The Performance of Information Systems Implementation Outcomes: The case of an Enterprise System Implementation in a South African University

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Declaration

I hereby declare that the thesis

The Performance of Information Systems Implementation Outcomes: The case of an Enterprise System Implementation in a South African University

is my own work, and all sources have been acknowledged through referencing.

Adedolapo Akin-Adetoro

Dedication

See how far You've brought me, Lord, I've come to worship You. Ẹyin le se yi. Ni gbo gbo ona, Ese.

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Si ara mi, Adedolapo Oluwabukunola Akin-Adetoro, o ṣeun fun gbigbagbọ ninu ara rẹ.

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Publications Relevant to this Thesis

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Abstract

Problem statement: The existing landscape of research on the outcomes of information systems (IS) development and implementation suggests that this domain has been extensively researched. Results indicate that most IS implementations fail, yet uptake of these systems is still on the rise. In response to the alarming failure rates, researchers and practitioners have extensively researched the concept of IS success and failure by prescribing and promoting a cumulative list of critical success factors which they believe should improve the success rate. These efforts, however, have not yielded much improvement considering the vast amount of research in this domain. This inconsistency might be as a result of the representational (rational/objective and narrative/subject) approach, which characterises how IS success and failure are currently defined, framed and assessed in research. By adopting a performative view, this study challenges the dominant representational approach which downplays the information technology (IT) system in focus and views outcomes as static and fixed.

Purpose of the study: The main purpose of this study was to provide understanding on how the realities of IS success and failure are performed within an organisation. This was necessary given that the performative approach eliminates the idea of the metaphorical middleman (representations) in understanding reality. The performative perspective puts forward IS outcomes as relational consequences enacted by sociomaterial practices of an IS implementation actor-network.

Research Question: This research addresses the question: "How are the competing realities of ES implementation outcomes performed?".

Research methodology: This study adopted an explanatory purpose guided by the agential realism theoretical perspective. This study employed the actor-network theory as a theoretical lens because it allows researchers to examine the complex network of relationships and intra-actions that shape the performance of IS implementation outcomes. This study used the implementation of an enterprise system at Ìwádí University as a case study to elucidate the phenomenon. We employed semi-structured interviews, documents, system event log, observations, and field notes to gather data. The data was analysed using ANT analysis and event log analysis.

Key findings: The findings reveal a multi-step process where competing realities of success and failure emergently unfold across different actor-networks through distinct sociomaterial practices shaped by ontological politics. Implementation outcomes are not pre-given, but relationally co-constituted via entangled sociomaterial intra-actions between technologies, organizational actors,

discourses and situated practices within each network. Coordination mechanisms like meetings and reports perform agential cuts, selectively including/excluding issues to stabilize particular realities aligned with network interests.

Originality/contribution: This study challenges binary success/failure notions, providing a performative perspective on how these outcomes manifest as multiple, divergent, relationally-enacted realities across organizational actor-networks. Theoretical propositions offer insights into the sociomaterial complexities, ontological politics and constitutive relations underlying competing assessments. It integrates ANT and process mining analyses to capture sociomaterial entanglements and technology performativities. For practice, it highlights adopting inclusive, iterative approaches bridging strategic aims and localized end-user realities through participative translation during implementations.

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List of Acronyms

ANT	Actor-Network Theory
CFF	Critical Failure Factors
CHIS	Computerized Health Information System
CRM	Customer Relationship Management
CSF	Critical Success Factors
CV	Curriculum Vitae
DHET	Department of Higher Education and Training
EHR	Electronic Health Record
EIS	Executive Information System
ERP	Enterprise Resource Planning
ES	Enterprise Systems
HEI	Higher Education Institution
HR	Human Resource
IS	Information Systems
IT	Information Technology
KMS	knowledge Management System
OPP	Obligatory Passage Point
OS	Operating System
PIC	Project Implementation Committee
RIMS	Research Information Management System
SCM	Supply Chain Management
UAT	User Acceptance Testing

Glossary of Terms

Implementation	Implementation is the process of making an information system operational.
Information System	An information system is a constitutive entanglement of social and material components that work together to create and manage information.
Ìwádí University	The contextual settings where the phenomenon under study occurred. Ìwádí University is a pseudonym.
Óparí System	The legacy system used to manage publication count at Ìwádí University.
Performativity	Performativity is built on the notion of enactment- subject, objects, things, outcomes and boundaries that do not pre-exist; instead, they emerge and are enacted through intra-actions.
Pubcount	Publication count, commonly referred to as a pubcount, is an annual research support activity conducted in public higher education institutions (HEIs) in South Africa. It involves HEIs submitting research publications affiliated to their institutions to the Department of Higher Education and Training (DHET) for direct research subsidy as instructed in the DHET research output policy.
Representationalism	It is the make-believe that our knowledge (both objective and subjective) via language represents reality, the assumption that proxies or surrogates in the form of measures and perceptions represent IS implementation success and failure.
RIMS	The new system that replaced the Óparí System in managing the publication count at Ìwádí University.

1. Introduction

1.1 Introduction

We know why information systems fail, and we know how to prevent their failure - so why do they still fail (Cobb, 1996).

The enterprise system (ES) is one of the most important information systems (IS) to have emerged (Davenport, 2000) as it provides the platform to integrate people, process, information and technology across organisation functions. It offers organisational benefits such as improved quality and efficiency of organisational operations, standardized processes, reduced cost of operation, and real-time access to information amongst many others (Tarhini et al., 2015). Organisations channel enormous resources and investments towards enterprise systems implementation with the expectation of positive outcomes. Yet, negative, and negligible outcomes have been recorded as the output of such implementations. Failure rates of enterprise systems implementation have been reported as significant by several studies. Mahmud et al. (2017) indicate this rate to be above 51%. The Panorama (2021) report suggests that 60% of enterprise system implementations exceed their project budget, and 46% exceed implementation time, with 50% reported low satisfaction levels with the implemented enterprise system.

Avon, a make-up company, halted a one hundred and twenty-five million U.S. dollar SAP enterprise resource planning (ERP) implementation after four years of development and testing due to usability issues (Kepes, 2013). Marin County stopped and abandoned a thirty million U.S. dollar investment in SAP and related implementation services from Deloitte Consulting (Krigsman, 2010). Ramburn, Seymour, and Gopaul (2013) investigated a failed ERP implementation in a large engineering company in South Africa. Universities such as Indiana University and the University of Massachusetts-Amherst have also reported experiences of cost increases, revenue loss and delays in ERP implementations (Garg & Garg, 2013).

Doherty et al. (2012) examined IS outcomes over thirty years, and their results reiterate cases of failed IS implementations. They concluded that the rate of IS failures has comfortably remained consistently high. This outcome is of concern, given the plethora of studies that have investigated IS success and failure eliciting factors and critical factors which, if addressed, should provide significant improvement. Hence, we echo this inconsistency as pointed out by Cobb (1996). As IS

researchers, we claim to have some understanding concerning IS success and failure (Dwivedi et al., 2015); however, the high failure rate of IS implementations highlights our inability to understand and explain let alone prevent failure. As social scientists, we often tend to label phenomena quickly, assigning them a stabilised state without considering their dynamic nature (Latour, 2006). This tendency may explain why we are currently using outdated and static labels to describe the outcomes of IS implementations. These labels might not adequately capture the complex and ever-changing reality of modern IS implementations. As IS implementations and their context have grown increasingly complex over time, our traditional binary view of implementation outcomes, which typically categorizes outcomes as either "success" or "failure", has become outdated (Baghizadeh et al., 2020). This predicament probably indicates that our “existing assumptions and approaches to IS research have not served us too well” (Kautz & Cecez-Kecmanovic, 2013, p.2).

Kautz and Cecez-Kecmanovic (2013) presented and adopted a sociomaterial perspective towards investigating the implementation of a web-based insurance IS in Australia. Their results produced novel insights into how ontological politics simultaneously gave rise to contradictory and competing outcomes of success and failure in the same IS implementation. This result opposes extant and established knowledge of IS success and failure. Malaurent and Avison (2015) demonstrated how users' workarounds and system adaptations materially transformed an initially unsuccessful ERP implementation into a functioning system that met organizational requirements. Through these enacted practices, the system's performance evolved from inadequate to effective. Critical decisions and outcomes of IS implementations are neither value-free nor devoid of politics (Flyvbjerg, 2005).

This inconsistency regarding the outcomes of implementation is problematic and might to a certain degree be related to the prevailing way in which success and failure are determined, defined, framed, understood and explained in empirical studies (Cecez-Kecmanovic et al., 2014; Doherty et al., 2012). This concern is further reinforced by Hirschheim and Klein (2003), who questioned whether the IS discipline's theoretical understanding of IT system use and its effects actually aligns with practitioners' real-world experiences. This gap between theoretical understanding and practical reality suggests that our current approaches to defining and measuring IS success and failure may be inadequate. Markus and Tanis (2000) suggest that there is a compelling disparity between reality and what we refer to as IS success and failure. Hence, this warrants further probing.

1.2 Research Problem and Question

The extant landscape of research on the outcomes of IS development and implementation suggests that this domain has been extensively researched (Doherty et al., 2012). Research findings suggest a high IS implementation failure, yet the adoption of these systems continues to increase (Durmic, 2020; Statista, 2024; The Standish Group, 2020). In response to the alarming failure rates, researchers and practitioners have extensively researched the concept of IS success and failure prescribing and promoting a cumulative list of critical success factors (CSFs), such as top management commitment and support, change management, and project management, which they believe should improve the success rate (Bartis & Mitev, 2008; Ngai et al., 2008). This effort, however, has not yielded much improvement considering the vast amount of research in this domain (El Emam & Koru, 2008). This inconsistency might be as a result of the rational and narrative approach which characterises how IS success and failure are currently assessed, defined and framed in research (Mpazanje et al., 2013).

The dominant rational approach (scientific realism) has been criticised for being simplistic in its representation of success and, by implication, failure in IS implementation (Cecez-Kecmanovic et al., 2014). It presents IS success and failure as static, discrete, determinate, and time resistant, despite the uncertainty and unpredictability involved (Cecez-Kecmanovic et al., 2014; Fincham, 2002). For instance, an IS implementation would be perceived as successful by an organisation if it delivers benefits that outweigh the cost involved (Doherty et al., 2012). However, benefits take time to materialise, and this is usually not always factored in. The generalized set of CSFs promoted by the rational approach as a uniform solution lacks specificity and is therefore inadequate in framing the success and failure of IS which are characteristically different (Mir & Pinnington, 2014).

The narrative approach advocates for a subjective interpretation, utilizing narratives and social construction to frame IS success and failure (Bartis & Mitev, 2008; Walsham, 1999). Given the multifaceted nature of IS, this approach argues that the success and failure of an IS cannot be objectively determined as different social groups attribute different understanding and meaning to the concepts of IS success and failure (Bartis & Mitev, 2008; Wilson & Howcroft, 2002). This approach is concerned with the different perceptions and views of success and failure. It has been, however, criticised for overlooking and often downplaying the central object being assessed (the information technology system) while focusing on the role and agency of social actors (Cecez-Kecmanovic et al., 2014; Orlikowski & Iacono, 2001).

