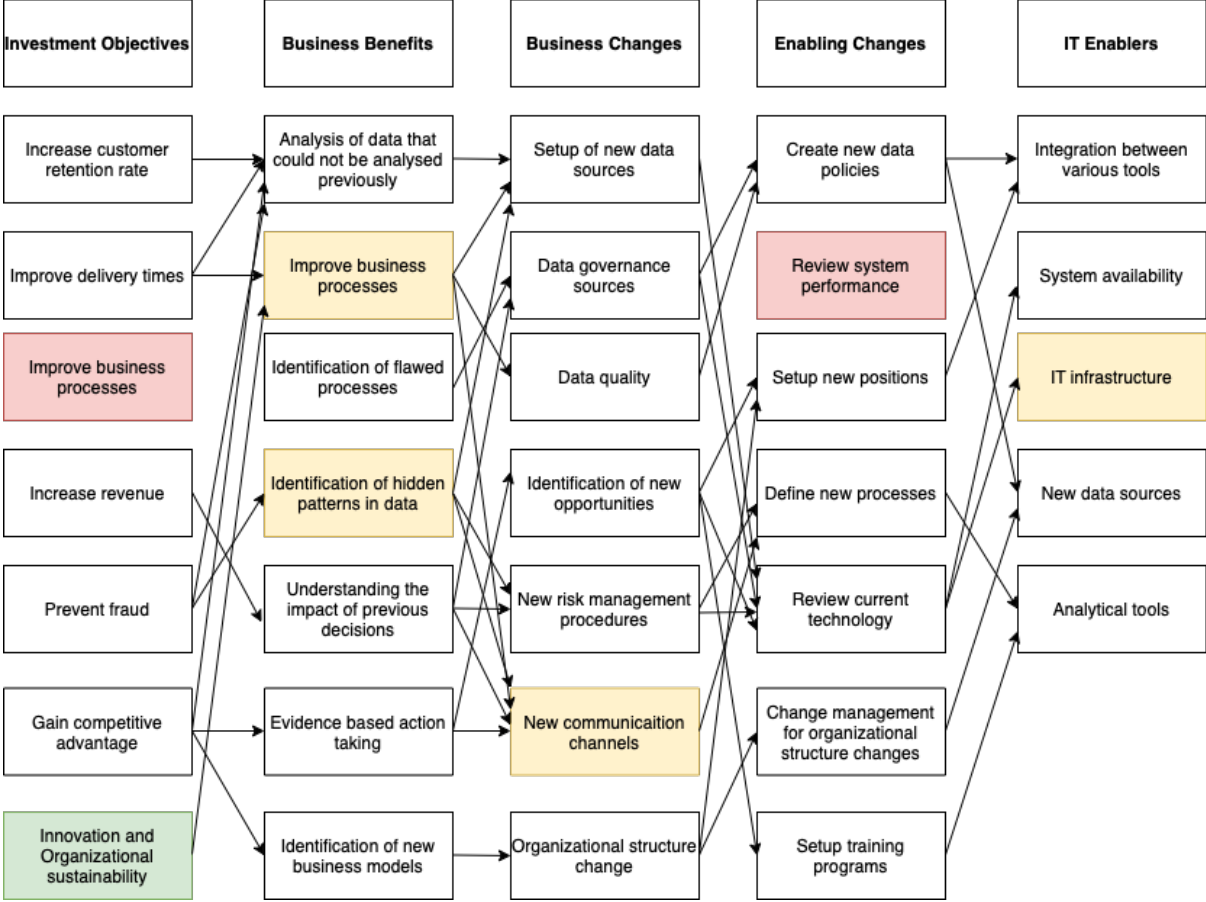


### 5.9. Ninth Design Scientific Research Iteration

With over 23 years of experience as a network architect and systems administrator, this interviewee claimed to have some knowledge on SIT and its impact on organizations. As displayed in Figure 13, his suggestions were: removing Improve business processes from Investment objectives column into Business benefits and have it replace Refinement of business processes; linking Improved business processes with Improve delivery times; adding Innovation and Organizational sustainability to Investment objectives and linking with Improved business processes and Gain competitive advantage; replacing Network infrastructure with IT infrastructure; merging Review system performance and Review current technology into the latter; linking Review system performance with Identification of new opportunities, new risk management and data governance sources; add New communication

channels and link it with Improve business processes and identification of hidden patterns in data.