Both the rational and narrative approach have taken a proxy, and a representational view of the conceptualisation of an IS and IS implementation outcomes. With this view, certain key elements are used to represent the important aspects and characteristics of IS outcomes. It is assumed that surrogates related to measures and perceptions can be used to operationalise success and failure.

This representational view which characterises much of research in IS (Grover & Lyytinen, 2015; Palvia et al., 2015) means success is either represented by objective measures or by subjective perceptions of social actors. The issue with this representational view is its perspective on reality, specifically that: (1) IS success and failure are reified as given, fixed and time resistant, (2) IS assessment criteria pre-exists as an entity separate from the IS that is being assessed, (3) it encourages the importation of incomprehensive models as ready-made products that can be used out of the box to determine success or failure (Sadoughi et al., 2013), (4) IS success and failure are viewed as the product of the IS characteristics and their influence (Delone & Mclean, 1992, 2003), hence salient social and contextual forces such as power and resources involved in negotiating IS outcomes are neglected, (5) it creates a notion in which artefacts are only investigated as a matter of interest in certain specific organisational circumstances or technological events (Orlikowski, 2007) which "loses sight of how every organisational practice is always bound with materiality. Materiality is not an incidental or intermittent aspect of organisational life; it is integral to it" (Orlikowski, 2007, p.1436) and (6) the information technology (IT) system in focus is often black-boxed and downplayed. With the IT system being exogenous to theorising in IS research, there is a scarcity of innovative theorising, hence, an increase in the number of incommensurate mid-level models or frameworks that produce confounding results (Grover & Lyytinen, 2015).

We challenge the dominant representational view of IS assessment, which downplays the IS and considers outcomes as static and fixed. Instead, we adopt an alternative approach where the outcomes of an IS implementation are fundamentally indeterminate. These outcomes become temporally determinate by observing the related actors and their dynamic interactions within emerging actor networks. From these networks, properties, boundaries, and concepts emerge, making sense of the outcomes (Cecez-Kecmanovic et al., 2014). Reality is enacted; hence, it is not static and singular, instead, dynamic and plural. This outlook does not imply multiple views to one true reality; rather, multiple realities in which truth is no longer the only criterion for validating and disproving reality (Law, 2004). Thus, there is the possibility of multiple concurrent realities of success and failure as outcomes of an ES implementation. It is not clear how the realities of

implementation outcomes are performed post implementation. Realities in this context refer to the multiple, concurrent ways in which the outcomes of an ES implementation can be enacted in practice. By providing understanding (via theoretical propositions) on this phenomenon, this study contributes to the ongoing theorising of ES implementation outcomes. In addition, organisations can understand what actions/activities to adopt and avoid in relation to the performance of implementation outcomes.

Based on this background, this study, therefore, sets out to answer the below research question.

1) How are the competing realities of ES implementation outcomes performed?

1.3 Structure of thesis

Chapter 1 of this study introduces the research problem and research question. Chapter 2 offers a literature review on IS implementation outcomes. Chapter 3 justifies the use of Actor-Network Theory (ANT) as the theoretical lens for the study. Chapter 4 discusses the study's explanatory purpose, including the use of qualitative research methods, the agential realism theoretical perspective, and a case study design. It also discusses the data collection methods of face-to-face interviews, observations, documents, field notes, and system log. Chapter 5 focuses on the contextual setting of the study at a university called Ìwádí and the implementation of RIMS for the pubcount process. The name 'Ìwádí' is a pseudonym, while RIMS refers to the new research information system that was implemented to replace the legacy system (Óparí). Chapter 6 presents empirical findings from an ANT and event log analysis, revealing how competing realities of success and failure emerged through different networks' sociomaterial practices. Chapter 7 builds on this to explain the multi-step process through which these realities were relationally performed, challenging intrinsic outcome notions. Finally, Chapter 8 summarises and presents the contributions of the study.

2. Literature Review

2.1 Background on Information System Implementation Success and Failure

Existing literature on the outcomes of IS implementation indicates that this domain has received considerable attention from researchers. Despite the extensive research, results show high failure rates for IS implementations, even as the adoption of these systems continues to increase. This inconsistency might be due to the way IS success and failure are assessed, defined and framed in research; hence, the need for a comprehensive characterisation of research in this domain. As a first step in unpacking this contradiction, this study took a broad, overarching perspective on extant literature in this domain to understand the important trends, topics and biases within this field. Data collection details, including search queries, exclusion criteria, journals used, and the period covered, were provided in Appendix 5. By doing this, this study aimed to assist future researchers on IS success and failure in charting a new course as they decide what to investigate and avoid. Abstracts (379) related to IS implementation success and failure were analysed and 37 themes emerged. These themes are discussed below under five broad categories labelled: model/theory, user, information technology (IT) artefact, factors, and context.

2.1.1 Model/Theory

There is a widespread application of the original and updated version of the DeLone and McLean's model, also known as the IS success model, in evaluating the degree of an IS implementation outcome. The Delone and Mclean (2003) model proposes six interdependent dimensions of information system success: system quality, information quality, service quality, system use/intention to use, user satisfaction, and net benefits. It provides a comprehensive framework for conceptualizing and measuring IS success. This model was used to determine the success of systems such as a financial IS, an emergency response medical IS, an online learning system and an e-tailing system (Petter & Fruhling, 2011; Wang et al., 2018). Based on the nature of the study, researchers have introduced changes to how the DeLone and McLean model is applied. For instance, Wang (2008) adapted the DeLone and McLean model to study e-commerce system success by replacing net benefit with perceived value. Furthermore, several studies have combined the DeLone and McLean model with complementary theories, including attribution theory (Snead et al., 2015),

gratification theory (Zhang et al., 2016), and social exchange theory (Gharib et al., 2017), to understand IS success and failure.

2.1.2 User

The IS user was highlighted as an important actor that plays a key role in determining the success or failure of an IS implementation. This result is not surprising considering the widespread use of the DeLone and McLean IS success model, which espouses user satisfaction and intention to use as dimensions for measuring success. Studies that highlight the IS user focused on IS such as e-learning system and the knowledge management system as they investigated IS implementation outcomes (Leung et al., 2012; Lwoga, 2014). Furthermore, they used factors such as quality, satisfaction, use, service and intention as representations used to measure or capture IS implementation outcomes. These studies examined specific types of users within their particular operational environments, including students in educational settings, customers in commercial services, and nurses in healthcare facilities. In the case of the student, the relationship between IS implementation success and concepts such as use, quality and satisfaction were examined. An example of a study that applied this approach is Wang et al. (2016), which investigated the implementation of a blog-based learning system in the context of business education. For the nurses, the focus was more on evaluating factors such as quality, use, acceptance, and benefit (Cohen & Kangethe, 2015). Lastly, the user termed as "customer" was investigated in relation to quality and service in the context of mobile and banking systems (Chung & Kwon, 2009).

2.1.3 Factors

The following themes are identified as factors that influence an IS implementation outcome. They include the intention to use, service quality, trust, perceived usefulness, user satisfaction, use, participation, and involvement. Holistically, these factors are argued to be socially inclined due to the common relationship with the user. The IS discipline is referred to as being predominantly social (Sarker et al., 2019); hence the skewness towards the social end of the social-technical continuum is a reflection of the broader disciplinary trend. In Table 1, we present the relationship between factors that influence IS implementation outcomes and their related IT artefacts.

Table 1: Factors Influencing IS implementation outcome and their Associated IT Artefacts

Factor	Description	Related Factors	Related IT Artefacts	Reference
Intention to use	The degree to which a user intends to use a system	quality, use, satisfaction	electronic health record (EHR), computerised health information system (CHIS)	(Mardiana et al., 2015; Yakubu & Dasuki, 2018)
Service quality	The quality of service provided by an information system	satisfaction, use, intention	ERP, library system, mobile system	(Beynon-Davies & Lloyd-Williams, 1999; Daghouri et al., 2018)
Trust	The degree of trust in an information system	service quality, intention and satisfaction	mobile system, e-commerce system	(Gao et al., 2015; Petter et al., 2013)
Perceived usefulness	The degree to which a user believes a system will enhance their performance	quality, use, satisfaction	e-learning system, customer relationship management (CRM)	(Strudwick & McGillis Hall, 2015; Gan & Balakrishnan, 2018)
User Satisfaction	The level of satisfaction with an information system	quality, use, intention	knowledge management system (KMS), e-learning, Web system	(Schaupp, 2010; Laumer et al., 2017)
Use	The extent to which an information system is used	quality, intention, satisfaction	e-learning system, CHIS	(Wu & Wang, 2006; Noh & Lee, 2016)
Participation and involvement	The degree of user participation and involvement in system development	community, development, continuance	e-learning system, executive information system (EIS)	(McGill & Klobas, 2008; Saleem et al., 2017)

Overall, quality stands out as an essential factor that influences IS outcomes. The result from Hsiu-Fen (2007) showed that service quality, system quality and information quality have a significant effect on the use of an online learning system. While system use is an important indicator in online

learning systems, it should be noted that usage alone does not necessarily equate to successful implementation. Successful IS implementation encompasses broader outcomes. Trust, user participation and involvement are the only factors not directly related to the DeLone and McLean's IS success model.

2.1.4 IT Artefact

The following systems are identified as the IT artefacts being evaluated in the literature on IS implementation success and failure. They include learning system, HER system, e-commerce system, ERP system, library system, e-government system, mobile system, CHIS, web-based information system, cloud-based information system, CRM system, KMS and EIS (Amoush et al., 2018). These systems cut across several domains and, to a certain extent, they depict the diversity and evolution of research focused on evaluating IS. Having the mobile system, web and cloud-based IS as IT artefacts in focus is a good indicator that research in this area is in sync with the evolution of technology. However, more can still be done to ensure that technologies such as machine learning and artificial intelligence (AI) based IS are also evaluated. The introduction of these new technologies is changing the interaction and organisation between the social and the material and, as such, it is challenging the existing models and theories used to evaluate IS. A study conducted in the United States by Donovan, Guzman, Adya, and Wenli (2018) updated the DeLone and McLean's IS success model for cloud-based IS. In addition, the IT artefacts themed literature presented some relationships between IT artefacts and countries. For instance, Taiwan and the library system, China and KMS, South Africa and CHIS, Germany and Turkey and e-government systems, and Nigeria and health-related IS. Perhaps these IT artefacts reflect the predominate development areas in these countries (Mudzana & Maharaj, 2017; Ojo & Popoola, 2015).

2.1.5 Context

Themes such as hospital, government, banking, project, organisational environment, educational institution, and culture provide a picture of the prevalent settings and contexts in which research on IS implementation success and failure is being carried out. These themes are neither innocent nor dormant; instead, they are actively involved in influencing outcomes. For example, Moen et al. (2011) studied the relationship between the hospital-specific organisational factors and user assessment of CHIS success. Also, Hafid and John (2007) and Bradley et al. (2006) found the national culture and corporate culture, respectively, are factors that influence IS success and failure.