**Figure 13. Proposed BDN after ninth DSR iteration**

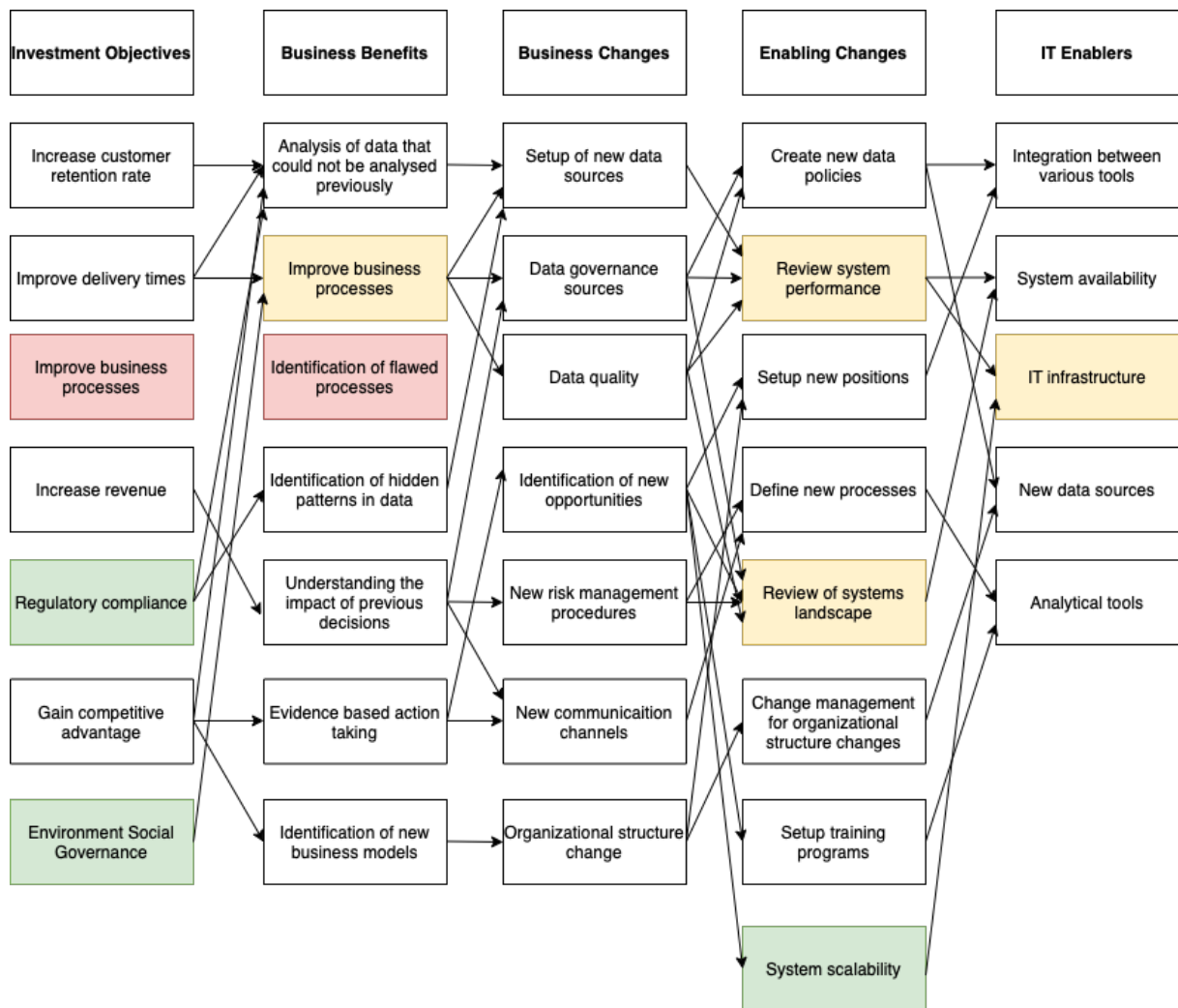


**5.10. Tenth Design Scientific Research Iteration**

Currently part of the executive team, this interviewee has a vast experience in IT Management as is very much aware of the existence of SIT and its negatives. When reviewing the proposed BDN he suggested as displayed in Figure 14: replace Refinement of business processes and Identification of flawed processes with Improve business processes; adding ESG as an Investment objective; linking Review system performance with Data governance sources and Data quality; Review current technology should be linked with Identification of new opportunities, New risk management procedures, Data governance sources and Data quality; adding Review of systems landscape and put it in place of Review current technology; replacing Network infrastructure with IT infrastructure; add System scalability as an enabling change and link it with IT infrastructure; replace Prevent fraud with Regulatory compliance.



**Figure 14. Proposed BDN after tenth DSR iteration**

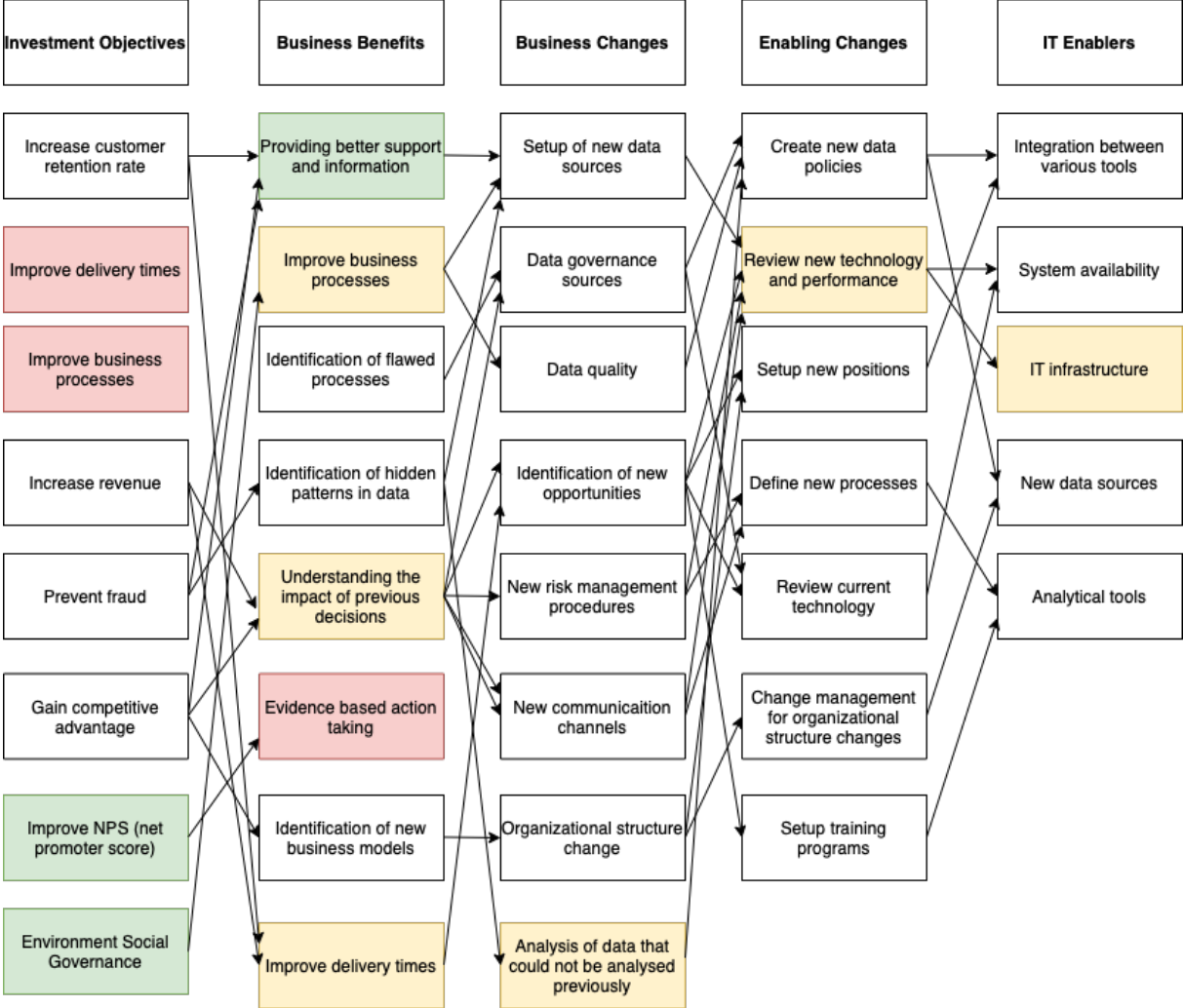


### 5.11. Eleventh Design Scientific Research Iteration

This interviewee has a vast experience in the IT field and currently Works as the Head of IT services, he was not very familiar with the specific terms of SIT but he admitted it is something that he has into multiple times. His suggestions, shown in Figure 15, for the proposed BDN were: adding Improve Net Promoter Score (NPS) to Investment Objectives; move Analysis of data that could not be analyzed previously to Business changes and replace it with Providing better support and information; replace