In Table 2, we present the relationship between context and the related IT artefacts identified in literature.

Table 2:IT artefacts related to the context

Context	Related IT Artefact	Reference
Hospital	CHIS, EHR	(Tubaishat, 2017)
Government	e-procurement system, Facebook	(Sebetci & Aksu, 2014)
Banking	mobile systems	(Chung & Kwon, 2009)
Project	ERP	(Jung, 2019)
Organisational environment	CRM, ERP	(Hossain et al., 2012)
Culture	ERP	(Agourram, 2009)
Educational institution	e-learning systems	(Klobas & McGill, 2010)

In summary, we discovered that the DeLone and McLean's IS success model is widely used in assessing IS success and failure. Users such as nurses, customers and students are important agents of assessment. Quality stands out as an important influencing factor and the IT artefacts being evaluated cut across several domains, thus underscoring the diversity of research in this domain. In addition, context is actively involved in shaping the assessment of an IS implementation. Overall, there is a strong emphasis on identifying and studying factors that influence information systems success and failure outcomes across the research in this domain. These results confirm that a socially skewed objective/rational perspective characterises how IS success and failure are assessed, defined, and framed in research. An overemphasis on factor research centered on stable social factors may oversimplify the complex, dynamic and sociomaterial nature of IS implementation success and failure.

2.2 What is an Information System?

Several views have been taken and claims made concerning the definition of IS in literature. Given the plethora of definitions, the lack of consensus and the interchangeable, fuzzy and unclear conceptualisation of IS in the IS discipline, the notion of what an IS is, remains unestablished (Boell & Cecez-Kecmanovic, 2015). This is problematic as it hinders the cumulative tradition of research. This ambiguity is particularly problematic when studying IS implementation outcomes, as how we conceptualize an IS shapes how we assess its success or failure.

In addressing this problem, Alter (2008) attempted to provide a fit for purpose definition (process view) of IS. He defined IS as a work-system in which information, technology, and other resources are used to perform processes and activities that produce informational products and services for internal and external clients. Next, Boell and Cecez-Kecmanovic (2015) took a holistic approach in categorising the various views of IS in literature into four different definitions, namely, the technological view, the social view, the socio-technical view and the process view.

The technological view underlines the importance of IT (hardware, software, and networks) and its application in processing, storing and distributing data and information in the organisational context (Symons, 1991). It perceives technology to be independent, certain, static and stable across space and time (Orlikowski, 2007). Studies that adopt this view concentrate majorly on the theorising about technology, its uses and its effects on organisations. Despite the increasing significance of IT in organisations, this view undermines the role and importance of social conditions in the development and implementation of IT.

In addressing the shortcomings of the technological view, the social view emphasises the social make-up of IS and how IT is just another system amongst other systems embedded in a broader social system. In this context, humans and social systems are privileged over IT. The social view provides insights into how identical IT, implemented in a different context, can potentially have different outcomes due to social influences. This claim perhaps is valid since IT is not static (Leonardi, 2012). The social view has been critiqued in literature for vanishing IT from sight; hence its failure in being unable to view, grasp and explore the opportunities and agency IT provides (Boell & Cecez-Kecmanovic, 2015).

In addressing and overcoming the weaknesses of technological and social views, the socio-technical view was established. This view defines IS from both the social and technical perspective and how they frequently interact. In this context, IS is neither socially or technically determined; instead, it is a phenomenon that emerges from the social and technical interaction. The social and technical are supposed to be advantaged; however, the application of the socio-technical view in research has been criticised for disadvantaging the technical (Orlikowski, 2007), and in practice it has been critiqued for failing to overcome the shortcomings of both social and technological determinism (Mumford, 2006). The social-technical view suggests the separation of the social and the technical. Nonetheless, this stance needs critical unpacking. The dualist ontological view of IS is made up of separate entities (the social/human and the material/technological) which have characterised the way

in which IS and IS-related phenomena are defined in the literature. This need for clear-cut boundaries, separation, and demarcation between the social and technical taken as destiny is rarely questioned and reflected upon in the IS discipline (Boell & Cecez-Kecmanovic, 2015).

The social/human and material/technological split is argued from the perspective of organising and its progression through history (Orlikowski, 2007). The concept of organising, however, is not static; systems are continually interacting, and the relationship between the social/human and material/technological is continuously being transformed. This change has been overlooked, taken for granted or investigated in exceptional cases. As long as this endures, our understanding of organisational life and its outcomes will certainly remain limited (Orlikowski, 2007). With the introduction of the internet and the digitisation of products, the modern form of organising is one that is increasingly constituted by "multiple, emergent, shifting, and interdependent technologies" (Orlikowski, 2007, p.1) entangled with human existence and experience which earlier views have been unable to conceptualise (Boell & Cecez-Kecmanovic, 2015). In overcoming these conceptual impediments in defining IS, the sociomaterial view was proposed. The sociomaterial view focuses and engages with the everyday materiality of organisational life where the social/human and the material/technology are constitutively entangled (Orlikowski, 2007). That is to say; the social does not exist without the material and vice versa. In defining IS, this study adopts the sociomaterial view.

2.3 Sociomateriality

In recent years, under the theme "sociomateriality", several scholars from the IS and related disciplines have made notable contributions towards understanding the intricate relationship between social and material elements in information systems. Of note is Orlikowski (2008) whose work on sociomateriality is based on the theoretical foundation of agential realism. Sociomateriality is not an ornamental academic word for technology. It rejects the ontology of separateness which assumes that people and things, social and material, exist as independent, self-contained entities that interact and affect each other. The view of separation loses sight of how the social and material are inseparably fused, hence leading to results that are already configured.

Sociomateriality follows a relational ontology which assumes that the social and the material are intrinsically inseparable (Cecez-Kecmanovic et al., 2014; Orlikowski & Scott, 2008a). As Slife (2004, p.159) puts it, the relational ontology is not made up of relationships that are just "the interactions of what was originally non-relational; relationships are relational all the way down.

Things are not first self-contained entities and then interactive. Each thing, including each person, is first and always a nexus of relations". That is, materials that seem to be fixed, self-contained, and non-relational actually originated from and exist in a state of relation. This relational underpinning of sociomateriality has many implications for extant IS phenomena.

As proposed by Orlikowski and Scott (2008a), sociomateriality can be considered to have five main notions. These include: (i) an interest to (re)enact materiality as fundamental to the sense-making of present-day organisations; (ii) an ontological claim about the intrinsic inextricable entanglement of the social and the material; (iii) the dismissal of the essentialist notion that entities have inbuilt properties, rather regarding these as relational; (iv) a view of the ongoing relations and boundaries between the social and material as being performed rather than prearranged; and, finally, (v) an intentional effort to focus on practices in lieu of discourses or perception (Jones, 2014). In the same order, we can simply refer to these ideas as materiality, entanglement, relationality, performativity and practices.

Materiality is brought back to focus because it is typically taken for granted. Tangibility is not a characteristic of materiality. Intangible concepts such as language and software which are generally labelled as exemplars of immateriality cannot materialise without material enactments; whether thought about, brought into being or expressed in text or machine (Scott & Orlikowski, 2014). Materiality, meaning, and practice are interconnected and simultaneously shaped through our daily interactions and actions, influencing and informing one another in a dynamic and ongoing process (Scott & Orlikowski, 2014). Meaning as commonly conceived is not married to a word or a group of words but rather a continuing performance of the world in its differential intelligibility (Barad, 2007).

Entanglement, in the context of sociomateriality, is not merely a metaphorical concept or the simple combination of distinct elements. Instead, it represents a fundamental ontological state where elements are inherently inseparable and mutually constitutive (Barad, 2003, 2007). Reality entails the entanglement or ontological inseparability of existing categories (i.e. matter and meaning) enacted in practice within a phenomenon (Scott & Orlikowski, 2014). The notion of entanglement dismisses pre-existing dualism, for example, subject and object, social and material, success and failure, regarding these as outcomes produced in practice.

Relationality advances the idea of entanglement. It refers to the term "intra-action" which is different from the typical "interaction" that assumes pre-existing entities are coming together in a relationship (Barad, 2003, 2007). Intra-action signifies the ensuing entanglements of matter and meaning that

enacts the world's differential becoming (via distinctions and boundaries) in practice (Scott & Orlikowski, 2014). There is a strong temporality to these enactments, which is based on the ongoing materialisation in practice. Relationality is non-linear as it fades away the concept of clockwise linear time. The notion of practice and becoming centres attention on matters of everyday doings that enact reality.

Practices are material-discursive; primary meaning-making units, not words (Barad, 2007). Material-discursive practices are specific inclusions and exclusions of agential implementation intra-actions through which specific distinctions, differences, boundaries and properties of a phenomenon become determinate and meaningful (Barad, 2003; Scott & Orlikowski, 2014). Material-discursive practices are practices of determination which in reality enact analytical stops termed agential cuts (Barad, 2007). These cuts differ from the Cartesian cuts which inherently differentiate between subject and object in an ontological sense. Agential cuts are local determinations or separations within the implementation phenomenon of characteristically inbuilt indeterminate ontology (Barad, 2007). Taking pre-existing categories as realism is not only an effect of the Cartesian cut but also the faith that grammatical categories (i.e. subject and predicate structure) mirror the underlying (ontological) structure of the world (Barad, 2007).

In giving up this determinate reality, a performative turn is introduced as a way of contesting the comfortable unquestioned routine of the mind that accords language and other types of representation more power than necessary in determining our ontology (Barad, 2003). Even though performativity in IS is being advocated by Cecez-Kecmanovic et al. (2014) and Kautz & Cecez-Kecmanovic (2013), it takes root in earlier writings focused on surmounting the dualism of rational and narrative approaches in evaluating IS (Introna & Whittaker, 2003) as well as in studies on sociomateriality as a contemporary form of organising in an organisation (Orlikowski, 2007).

Performativity challenges traditional representational approaches that view success and failure as pre-existing categories mediated through various interpretations. Instead, it proposes that success and failure emerge directly through material practices and actions in IS implementations. Rather than relying on intermediate representations to understand implementation outcomes, performativity suggests that these outcomes are directly enacted through the ongoing sociomaterial practices of the implementation process. Performativity is built on the notion of enactment, subjects, objects, things and boundaries that do not pre-exist; instead, they emerge and are enacted through intra-actions (Barad, 2007). It is a sociomaterial characteristic that centres on IS enactment in practice - that is, the

iterative intra-activity of both discourses and materiality (Kautz & Cecez-Kecmanovic, 2013). The performative perspective puts forward IS outcomes as relational consequences enacted by sociomaterial practices of an IS implementation actor-network (Cecez-Kecmanovic et al., 2014). As depicted in Figure 1, IS implementation outcomes are temporarily determined by observing and understanding the actions and events produced by the interactions of actors (such as technologies, analysts, developers, managers, documents, methodologies, and so on). However, the Figure 1 diagram by Jrad and Sundaram (2015) can be improved by the addition of feedback loops, which are currently missing from their diagram on the performative approach. Feedback loops would better represent the dynamic and iterative nature of the IS implementation process, allowing for continuous improvement and adjustment based on observed outcomes and interactions. Without feedback loops, the diagram fails to capture the recursive and adaptive aspects of IS implementation in practice, as emphasized by the performative approach.

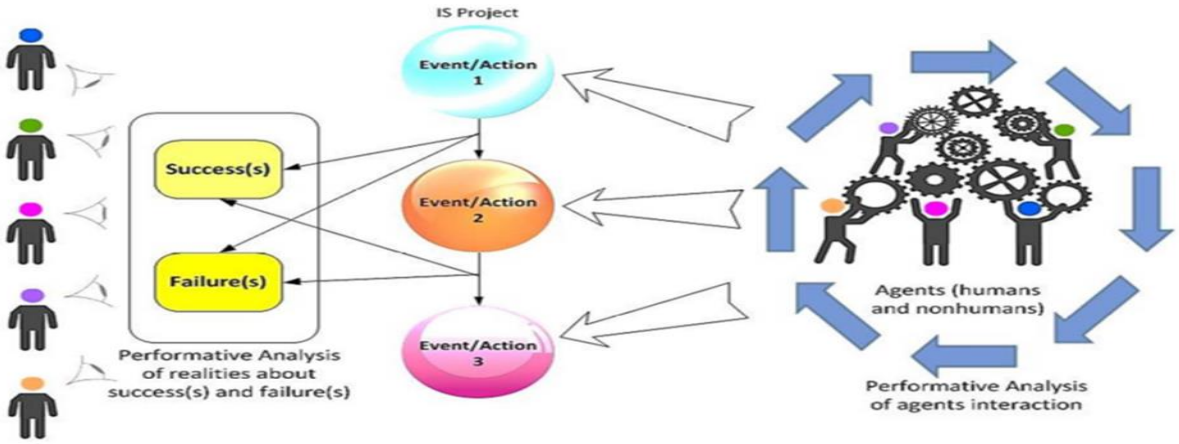


Figure 1:Performative approach (Jrad & Sundaram, 2015)

A common criticism of sociomateriality is its lack of a clear definition for the material (Jones, 2014). For sociomateriality, it is this discrete entity-like framing that is rejected. As Orlikowski (2007) puts it, the social and the material are like two sides of the same coin; there is no social without a material turn, and there is no material without a social turn. The difference between the social and the material is analytical; such distinction should be made by acknowledging that these entities are one in practice. A prior distinction between the social and material can be likened to an account on "the dynamics of a battle by imagining, first, a group of soldiers and officers stark naked; second, a heap of paraphernalia—tanks, paperwork, uniforms—and then claim that of course there exists some dialectical relation between the two" (Latour, 2004, p.277).

Despite the suggested tenets of sociomateriality available in the literature, there are still growing concerns about how to study the relationships in focus practically. Constantinides and Barrett (2012) emphasise that “there is still the problem of how to study the constitutive entanglement of the social and the material; where does one start, methodologically and analytically, to trace the entanglement”. In agreement Contractor, Monge and Leonardi (2011) affirm that the sociomaterial approach “does not provide much guidance in specifying how researchers might depict sociomaterial relations empirically”. While researchers have made efforts to develop and refine methods for studying sociomaterial relationships, Hultin (2019) found that existing methodological approaches remain inadequate.It is somewhat evident that the sociomaterial approach is lacking in these areas; however, it is to be expected, given that this approach is still emerging.

In providing clarity, Parmiggiani and Mikalsen (2013) suggest addressing the what, how, and where/when of sociomateriality. The “what” involves defining sociomateriality as well as providing background on its theoretical underpinning. This study defines sociomateriality according to Orlikowski (2007) and its tenets which are based on agential realism by Barad (2007). Parmiggiani and Mikalsen (2013) argue that a key aspect of the "what" is the mutual constitution and entanglement of the social and the material. The “how” involves the means through which sociomaterial entanglement are figured to perform in practice. In this thesis, this includes employing agential cuts which are temporary analytical boundaries that allow us to trace sociomaterial phenomena through ANT while maintaining their underlying entanglement. Parmiggiani and Mikalsen (2013) suggest that a key feature of the "how" is the performativity of sociomaterial assemblages, emerging in situated settings through configurations of human and nonhuman actors. Finally, the where and when, which relate to the place and time of the sociomaterial performance. Parmiggiani and Mikalsen (2013) highlight the multidimensionality of sociomateriality, noting that sociomaterial assemblages are distributed across time and space.

Empirically, sociomateriality has been applied to various research settings such as IT compliance (Liang et al., 2013), social media and human resource management (Hauptmann & Steger, 2012), ERP systems (Wagner et al., 2011), IS assessments (Cecez-Kecmanovic et al., 2014) and project survival in an ES environment (Wagner et al., 2010). Building on this empirical tradition, particularly the work of Cecez-Kecmanovic et al. (2014) on IS assessments, this thesis employs a sociomaterial perspective to investigate how the competing realities of success and failure are performed in an IS implementation.

The sociomaterial perspective is considered appropriate for investigating how outcomes of ES implementation are produced. This is because it acknowledges that the social and the material are mutually and emergently responsible for the production of each other as people become constitutively entangled with technology in fulfilling their daily practices. By adopting this perspective, rather than viewing IS outcomes through predefined metrics or social interpretations, ES success and failure are situated actions which emerge as a result of the context and the materiality that are themselves configured and re-configured as part of the phenomenon (Hassan & Hovorka, 2011; Suchman, 2007).

2.4 Materiality and the Information Technology

The concept of materiality, often underemphasized in organisational research, has been a subject of debate in organisational studies (Iedema, 2007). These studies argue for an increased focus on materiality as: (i) an essential counteractive action against its deficiency in the dominant constructivist and poststructuralist approaches, (ii) an opportunity to surpass the privileging and favouring of either the social or the material (Weissenfels et al., 2016).

Materiality refers to the physical, digital, and infrastructural elements that are constitutively entangled with social aspects in everyday organizational life (Orlikowski, 2007). It encompasses both visible forms (such as bodies, clothes, rooms, desks, computers, documents) and invisible infrastructures (like networks, electricity, software, algorithms), which exist not as independent pre-formed substances but as performed relations that emerge through ongoing practices. Rather than being separate from social aspects, materiality is integral to and inextricably linked with organizing, shaping organizational possibilities and constraints through its dynamic, contingent, and performative nature.

When you take into account any organisational activity, and you reflect upon the role of materiality, it evidently becomes visible how every aspect of organising involves materiality (Orlikowski, 2005). The concept of materiality aims to balance the social and material in theorising (Cuellar, 2016). In understanding materiality, we must discard the idea of a pre-existing material having predefined relations when describing the intra-action of the social and material since these occur in practice (Latour, 2005).

Orlikowski and Scott (2008a) put side by side IT in organisational work and IT in research, and their results reveal a paradox. The noticeable presence of the IT is evident in every organisation, from start-ups to large manufacturing plants. These include IT ranging from simple mobile phones to complex enterprise systems. Organisations invest heavily in IT as it is vital to their business operations.

However, the review of academic literature on organisational research disagrees. Less than 5% of articles published in leading management journals take into account the presence of IT in organisational life (Orlikowski & Scott, 2008a). This oversight by research discourse may be as a result of the increasing complexity of organising, or the lack of interest in technological subjects, or the perceived static view of IT or the lack of training and skills needed to track and analyse technological issues (Orlikowski & Scott, 2008a).

The discipline of IS is grounded on the "centrality of information-technology in everyday socio-economic life" (Orlikowski & Iacono, 2001, p.121). Yet, several studies have highlighted how the IT continues to receive little or no attention by researchers (Fromm et al., 2017; Jones, 2014). This trend was analysed by Orlikowski and Iacono (2001, p.121) and their results indicated that the IT "itself tends to disappear from view, be taken for granted or presumed to be unproblematic once it is built and installed". Hence, they called for a deeper engagement with the IT in IS research. Since then, several studies have reassessed the situation and engaged the IS community on the status of IT engagement in the discipline (Akhlaghpour et al., 2009; Ayanso et al., 2007; Benbasat & Zmud, 2003; Matook & Brown, 2017). Their results reiterate concerns raised by Orlikowski and Iacono (2001) over a decade ago. Their findings show the lack of interaction between, and theorising of "the material artefacts, bodies, arrangements, and infrastructures through which practices are performed". The situation of things was well captured by Barad (2003 p. 301) who stated that "language matters. Discourse matters. Culture matters. But there is an important sense in which the only thing that does not seem to matter anymore is matter."

2.5 Enterprise Systems as the IT

IT artefacts are interwoven material and cultural elements that exist in some socially identifiable form, such as hardware or software (Orlikowski & Iacono, 2001). Enterprise systems are a unique form of information technology artefact in that they intend to "standardize applications and business processes across an entire organisation" (Berente, Gal, & Yoo, 2010, p.21) through a unified, centralized data infrastructure that integrates information across all organizational functions. They are implemented to systematically retrieve, process and integrate data from various units in an organisation to provide the organisation and its employees with a holistic view of the business information (Sasidharan et al., 2012).

The presence of the social/material dichotomy and its intra-action are evident in empirical accounts of enterprise systems. From a material perspective, enterprise systems are often viewed as having a dominant technological effect on outcomes, imprinting a standardised approach which an organisation must follow. This stance was emphasised in an ES implementation study by Malaurent and Avison (2015), where an ERP was described as a rigid system whose imposed features did not fit the Chinese context. From a social perspective, other studies have also elicited accounts of social imperatives on outcomes. For example, Liang et al. (2007) investigated how top management influenced the use of ES in organisations. From a sociomaterial perspective, enterprise systems provide the opportunity to study the sociomaterial intermingling, which produces results. For example, Wagner, Moll, and Newell (2011) examined how non-linear changes in accounting practices were mostly dependent on particular entanglement of an ERP and its users rather than either ERP characteristics or human actions.

The landscape of studies on the implementation of Enterprise Systems in IS has majorly examined systems labelled as enterprise resource planning (ERP) systems. An ERP system is a packaged application software built with a set of assumed best practices, rather than to the specifics of the organisational processes and context (Wagner et al., 2010). These systems incorporate best practices from profit-oriented businesses; hence, Heiskanen, Newman, and Similä (2000) have questioned the suitability of ERPs in higher education institutions (HEIs), given that the majority of HEIs are not driven by profit. Other IS, such as customer relationship management (CRM), supply chain management (SCM) and Current Research Information System (CRIS) - a specialized enterprise system designed to store, manage, and disseminate research-related information and metadata within research organizations - are also categorised as enterprise systems (Roztocki & Strzelczyk, 2020; Yu Chung Wang et al., 2022) .