Refinement of business processes with Improve business processes; move Improve delivery time into Business benefits; adding ESG as an Investment objective; replace Network Infrastructure with IT infrastructure; adding Review new technology and performance - by removing Review system performance - to enabling changes and connect it with Identification of new opportunities, New risk management

procedures and new communication channels; merge Evidence based action taking and Understanding the impact of previous decisions into the latter.

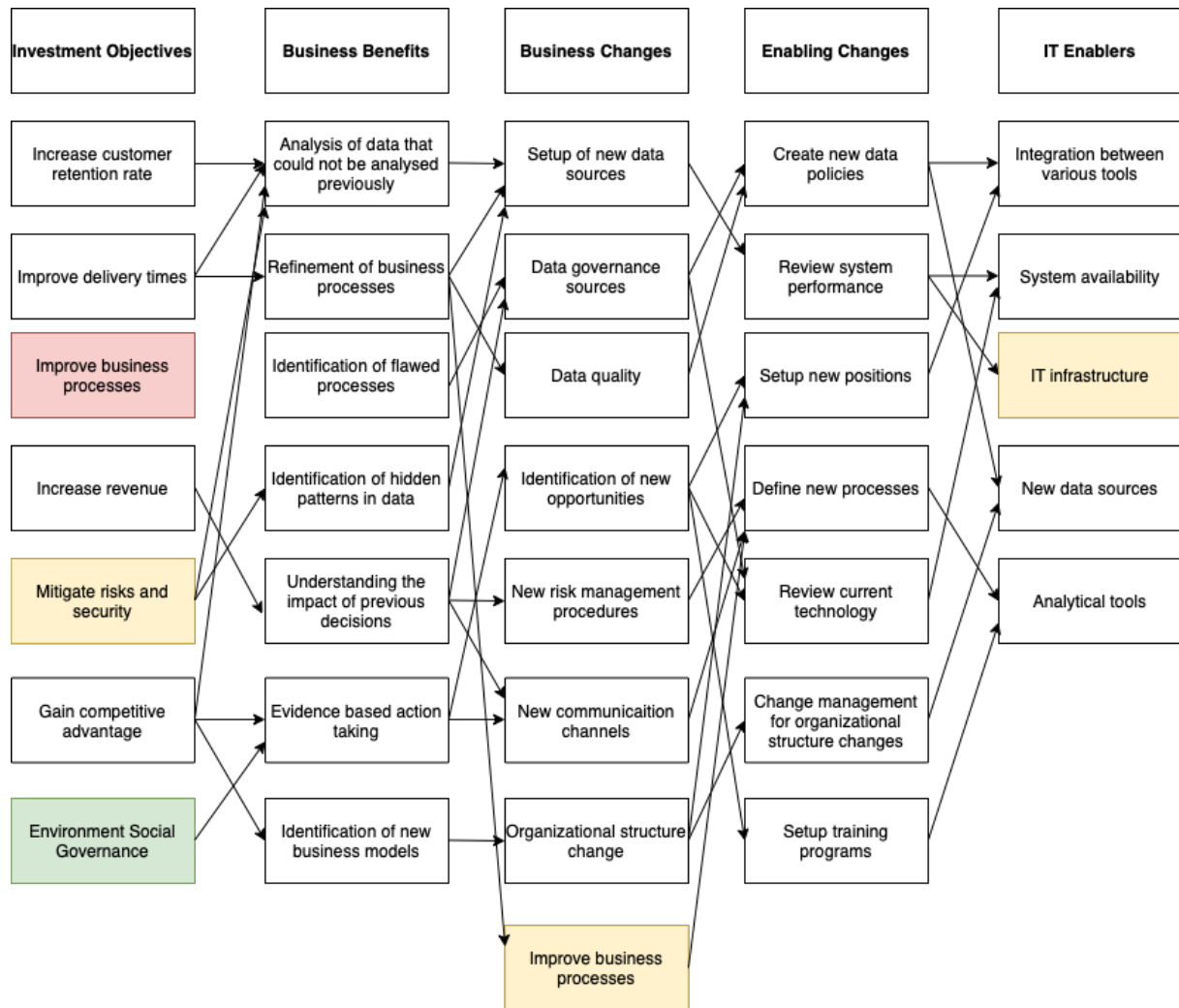
**Figure 15. Proposed BDN after eleventh DSR iteration**