The ES implementation consists of three major phases: the pre-implementation phase, the implementation phase, and the post-implementation phase (Razi & Hossain, 2012). The pre-implementation phase, typically lasting 4-6 months, is characterised by planning and decision-making activities. During this phase, organizations usually require support from external consultants and internal stakeholders from various departments to define system goals, system scope, document the request for proposal, conduct system selection, vendor selection, and make implementation approach decisions (Razi & Hossain, 2012). The implementation phase, which can span 12-36 months depending on organizational size and complexity, involves the actual deployment of an ES. This phase

demands intensive support from vendor teams, system integrators, and dedicated internal project teams for activities such as staff recruitment, software installation, system configuration, system integration, testing and training (Razi & Hossain, 2012).

Several critical activities span across multiple phases of ES implementation. Change management, for instance, begins in the pre-implementation phase with stakeholder analysis and communication planning, continues through implementation with user engagement and training, and extends into post-implementation with user support and adoption monitoring. Similarly, project management activities, including risk management, resource allocation, and progress monitoring, are conducted throughout all phases. Lastly, there is the post-implementation phase, which continues indefinitely as a part of ongoing operations, where the actual outcomes of ES are assessed (Razi & Hossain, 2012). This phase requires sustained support from internal IT teams, periodic vendor maintenance, and engagement from end-users for activities including benefits realisation and post-implementation audits. This study is focused on the post-implementation phase as ES outcomes are predominantly enacted at this stage.

2.6 Prior Research on Enterprise Systems Implementation

In organising prior research on enterprise systems implementation, we adopt Mohr's (1982) distinction between variance and process research. Variance research seeks to explain the difference, divergence or inconsistency in outcomes by associating outcomes with antecedent or predicting input variables, constructs or factors (Robey et al., 2002). This is in contrast with process research which is concerned with how outcomes come about through a sequence of events (Williams et al., 2013).

2.6.1 Variance Research on Enterprise Systems Implementation

The variance approach to an inquiry has been adopted by most research on enterprise systems (Robey et al., 2002). This choice can be attributed to the reality of most theories in organisational and IS research being variance theories (Crowston, 2000). Two streams of study have been identified under the variance approach: research on critical success/failure factors which focuses on the inputs that explain success and failure as outcomes of ES implementation, and research on enterprise systems effect which focuses on the actual outcomes of enterprise systems implementation (Robey et al., 2002).

CSFs are generally categorised based on four significant dimensions. They include strategy, tactics, culture, and technology (Shaul & Tauber, 2013). In analysing CSFs that have emerged in literature, several results indicate that more attention has been given to social-related CSFs when compared to

technology-related CSFs. A review of 524 articles on ERP implementation from 1998-2007 by Huang (2010) indicates that researchers are keener on human factors because successful implementations depend more on social and business issues. This finding is corroborated by Tarhini, Ammar, Tarhini, and Masa'deh (2015) who presented a list of 51 ERP CSFs from literature. These factors listed in the order of importance had one technical factor (labelled "suitable IT legacy systems" - number 23) in the top 25 factors and eight technical factors in the entire list. Ram and Corkindale (2014) reported the presence of 236 CSF-related papers on ERP over a period of ten years. While research on CSFs has been extensive, there is a need to consider the practical implications of this research and how it can inform the development of process models that can improve the success of ES implementation.

Studies on ES effects focus on investigating, explaining and representing the influence certain factors have on the outcomes of ES implementation. For example, Amoako-Gyampah & Salam (2004) provided empirical and theoretical support showing that user training and project communication positively influence the shared beliefs users create towards the benefits of ERP. Huigang, Nilesh, Qing, and Yajiong (2007) demonstrated that top management plays a crucial intermediary role between institutional pressures and how well enterprise systems are integrated into organizations. Research has reported the presence of positive and negative effects as outcomes of ES implementation in organisations. These effects materialise over time hence while certain organisations experience improvement in customers' responsiveness immediately, with others it might take some time (Robey et al., 2002). A study conducted by Yan Huang, Huang, Wu, and Lin, (2009) on 25 organisations that implemented ERP packages between 1994-2006 showed that business process, process efficiency, and profitability improvement tend to occur in the fourth or fifth year. Similar to studies on CSF, the influence of social/human factors on ES implementation outcomes are more prevalent.

2.6.2 Process Research on Enterprise Systems Implementation

Unlike the variance research which speculates, the process research seeks to explain how change develops over time. The process approach is a valuable perspective on ES implementation, as it can provide a more nuanced understanding of the complex and dynamic nature of organisational change. This approach is particularly relevant in the context of ES implementation, where organisations are constantly evolving and adapting to new technologies and business requirements. In adopting the process approach on ES, implementation is conceptualised as a sequence of stages using stage models. These models which focus on processes aimed at explaining ERP implementation outcomes have been criticised for providing more description than explanation (Williams et al., 2013). They

also assume that ES go through the same predefined sequence of life cycle stages, which is problematic (Robey et al., 2002).

In response to the hegemony of the variance approach, Williams, Williams, and Morgan (2013) adopt a process approach to identifying dimensions critical for a successful IT-enabled change process. The identified dimensions, some of which include prerequisites and evaluation methods, business process change, vendor expertise/IT governance, business and user conflict resolution, are all social related.

2.7 ES Implementation Outcomes

ES implementation outcomes are categorised under the broad category of success and failure. Defining the success and failure of an ES has stirred mixed reactions in literature. Success can be defined in terms of both accomplishing technical requirements and achieving set goals or objectives, as these two aspects are interconnected and important. It is also dependent on who is defining success and at what point it is assessed and defined. The success of an ES implementation is a multifaceted and dynamic concept that is often evaluated relative to time and the organisational goals for the system (Markus & Tanis, 2000). Prominent studies in the IS discipline have taken a sociotechnical perspective in defining IS (Delone & Mclean, 1992, 2003) and ES success (Sedera & Gable, 2004). They define success based on the quality of the system producing information, the ability of the produced information to convey the intended meaning and the effect or impact of the information on the receiver. Failure is defined as a reverse of what success is envisioned to be.

The literature on success and failure is broadly divided into two dominant perspectives, namely objective/rational and subjective/narrative. This categorisation of IS research along the ontological divide of objectivism and subjectivism has had a cascading influence on the object/subject dualism which characterises the way success and failure are conceptualised and assessed in the IS discipline (Cecez-Kecmanovic et al., 2014; Introna & Whittaker, 2003; Jrad & Sundaram, 2015). As Introna and Whittaker (2003) put it, " trying to simplify it (success and failure) through recourse to dualisms is to postpone perpetually our duty to face the seemingly contradictory simultaneity of reason, method, politics, and situated understanding as the very best possibilities".

The objective/rational perspective assumes an ontological stance that ES implementation success or failure exists in a fixed, defined and discrete state. The epistemology is that ES implementation outcomes exist out there, and they can be determined using precise and objective measures. Such objective techniques involve evaluating the performance and reliability of IT using basic factors and

methods such as cost-benefit analysis or information economics (Introna & Whittaker, 2003). This objective/rational perspective is widespread, given the positivist nature of research in the IS discipline. This representational approach has led researchers to survey various ES implementations in a bid to identify similar factors that have determined their success or failure. Factors such as information quality, system quality, individual impact and organisational impact have been used widely to measure the outcomes of ES implementation (Sedera & Gable, 2004). Studies with this rational view have been criticised for considering ES as static, passive and neutral objects whose properties, values and performances are objectively represented and measured during an assessment process. Hence, "the messiness, indeterminacy, and arbitrariness of the assessment processes and their performative effects are disregarded or hidden" (Cecez-Kecmanovic et al., 2014, p.565). This perspective tends to treat ES as a black box, focusing on measuring inputs and outputs rather than examining how the system itself dynamically interacts with and shapes organizational processes, user behaviors, and implementation outcomes.

In adopting the subjective/narrative perspective, the ontology does not assume that ES implementation success or failure exists out there as an independent defined entity; instead, it emerges and becomes perceived as such as a result of perceptions and ensuing actions of social actors who are concerned with its existence (Bartis & Mitev, 2008). The epistemological perception is that this socially constructed reality can only be interpreted through languages, practices, and meanings assigned by social actors (Orlikowski & Baroudi, 1991). That is, ES implementation success and failure do not exist as definite states; rather, they emerge and are socially and politically created (Bartis & Mitev, 2008). The ES implementation as the object of assessment is represented by subjective perceptions, sense-making, interpretation, social constructions, narratives and meanings ascribed to it by various individuals, social groups and stakeholders (Fincham, 2002). This approach downplays the role and performance of the material/IT by shifting the focus to the social/actors.

In charting a course which transcends beyond the philosophical debates regarding the relationship between the mind and reality comes the relegation of objectivism and subjectivism to the background and the introduction of the philosophical concepts of representationalism and anti-representationalism to the foreground (Tsoukas, 1998). These concepts are related to contemporary philosophical debates concerning language and reality. Both the objective/rational and subjective/narrative perspectives on ES implementation success and failure adopt representationalism. That is the make-believe that our knowledge (both objective and subjective) via

language represents reality, the assumption that proxies or surrogates in the form of measures and perceptions represent ES implementation success and failure. Where both perspectives differ is whether reality is represented as is or reality is represented based on perceptions. This mirroring of reality (i.e. science mirrors nature or science mirrors culture) in actuality produces a version of the so-called "reality" in focus (Leonardi, 2013) because reality is neither passive nor is it a blank slate for social imprinting. Reality is dynamic, and it kicks back (Barad, 1996). Tsoukas (1998) refers to representationalism as a tool of manipulation which shapes reality by providing validation to implement bureaucratic rules that sway the behaviours of the actors. Our descriptions, concepts, models, frameworks and theories are to a larger degree tools that facilitate "doing" and "actions" in social systems rather than being mirrors that reflect the way social systems are (Tsoukas, 1998). The challenge with this approach is that there is always a gap between our representations and the reality they aim to describe (Barad, 2003). This gap can lead to inaccuracies and misinterpretations, highlighting the need for a more nuanced understanding of the complex relationship between our representations and the reality they seek to reflect.

Reality is not made up of dualism, demarcation or dichotomies as a Cartesian-like cut which dominates the foundation of all knowledge (Barad, 1996). The representational view of knowledge is fuelled by the ideology of realism (the belief that there is an external social reality independent of actors) and social constructivism (the idea that an actor's perception of reality is all that there is). Both realism and social constructivism, to an extent, have a point; however, individually, they are meta theoretically flawed (Tsoukas, 2000). It is correct to say that there is an external social reality, and it is also correct to say that reality is socially constructed by actors (Tsoukas, 2000). This doesn't mean that the realist-constructivist and objectivist-subjectivist demarcation of knowledge does not work. As articulated by Barad (1996, p.162) "the fact that scientific knowledge is socially constructed does not imply that science doesn't 'work', and the fact that science 'works' does not mean that we have discovered human-independent facts about nature". According to Barad (1996, p.162), empirical adequacy is not a proof of realism that can be used to silence charges of constructivism; neither is constructivism proof of epistemological relativism. We are realists because reality does not live in our heads, it exist out there and we are constructivists because we talk about what exists out there using language – 'language' which in itself is man-made based on beliefs and meanings institutionalized by a group of actors which evolved over time (Spender, 1980). Language is not as innocent, independent or trustworthy as it appears.

An anti-representational account of reality, which is what is being argued for, rejects the realist-constructivist and objectivist-subjectivist rivalry (Tsoukas, 2000). This stance, however, does not mean it accepts the union of both extremes; instead, it posits that reality and phenomena are produced from their intra-action. As put forward by Barad (1996), reality is enacted from the "between" of word and world, meaning and matter, social and material. Anti-representationalism rejects the idea of always reducing things, including materiality, to language. It rejects the notion of using representations to define what is real. It takes away attention from the objective measurement or subjective assessment of ES implementation by focusing on practices, doing and actions. An anti-representational account of reality is performative (Barad, 2003). Performativity posits that the relation and boundaries between the social and material are enacted in practice rather than given (Jones, 2014). The performative perspective is rooted in the socialmaterial worldview, which zooms in on the relations between actors. It dispels the assumption that the social and the material (in this case the information technology artefact) pre-exist as separate objects with certain properties, characteristics or factors which can be used in capturing their existence; rather, they relationally entail or enact each other in practice (Orlikowski, 2007). A performative perspective to reality interrogates sociomaterial practices and how they produce realities - realities in which ES implementation outcomes are performed (Cecez-Kecmanovic et al., 2014). Jones (2014) describes practices as an "enactment of performativity". A performative perspective focuses on how ES implementation outcomes emerge and acquire meaning, rather than analyzing their composition, to understand their dynamic and context-dependent nature. (Cecez-Kecmanovic et al., 2014). The performative perspective, informed by ANT, treats humans and non-humans equally, examining their relationships and interactions to understand how they co-produce actions, events, and ultimately, the realities of success and failure. (Jrad & Sundaram, 2016).

2.8 Chapter Summary

The chapter reviewed previous studies related to IS implementation outcomes. First a high-level review was conducted to understand the important trends, themes and topic on IS implementation success and failure. Next, the study reviewed themes describing existing research. This was done to identify gaps so as to justify the study and validate the research motivation. The major gap identified in this chapter relates to make-believe that our knowledge (both objective and subjective) via language represents reality, the assumption that proxies or surrogates in the form of measures and perceptions represent ES implementation success and failure. The problem with this representation

is the void that exists between the representation and the represented, and how exact the representations represent the represented. Hence, this chapter introduced the performative approach to close the identified gap.

3. Actor-Network Theory

"No man ever steps in the same river twice, for it is not the same river and he is not the same man."

(Heraclitus)

ANT is a diverse family of material-semiotic tools that have been performed and translated in different ways, hence, since this study is based on ANT writings by Callon (1986), Latour (2005) and Law (2009), ANT in this study is also transformed. ANT in this study is performed both as a theoretical lens and a methodology.

3.1 Introducing ANT

ANT evolved from science and technology studies as a tool that researchers can use in studying sociomaterial systems (Law, 1999). It provides sensibility to the messy and precarious relationality and materiality of the world (Law, 2009). ANT has been adopted and applied to studies on IS (Mpazanje et al., 2013; Sarker et al., 2006) and more recently to studies on the sociomateriality of IS (Cecez-Kecmanovic et al., 2014). ANT is concerned with the relations which perform and temporally stabilise social arrangements (Cecez-Kecmanovic et al., 2014). These social arrangements are relational effects and not entities with defined properties (Law, 2008).

A vital characteristic of ANT is its ability to explain how relational effects such as success and failure are performed into being (Alcadipani & Hassard, 2010) and in doing this it does not privilege any actor. ANT decentres the human subject; hence it includes both human and non-humans as it attempts to understand the social (Latour, 2005). Humans and non-humans are referred to as actants in ANT. These actants are not fixed or given, and they have no existence outside the actor network. Through relations, the actants are enacted continuously as relational effects (Law, 2004). Some relational effects which emerge from interaction include people, technology, documents, natural phenomena, knowledge and social structures, all of which are equally engaging and responsible for the reassembling of the social (Cecez-Kecmanovic et al., 2014). There is no social without material, and the material does not exist without the social (Orlikowski, 2007).

ANT and its relational foundation provide the opportunity to explore practices and novel heterogeneous links that are otherwise not possible, off-limit or not worthy of note to non-semiotics approaches (Law, 2009). At the centre of an ANT investigation is the erosion of foundational ontological distinctions taken as given. For ANT, these unchallenged distinctions and divisions

viewed as ultimate are dethroned and regarded as enacted relational or translational effects (Law, 2009). The eroding tendency of ANT known as generalised symmetry is possible because things do not have inherent properties; hence they cannot belong to pre-established categories (Gad & Jensen, 2010). Human and non-human, social and material, nature and culture, true and false, micro and macro – these are all secondary dualisms dissolved by the relationality of ANT (Law, 2009). The social and the material constitute each other such that one cannot examine the social without concurrently examining the 'hows' of relational materiality. Studies wonder why ANT fixates on the material nitty-gritty, considering it unnecessary. For ANT, these studies are too eager to study the stable non-material version of the social without understanding how the social is done (Law, 2009).

We question ANT for undoing stable foundations and dualism. ANT responds to this by examining the logic of its network and identifies patterns that produce relative stability. These overlapping patterns include material durability, strategic durability and discursive stability (Law, 2009). In support of material durability, social configurations ordered in non-bodily physical form (for example legal contracts) are likely to be more stable than those contingent on face-to-face interactions (Law, 2009). Next, strategic durability ensures network stability by translating durable strategies (for example accounting practices) from other networks (Law, 2009). The internal working of these durable configurations that work elsewhere does not need to be understood. They can be black-boxed as a piece and translated into a network. Finally, with discursive stability, network stabilising is possible with the availability of different possibilities or interchangeable ordering modes (for example ordering collaboration through in-person meetings, video conferences, email exchanges and so on)(Law, 2009). When one mode does not work, the solution might lie with the other modes.

In providing answers to the main research question, this study adopts ANT because instead of inquiring why a phenomenon happens, it investigates how it occurred (Law, 2008). ANT is a useful perspective for performative studies because it allows researchers to examine the complex network of relationships and intra-actions that shape the performance of IS implementation outcomes. From an ANT perspective, the performance of IS implementation outcomes is seen as the result of the intra-actions and negotiations between different actors within the network. These actors can include both human and non-human entities, such as people, organisations, technology, and other elements. ANT emphasises the importance of understanding how these actors influence and are influenced by each other in shaping the performance of IS implementation outcomes.

In this section, we explain the relevant ANT vocabularies and analytical concepts.

3.2 Actor

An actor is not the sole performer of action; instead, it is the target of a substantial collection of entities grouping towards it (Latour, 2005). An actor is the outcome of a relational configuration. It comes into existence as the effect of a network. An actor is defined by the attributes of the network or relation to which it belongs. It does not exist outside the relation or network that defines it.

3.3 Network

A network in ANT sense should not be confused with a telephone or subway network. Far from it, the network in question is an expression, a notion and not a thing. It is not what is being described but a tool that assists in describing things (Latour, 2005). It ensures the analysis of different patterns of connections. A network captures the flows of translations via a point to point connection which is materially traceable, thus, ignoring anything that is not connected (Latour, 2005). A network connection is precarious, unstable and made up of the lingering traces of some moving mediators (Latour, 2005). An actor-network shapes and is shaped by the interests actors bring to the actor network. Actors can belong to more than one actor network simultaneously, hence, in creating a new actor-network, actors can bring interests that have emerged from other actor-networks. (Cordella & Shaikh, 2003).

3.4 Performativity

ANT posits a material-semiotics relationality, where the individual components of a network do not possess inherent existence or meaning outside of their relationships with one another. Rather, these components mutually define and influence each other through their interconnectedness, thereby shaping the network as a whole (Law, 2009). The material-semiotic relationality is precarious and heterogeneously material, comprising different kinds of actors and stuff, not just “the social” (Law, 2009). Central to the working of material-semiotics is the notion of performativity; that is, nothing is real or rather reality does not exist until it is enacted into being. Furthermore, this enacted reality is not fixed or permanent, but rather it is subject to ongoing re-enactments and reconfigurations, which can modify or even undo its existence. The enactment or performance of reality is not a social construction by actors; instead, it is a configuration where everything involved assembles and plays its part relationally in producing practices (Law, 2009). ANT argues that reality is enacted through the interplay of actors, both human and non-human actors, with equal constitutive abilities (Latour, 1987). Actors within the actor-network are in a continuous state of interactions and as such in a continuous state of change (Cordella & Shaikh, 2003). This ongoing relational sociomaterial interplay

is the performative quality of actor-networks in which actors are "performed in, by, and through relations" (Law, 1999). The performativity of actor-networks enacts realities.

This turn towards performativity has odd consequences in that things referred to as singular, in theory, exist as multiples in practices. Each practice enacts a different reality which rarely momentarily collapses into a single reality. Although it seems counter-intuitive, a completed translation does not create a single consistent configured network or reality, rather a multiplicity of realities emerge (Mol, 2002). At times, such realities could unite, and other times they are different, and they oppose each other. Nonetheless, it is imperative to understand how different realities relate. The relationships that exist between realities are flexible rather than rigid (Law, 2009). The need for a centre or a singular reality no longer holds. Multiple realities are performed through different practices, and these performances work together because their differences and similarities enable transitions and connections between various enactments (fluidity). These performed realities are not pre-existing but are continuously enacted through the sociomaterial practices that bring them into being.

ANT is credited for playing an instrumental part in the development of sociomaterial thinking (Cecez-Kecmanovic et al., 2014). It is noted as a distinctly sociomaterial methodology (Alcadipani & Hassard, 2010; Law, 2004) which possesses investigative tools evidently suited for a sociomaterial investigation (Cecez-Kecmanovic et al., 2014).

3.5 Translation

In thinking about how to study relationality and how movements occur between order and disorder, the metaphor translation was birthed. Translation is a process of aligning, shifting and making equivalent (Law, 2009). For instance, in a web of relationships that consist of various actors such as scallops, fishers and scientist, the process of translation relates, defines and orders these actors (Law, 2009). Actors are found in different or related situations (relations). They are not entirely the same from one situation (relation) to another situation (relation) because they get translated when moving between practices (Gad & Jensen, 2010). The order and relation between actors are precarious such that it takes one translation to fail (for example, fishers betraying the interest of scientists and scallops) for the ordered web or relation (reality) to disentangle and become disordered (Law, 2009). The interests of actors are not static; hence translation is ever vulnerable, a process liable to failure (Law, 2009). The process of translation consists of the following steps labelled as problematisation, interessement, enrolment and mobilisation, which can overlap in reality (Callon, 1986).

The first moment during translation is problematisation, during which one or more key, primary or focal actors "determine a set of actors and define their identities in such a way as to establish themselves as an obligatory passage point in the network of relationships they are building" (Callon, 1986, p.6). At this moment, the focal actors present themselves as indispensable to other actors by defining the problem and how it can be resolved (Callon, 1986). Problemitisation ends with the definition of the obligatory passage point, which is a situation or process that needs to take place before the defined interests by the focal actor can be achieved by actors (Sarker et al., 2006).