**5.12. Twelfth Design Scientific Research Iteration**

This interviewee was familiar with SIT however he was not aware that it was widely seen as a risk since his experience with it has been positive so far. Upon discussion after taking a look at the proposed BDN, he suggested as demonstrated in Figure 16: replacing Investment Objectives column with ROI (return of investment); moving Improve business processes to Business Changes and link it to Refinement of business processes; replacing Prevent fraud with Mitigation of risks and security; adding ESG to ROI and linking it to Evidence based action taking; replacing Network infrastructure with IT infrastructure.

**Figure 16. Proposed BDN after twelfth DSR iteration**



### 5.13. Thirteenth Design Scientific Research Iteration

The interviewee has vast experience in IT strategy however he was not familiar with SIT but he was very familiar with the BDN concepts. As shown in Figure 17, he suggested: reducing the number of Investment Objectives by prioritizing (preferably into three); removing Improve business processes and Prevent fraud from Investment objectives; adding Accelerate turnaround time to Business Changes; adding Transformation to Business benefits and link with Accelerate turnaround times; add Mitigate risks as a Business benefit and link it with New risk management procedures; link Mitigate risks with Increased customer retention rate and Gain

competitive advantage; link Transformation with Gain competitive advantage; link Transformation with Setup of new data sources, Organizational structure change.

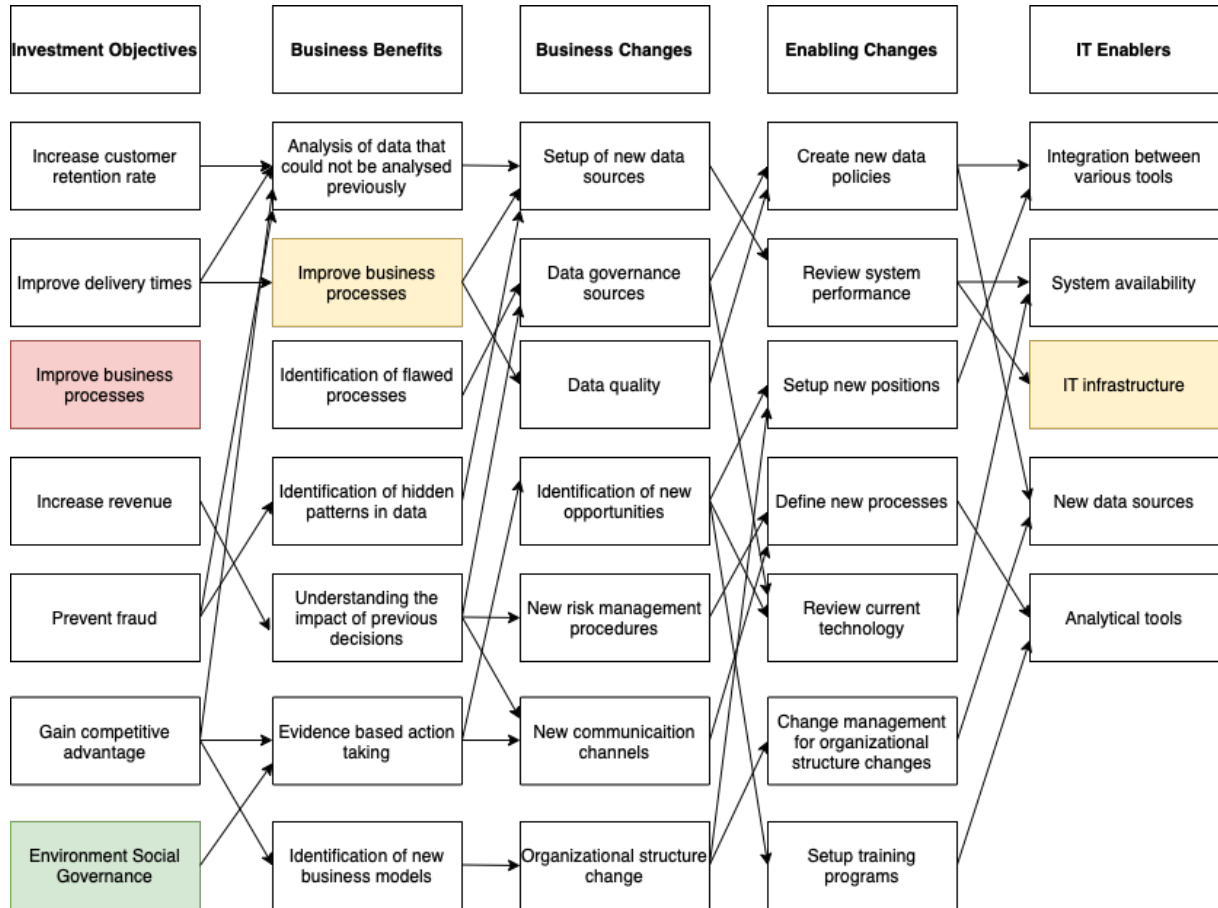
**Figure 17. Proposed BDN after thirteenth DSR iteration**



**5.14. Fourteenth Design Scientific Research Iteration**

With vast experience in IT management, this interviewee was familiar with the concepts of SIT. After a brief explanation he suggested as shown in Figure 18: adding ESG as an Investment objective; replace Network infrastructure with IT infrastructure; Improve business processes should be a Business benefit.

**Figure 18. Proposed BDN after fourteenth DSR iteration**



### 5.15. Data Saturation

For this particular situation, data saturation was observed to help determine the state of the artifact and prepare it for the evaluation phase. During a qualitative research the purpose is to understand when data gathered is unnecessary, based on what has already been gathered and analyzed. The reason for the use of data saturation is due to a particular observation being repeated or similar comments seeming repeated and, after 15 interviews we had to stop – as other interviewees were not available to connect –, in order to move on to the next step and show the results of these sessions.

**Table 10. Total contributions from interviewees during DSR iterations**

Iteration	Relations		Updated or Added	
	Contributed	Total	Fields	Relationships
1	5	5	5	0
2	3	8	1	2
3	14	22	6	8
4	7	29	5	2
5	7	36	6	1
6	6	42	1	5
7	5	47	3	2
8	15	62	8	6
9	12	74	5	7
10	12	86	5	7
11	11	97	8	3
12	8	105	5	2
13	12	117	5	7
14	3	120	3	0

As seen in Table 10, we were not able to reach data saturation, as other interviewees were not available to participate in the interactions. Also, one of the interviewees feedback was deemed invalid as he only suggested one change.

### **5.16. Final artifact**

Based on the feedback received from our interviewees, all information was carefully analyzed and it was decided that in order to validate a change or suggestion, it would have to be confirmed at least by three separate interviewees. New fields as seen in Figure 19 that were added to the BDN include ESG as an Investment objective, replacing Network Infrastructure with IT infrastructure in IT enablers, merge Evidence based action taking and Understanding the impact of previous decisions into the latter, removing Improve business processes from Investment objectives, place it as Business benefit and merge Identification of flawed processes and refinement of business processes into it, removing Prevent fraud and merging Review system performance with Review System performance into the latter.