Interessement is the second moment of translation. Prior to it, problematisation is still hypothetical and hence, at this moment, the focal actor tries to negotiate, impose and stabilise the identity or roles of actors to that defined at the moment of problematisation (Callon, 1986). Each actor can either choose to accept or refuse by defining a different identity. A successful interessement confirms problematisation and leads to enrolment.

Enrolment is the third moment of translation during which other actors accept the roles or identities defined for them by the focal actor (Callon, 1986). Enrolment might include coercion, seduction or voluntary participation (Callon, 1986). In ensuring that interests are protected and locked in, inscription and irreversibility often occur as part of the enrolment process (Sarker et al., 2006). An inscription, for example, in a project context would be a service level agreement document which details commitment from relevant actors. Irreversibility, on the other hand, is the extent to which it is not possible to go back to a moment where alternative options are explorable (Sarker et al., 2006). Inscription and irreversibility are properties of a stable network which at times is simplified into a single actor or black box via a process called punctualisation (Sarker et al., 2006). Punctualisation is the process of turning a heterogenous network into a single actor to reduce complexity and introduce simplicity. Enrolment is temporary; hence, it is often a matter of time before an enrolled actor contradicts the network and betrays it (Callon, 1986).

Mobilisation is the fourth and final moment of translation which involves strategies used by the focal actor to ensure that the different networks are not betrayed but are well represented by their speaker or delegate (Callon, 1986). Mobilisation ensures that the definitions and commitments remain in existence.

3.6 Groups

There are no predefined groups that make up socialmaterial aggregates; instead, there is just group formation (Latour, 2005). The starting point for an ANT analysis is not to find which groups make up the social; rather, it commences by discovering what group actors belong to by following them via the traces that were left behind by their activity of assembling and dissembling groups. For ANT, every form of fixed grouping is discarded; a group has to be made and remade for it to exist (Latour, 2005). The moment the work of making and remaking stops, the group stops to exist just as a dance stops when the dancers stop dancing (Latour, 2005). The focus is on group formation because already established groups are silent and invisible and hence, they generate no new information. Group formation is visible and in performance, so it generates new data.

Groups are made up of mediators and intermediaries (Latour, 2005). An intermediary transport meaning without transforming it; that is, the input is the same as the output. Internally, it might be made up of several parts, but externally it is a black box that counts for one (Latour, 2005). A mediator, on the other hand, changes, translates or transforms. Therefore, it might count for nothing, one, two or infinity (Latour, 2005). The same explanation does not apply to an association of mediators because they do not trace the same relations.

Group formation traces out the anti-groups that constitute their social world. During the process of tracing or retracing a group, every other grouping is assigned the role of anti-groups which threatens to disband the group (Latour, 2005). As a result, every group formation is characterised by attributes set up to prevent its boundaries from anti-groups that endanger its stability (Latour, 2005). Irrespective of the rationale, it is not the duty of ANT to stabilise groups; such a function is left for the actors. To define a group, it needs to have a speaker or a representative who speaks for the group irrespective of the stage of formation. Although groups come off as being fully equipped, they do not exist without actors recruiting other actors.

3.7 Agencies have overtaken actions

In an ANT study, the action is not performed under the full control of consciousness of the actor as there are several other forces not of the making of the actor that are at play when it acts (Latour, 2005). There are agencies which the actor has no control over that make it do things. For instance, Mrs x loves her new gadget, but before purchasing it she reads in a tech publication that thousands of people also love the same gadget. This situation then begs the question – who is in love with the gadget? Mrs x, public opinion or both? Agencies exist in an account as transforming something or

making a difference to a state of affairs (Latour, 2005). There is no room for conspiracy theories in ANT. An invisible agency that is absent in an account, or makes no difference, or has no identifiable reference frame or does nothing, or creates no transformation, is not an agency (Latour, 2005). The presence of an agency must be established each time; it cannot merely be conceptualised. The thing performing an action always exists in an account with some frame and features, which gives it some form no matter the ambiguity (Latour, 2005). For instance, an election poll can exist in a figure or form just as much as a person. An agency and its figuration are separate things.

Action is not localized or centered in a single place or entity rather it is decentralised, distributed, multiple, dissimilar, and it remains a mystery to both the researcher and actor (Latour, 2005). Actors engage in the task of challenging and criticising agencies labelled as false or fake. They add and subtract from the list of agencies attributed to a defined role in reality. This does not imply that the researcher is powerless and always at the mercy of the actors. Instead, it means that if an alternative must be proposed, the researcher must participate in the reality making activities of those they study (Latour, 2005). Actors can suggest their theories of actions that elucidate how the effects of agencies are transported (Latour, 2005). They can decide whether an agency is an intermediary or a mediator. The figuration of an agency does not automatically decide what theory of action is brought into play. A non-human agency could exist in an account as a mediator while a human agency exists merely as an intermediary. Activities render actors, actions and agency visible to the researcher.

ANT does not operate on the principle where the effect is predicted by the cause when they are both mediators (Latour, 2005). For intermediaries, it is relatively straight forward. Nothing is transformed, so the input is the same as the output. This idea that the effect must always follow the cause is problematic because it means that we can disregard the effect since everything interesting or worth investigating lies with the former. For mediators transporting agencies, the case is different. Causes do not foretell effects. Rather, when mediators trigger other mediators, they make each other do unexpected things, thereby producing unpredictable effects.

In summary, an ANT researcher must pay attention to the agencies that are performed, that is, the figurations agencies take up and the concatenations of mediators that transport the agencies. ANT resolves to follow the actors irrespective of which complex metaphysical situations they lead us into (Latour, 2005).

3.8 Objects have Agency

In ANT, the social is a transient association between entities which are distinguished by the way they cluster to form new shapes (Latour, 2005). The social world is not limited to humans alone because even among non-humans it is possible to produce a social world understood as an entanglement of interactions. In questioning what makes social aggregates hold or the durability of the social ties, there is the risk of summoning social forces in the form of culture, social norms, and society as explanations (Latour, 2005). This common-sense solution appears satisfactory, but it fails to explain how weak social ties become strong and durable. Invoking the social to explain the solidness and durability of the social is a tautology, and it encourages what makes the social hold disappear from view (Latour, 2005). There is no need for an invisible social force that lies in the background. The social is not to provide explanations; instead, it is to be explained. The solution for ANT is to "follow the actors" in their entanglement with the things they add to the social to perform more durable changing interactions (Latour, 2005).

Objects act; for instance, the monitor 'displays' text, the sound system 'plays' music, the door handle 'opens' the door, the key 'locks' the door, and the car 'moves' you from point A to point B. Objects designate actions; however, objects have vanished from the course of action because of the way literature has predominantly defined actors, agency and the social. Action has been reduced to what intentional humans do and hence it is not surprising that it is difficult to see how objects act. For ANT, anything that makes a difference by changing or altering the state of affairs is an actor or an actant if it has not yet been endowed with a figuration (Latour, 2005). If one agrees that displaying the text without the monitor or playing music without the sound system or opening the lock without the key or moving from point A to point B without the car are the same activities without these materials, and they contribute nothing to the realisation of these tasks, then we can conclude that the elimination of the material is justified (Latour, 2005).

ANT's call to bring objects into focus does not imply a privileging objective matter over subjective language and values. ANT does not suggest that objects do things instead of human actors and vice versa, rather it suggests investigating who and what participates in the action. It is imperative to mention that ANT views objects as full-blown actors that offer explanations to the differences that exist in reality (Latour, 2005). Furthermore, ANT rejects the creation of some ludicrous symmetry between humans and objects. Symmetry for ANT is the elimination of a priori "asymmetry among intentional human action and a material world of causal relations" (Latour, 2005, p.76).

Objects and traditionally conceived social ties have a difference in their mode of action so at first sight it might be difficult to register the role of an object because of the difference in its mode of action when compared to traditional conceived social ties (Latour, 2005). This difference has been the justification for keeping objects separate from social ties without realising that objects were enrolled in the first place because of the difference.

To account for an object, it needs to produce visible traces; otherwise, it is no longer an actor because it is silent, unaccountable, and invisible to other agents and offers no information to the researcher. Objects are difficult to account for because they quickly shift from being mediators to intermediaries. To mitigate this challenge Latour (2005) suggested tips such as offering descriptions of them and producing accounts of what they make others do as ways of making them talk. Objects, unlike humans, are momentarily visible, and they quickly withdraw to the background no matter their significance. The higher their significance, the faster they vanish (Latour, 2005). Nonetheless, this does not mean that they stop acting; instead, it is their mode of action that does not seem visibly connected.

Fortunately, Latour (2005) has offered several solutions to this problem. Option one - the study of innovations highlights a more prolonged visible interaction between objects and traditional social ties before they become invisible. Option two - the most obscured objects become seen when they are approached by users that are unfamiliar with them, only to become invisible again once they become familiar. Option three - during a breakdown or an accident, mute intermediaries become a mediator. Option four - even when objects have been resolved to the background for good, it is possible to make them noticeable again by using documents, records, diaries, and historian accounts to re-enact them. Finally, if the other options are unsuccessful, the use of thought experiments and counterfactual history is also a valid option worth considering. There is no longer an excuse to omit objects; if this occurs, it will no longer be due to lack of data but rather lack of will (Latour, 2005).

3.9 Agential Cuts

By adopting a position of entanglement and an ontology of indeterminacy, the phenomenon under study is not merely a mesh of relationships; it also exists differentially, with distinctions and boundaries emerging as we enact agential cuts through our research practices. The concept of an "agential cuts" was introduced by Karen Barad. It refers to the specific practices or interactions that create boundaries and define properties, separating and distinguishing between "subjects" and

"objects" in a given phenomenon (Cecez-Kecmanovic et al., 2014). An agential cut is a localized resolution of the inherent indeterminacy of the world, where the boundaries and properties of various components become determined through these interactions (Barad, 2003). Agential cuts differ from the traditional Cartesian view, which assumes the pre-existence of independent objects with inherent distinctions and properties (Scott & Orlikowski, 2014). Instead, agential cut consider distinctions, boundaries, and properties as contingent performances and enactments in practice, rather than being naturally given or predetermined. The agential cut is always a local, situated performance that temporarily stabilizes particular distinctions between the knower, the known, and the knowledge itself. It is a contextualized process that enacts separations and definitions within a specific phenomenon (Fenwick & Edwards, 2013; Scott & Orlikowski, 2014).

3.10 Agential Realism

The modifier “agential” comes from the adjectival word “agency” whose notion is reworked by the agential realist account. Agency is not an attribute that belongs to humans or non-humans in an absolute sense; rather agency is an enactment, an attribute of practice; it is the ongoing dynamics (“doings” or “beings”) in its intra-activity through which the social and the material (sociomaterial) are continuously and differentially performed (Barad, 2007). Agency is only distinct in a relational sense (Barad, 2007).