**Figure 19. Proposed BDN for SIT**







## CHAPTER 6

### **Discussion**

SIT is a socio-technical phenomenon (Huber et al., 2018) and whether it is good, bad or even neutral is not clear yet as opinions diverge on what really happens in organizations, on how to handle it or if it is even worth the risk as a lot of times in practice, the situation is often more complicated (Gabriela Labres Mallmann & Maçada, 2019). Aspects like company data safety being more important than employee satisfaction or productivity and profit being the main focus no matter the downside, make the behavioral consequences of utilizing shadow IT ambiguous (Haag et al., 2019) as employees justify their use on better productivity but on the other side, management and IT departments spend a lot of time, effort and capital to assure that the company system stays up to date and protected. There is no clear solution for this problem as both sides have very valid reasons on why they are doing what they are doing and still, the differences are sometimes abysmal and many companies find it difficult and often impossible to fill this gap on their own (Walterbusch et al., 2017). Most times, organizations find themselves in an area of conflict, as IT integration might eliminate the benefits that SIT offers (Huber et al., 2018).

There is a need to try and find common ground, one where IT departments and employees are on the same page and both work together towards productivity and dynamism. There is a need for a consensus when it comes to SIT because it is not going away much to the contrary it is growing everyday as big techs companies focus more and more on the cloud and cloud-based services that are user friendly and interactive and even the management uses these solutions, which further strengthens the usage of SIT (Walterbusch et al., 2017). This is something the IT department and management can use to improve the corporate IT landscape accordingly, which may have a positive impact on a company's progress. SIT exists alongside formal enterprise systems and either complements, expands, or supplements them (Huber et al., 2018).

Despite all initiatives promoted by companies and IT departments, the rate at which employees still use SIT solutions for their daily tasks is very alarming for companies (Gabriela Labres Mallmann & Maçada, 2019), and that explains how a lot of management still looks at this reality, as most of the time they see it as a risk, dangerous for system integrity and normal functioning of the company. SIT can be used by one individual or a group of employees, which suggest two levels of use: an individual and collective use (Gabriela L. Mallmann, Maçada, & Eckhardt, 2018). More often than not SIT is looked at as a liability, and this sometimes incites employees to use it, even though its unapproved but it gives a sense of rebellion and at the same

time, as it helps with tasks it also helps fulfil professional needs, employees look at it as a win-win situation. There needs to be a deeper research in order to understand how can it be dealt with so both management and employees can get the most out of this situation, diminish the gap between them and help companies prosper. As it has been stated many times, SIT is only growing so it has to be dealt with, instead of being abolished or banned. One of the main issues is that these shadow solutions and devices leave no blueprints behind, making extremely difficult to assess the actual risk (Silic & Back, 2014) and it undermines both the main system of a company and causes damages to organizational processes and information. There is still a lack of knowledge so not many entities are taking risks and rather avoid SIT instead of considering embracing it. A lot of times organizations can solve these inefficiencies by converting SIT into business-managed IT (Huber et al., 2018).

The fact that employees many times still depend on their own knowledge and experience to address their daily tasks how they feel is best fit for their needs, while believing that the delivery of results will surpass the consequence of using SIT (Sillic, 2019) is one of the biggest factor of why its spreading so fast. Many times, employees see IT departments as a hold back and not as an entity that can help and, some in-house built solutions are not as user friendly and interactive as some of the solutions being used in the “shadow”. Even when the in-house solutions are up to employee needs, there is always going be issues like bugs, FAQ’s and updates that most employees rely on IT department help and when they cannot get that help right away, they resort back to the solutions they know best and from then on it is back to the same risks and liabilities for the company and its data when it comes to SIT. Communication and politics play a role in all of this, as they play a critical part on the overall success of SIT and the organization in general. Disagreements between departments or lack of communication between staff can all lead to failing to implement possible solutions to shadow, reason why some believe social factors like such as social presence, have a profound influence on the ways in which individuals perceive and use this technology (Gabriela Labres Mallmann & Maçada, 2019).

The challenge for CIO’s and IT department is to identify the employee needs that are being filled by these solutions and find a way to adapt company policy so that they can be used without risk for employees and the company itself. Being strict should not be a solution anymore as eventually employees find a way around implemented systems and measures specially against integrating systems, resistance to change or technical incompatibility (Huber et al., 2018). Part of the solution should be understanding SIT fully in order to embrace it and adapt to it instead of treating it as a liability. SIT should not be treated as the problem but as part of the solution

and the research suggesting that is almost non-existent, even though some researchers already chose to see the positives in it and the positive outcomes it might bring for organizations when properly embraced.

Occurrence of SIT is a phenomenon insufficiently explored on the one hand, and on the other hand it is often misinterpreted (Raković et al., 2020) and this is a big reason why this subject deserves more attention from both organizations and scientific world.



## CHAPTER 7

### **Conclusion**

There is not much research currently that has been conducted at the individual level when it comes to benefits of SIT and the reasons behind why employees choose or not to embrace it and what should organizations do about this ever-growing phenomenon. While literature on SIT has been growing in the last couple of years, the current knowledge is still very limited. Past studies put more focus on the consequences and the governance side of SIT on an organizational context, shedding no light on the antecedents, precedents, reasons and motivation behind SIT adoption at multiple levels in organizations, and this creates a big gap in understanding what works and what does not, what are the benefits and the risks when it comes to approaching the existence of SIT in organizations.

As SIT studies on an innovational context are also limited, we wanted with this research to bring attention to the world of possibilities and solutions that it has to offer, their motivations and benefits, to give a better understanding of this phenomenon. We identified that most opinions about SIT were neutral or focused on its negative impact instead of analyzing the potential and intangibles that it has. There is a growing need for organizations and IT departments worldwide to adapt to the new trends and advances in IT specially one that has the ability to motivate and improve productivity and creativity within their ranks.

Organizational focus should be on how to integrate, incorporate, explain, understand and encourage SIT in order to unleash employee's potential and improve production and ability to deliver, instead of ignoring or fighting against its growth, and that is what we wanted to achieve with this research by shedding a light on the benefits, in order to allow a clear analysis of what SIT is about and what it entails.

There are still some academics and IT professionals that believe SIT is "undesirable" due to its risks but on the other hand, more recent studies have stated that SIT "may be just what an organization needs". In times of constant change and digital transformation organizations need to have agile procedures to support facts and proper adaptation. However, without a minimum of control such solutions can be disastrous.

There will always be contradicting opinions when it comes to a topic like SIT but in a world that is always evolving it is important that organizations and management have in mind that not everything that is new or unknown will bring more harm than good, the focus should always be maximizing on potential in order to achieve success and sometimes taking calculated risks

because even though SIT has its negatives, the benefits of SIT adoption are numerous and there will always be a need for end users to complete their jobs.

This study was conditioned by the interviews only being made in one company and many people of interest not being available for an interview. Any future work with a bigger and broader focus in doing more interviews should be encouraged.

This research therefore, concludes that there is a lot of potential and upside on SIT adoption, but in order to reach its benefits, there needs to be knowledge on what the system landscape of the company entails and a clear understanding of what the investment objectives are as that is the starting point whenever taking a BDN approach for considering SIT adoption.

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## **APPENDIX A**

### **Questionnaire for research on a Benefit Dependency Network for Shadow IT adoption**

#### **Definitions:**

- a) Shadow information technology (SIT) describes the autonomous deployment, procurement or management of information technology. It represents all hardware, software, or any other technological solution used by employees inside of the organizational ecosystem that did not receive any formal IT department approval and is not prescribed by the formal policy.
  
- b) Benefit dependency network (BDN) is a core tool in constructing a benefits realization plan, it provides a framework that links the investment objectives and the necessary benefits with the business changes needed to provide said benefits and IT functionality to push and allow for these changes to be made.
  
- c) When discussing BDN, there are five concepts that can not be dismissed:
  - Investment objectives – specific to the project and focuses on the outcome of the project, on what the project will achieve if successful
  - Business benefits – advantages that are incurred as a result of the project. When benefits are delivered, they will lead to achieve the investment objectives
  - Business changes – permanent changes to practices, processes and relationships within the organization, required in order to achieve benefits
  - Enabling changes – adjustments or changes that need to be implemented for business changes to take place
  - IT enablers – IT tools that must be implemented as well as IT considerations to be evaluated before introducing new technology.

#### **Questions (after analysing figure 1):**

1. Based on the explanation above, would you remove any of the outputs in figure 1?

2. What outputs would you include on the table and how would they interconnect between each other?

**Figure 1. Proposed BDN for SIT adoption**