The agential realist ontology proposes the constitutive entanglement of everything where separateness is not an inbuilt characteristic of reality (Barad, 1996). Related entities are not predefined, but rather emerge and gain meaning through the relations and interactions between them. The relation comes first, constituting the very possibility of distinct relata (Barad, 2007). In place of objects with defined attributes, agential realism offers phenomena as the primary ontological unit. Phenomena are the ontological inseparability of intra-acting agencies through which the properties and differences of the constituents of phenomena become determinate and assume meaning. That is, phenomena are first and always relations within which relata are performed. As illustrated in Figure 2, agential realism puts forward material-discursive practices, instead of “words”, as the primary semantic unit through which boundaries are dynamically established.

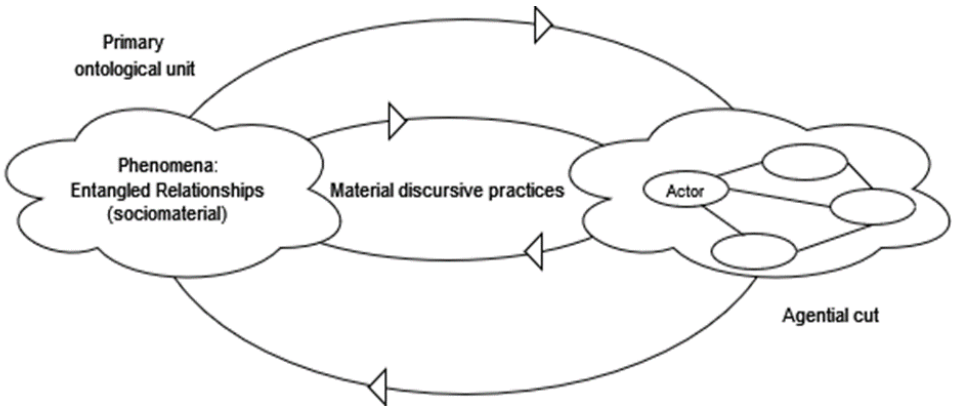


Figure 2: Agential Realism- Entangled Sociomaterial Relationships and Practice

"Knowing is a material practice of engagement as part of the world in its differential becoming (onto-episteme-ology)" (Barad, 2007, p.89). In dealing with ontological and epistemological issues, agential realism proposes the following key insights. To start with, it establishes and locates knowledge claims in local doings, practices and experiences within which objectivity is embodied (Barad, 1996). Knowledge is not a view from nowhere (objectivist), neither is it a view from everywhere (relativist), rather it is at all times a view from somewhere (Barad, 1996; Haraway, 1988). Objective knowledge is always situated, emerging from the specific local experiences and material-discursive practices through which phenomena are investigated. Objectivity itself is embodied rather than transcendent (Barad, 1996). This means that objective knowledge does not exist as an abstract, universal truth floating above and independent of material practices. Instead, objectivity emerges through specific material-discursive practices and apparatus that are necessarily situated in particular times, places, and bodies. Next, agential realism does not favour the material or the cultural: the agencies of observation (the apparatus of bodily production) are both material and cultural (Barad, 1996). Agential realism involves the interrogation of boundaries and critical reflexivity (Barad, 1996). Finally, agential realism emphasises the need for an ethics of knowing because the knowledge we construct has real consequences; hence, accountability and responsibility are a necessity (Barad, 1996).

Agential realism views the process of implementing IS as a dynamic and iterative process in which various actors engage in ongoing negotiations and intra-actions. These negotiations and intra-actions shape the direction and outcomes of the implementation process and can lead to unexpected changes and developments over time. Depending on the specific circumstances and conditions involved, these changes and developments can either lead to a successful implementation or to failure. By adopting an agential realism perspective in an ANT study, it is possible to examine the complexity and

dynamism of the IS implementation process and understand how it enables the success and failure of an IS implementation. While ANT provides methodological tools for tracing networks and relationships between actors, agential realism enriches this analysis by revealing how implementation outcomes emerge through material-discursive practices rather than being predetermined by network configurations. This combination is necessary because understanding IS implementation requires both ANT's ability to map actor relationships and agential realism insights into how success and failure materialize through practices, offering a more complete analytical framework than either theory alone could provide.

3.11 Matter of Fact vs Matter of Concern

A central preoccupation of an ANT analysis involves matters of facts being contested and translated into matters of concern. As we follow and trace new associations, researchers need to pay attention to and be acceptant of the new shapes objects might present. Since ANT has eliminated the artificial boundary between the social and the natural, non-human entities given as matters of fact are no longer confined to their predefined narrow cell as they are now matters of concern, free and open to deploy a wide range of agencies (Latour, 2005). Matters of concern is different from matters of facts in the sense that it is interesting, dynamic, more talkative, pluralistic, visible and more mediated (Latour, 2005). If there is any problem researchers should complain about, it will no longer be the silence of matters of fact, instead, a large volume of data about matters of concern that needs processing.

In deploying objects, we need to unlearn the tendency of predefining in advance its composition and agency. Just as we have learnt that the society is an association and not a substance made of social stuff, in the same vein ANT follows the deployment of matters of concern in reality and rejects the reflexive substituting into matters of fact (Latour, 2005). Matters of concern are multiple. This multiplicity is not as a result of multiple viewpoints of the same thing; instead, it is because the thing can deploy itself in multiples, thus making the multiple interpretations possible (Latour, 2005). At a later stage, these multiple viewpoints could be reconciled and unified. Multiplicity takes us from the metaphysics to the ontology because to remain at the metaphysics is to reiterate the interpretive flexibility or multiple interpretations of a singular reality in which case we have not made any progress.

3.12 Ontological Politics

Ontological politics is a composite term that suggests that the conditions of possibility are not predefined; rather, they are shaped in the routine practices (Law, 2004). Reality is performed; hence

in principle, it is not fixed and singular; instead, it is dynamic and multiple. Being multiple is different from being plural because with plurality it is either that the number of viewpoints is multiplied, but the object viewed at the centre remains singular (perspectivalism), or it could be that the alternate constructions of reality which could have been possible got lost in history (constructivism) (Mol, 1999). Multiplicity in ontological politics is not made possible by perspectivalism or constructivism; instead, it is as a result of performance. Performance does not imply that reality is observed; instead, it is enacted in the course of practices (Mol, 1999). Ontological politics investigates how multiplicity, in reality, is reconciled, unified, sustained or separate.

Mol (1999), using anaemia as a case study, describes how there is no singular and stable definition of anaemia; instead, anaemia is performed in practice in different ways. She pointed out three different ways in which anaemia is diagnosed, namely: clinical, statistical and pathophysiological and, in practice, they each diagnose something different. She concluded that there is no one form of anaemia; instead, there are three different anaemias that have co-evolved for a long time. An implication of multiple realties is the existence of different options and the choice of which one to perform. This led to questions concerning where such options are located and what was at stake when an alternative reality was enacted. Also, if realities are not different, we need to know if the options are real options and finally how the choice is made. The concept of choice indicates that there are actors actively making choices; hence, what are the (political) reasons why certain realities are enacted and others are not?

Ontological politics provides the tools that enable the exploration of how specific local associations and agential-cuts in different actor-networks momentarily stabilise and enact concurrent competing or complementing IS realities (Cecez-Kecmanovic et al., 2014). Using the concept of ontological politics, we investigate why an IS and its assessment is performed in a particular location or actor-network, why certain realities are enacted, and others are not, and why multiple realities of IS success or failure are performed.

The descriptions, interpretations and results produced by ANT are not innocent. They do not just merely represent reality, but rather it enacts it, good or bad. As emphasised by Haraway (1991), we make realities; hence, we need to be aware of the kind of difference we make. Reality is not destiny and, as such, what is real can be remade (Law, 2009). The good and the bad are rooted in the real and the real rooted in the good and bad (Law, 2009). As researchers, we have a combined responsibility to both the real and the good.

3.13 ANT Perspective on IS Implementation

Cresswell, Worth, and Sheikh (2010) adopted ANT in studying the implementation of an electronic health system in a health care setting. Their findings highlight the capability of an ANT perspective in eliciting complexity as well as the active role of technology in an implementation context. In their study, complexity was evident as actors performed multiple roles in different networks while the role of technology was visible in the transformation of health care services delivery. In addition, they showed how ANT offers a theoretical approach to both sampling and analysis.

Using ANT as a lens, Rodon, Pastor, Sesé, and Christiaanse (2008) refute mainstream literature by showing that static independent factors alone cannot explain the evolution and outcomes of an inter-organisational information system implementation (IOIS); rather, this is achieved through the continuous alignment and shaping of social and technical actors throughout an implementation. In their study, they followed actors through an implementation that spanned over 11 years (1994-2005). From a practitioner point of view, this implementation would be labelled as a failure because it exceeded the estimated completion time and budget; however, this simplistic view of failure is rejected. After all, undisclosed interests, lack of control and unexpected events are common traits of an IOIS implementation.

Cavalheiro and Joia (2016) used ANT to examine the implementation of a European patent management system in Brazil, contributing to the body of work studying the translation of IS between developed and developing nations. Findings from this study depict the overlap between moments of translation. For instance, actors were enrolled in different networks without a formal definition of roles and identities due to delays experience during problematisation. Another example involved enrolment as a mobilisation strategy for network stabilisation.

3.14 ANT Critique

In adopting ANT as the theoretical lens of this study, it is imperative that ANT critiques are brought to the foreground and addressed. ANT has been heavily criticised for its lack of attention to political and power issues. This critic, however, has been addressed in studies labelled as ‘ANT and After’ literature (Latour, 2003, 2005; Law, 2009; Law & Hassard, 1999). For example, ANT and After research focused on organisations suggests that organisations are not static; instead, they are outcomes of ongoing multiple interactive processes termed ‘organising’. Emphasising the noun ’organisation’, an organisation can only exist as an ongoing outcome of organising (Alcadipani &

Hassard, 2010). As such, the analysis of organising by ANT is not just a methodological issue; it is political as well (Alcadipani & Hassard, 2010).

Furthermore, power for ANT does not involve explaining a phenomenon; instead, it is an event or phenomenon whose construction needs understanding before it can be analysed and challenged (Alcadipani & Hassard, 2010; Latour, 2005). Power is not a stock, capital or natural resource that can be used in conveniently offering explanations; instead, like society, it is the outcome of a performance. Political insights from ANT and After literature are applicable in making clear the performance of "profit imperatives, patriarchy, racial inequality, and ecological irresponsibility, as well as bundles of relations and associations that assist in enacting organisations as instruments of domination" (Alcadipani & Hassard, 2010, p.430).

3.15 Chapter Summary

This chapter gives an in-depth explanation on ANT which was adopted as the theoretical lens of this study. In addition, the relevant ANT vocabularies and concepts which were utilised in this study were further explained in the chapter.

4. Research Methodology

In this chapter, the research methodology is presented, and the researcher's approach towards executing the study is described in detail.

4.1 Theoretical Perspective

Ontology and reality are closely related. In undertaking research, it is vital that both are understood. Ontology is concerned with the perspectives of reality (Slife, 2004) while reality is the state of a thing as opposed to the perception, idea or measure of it. Reality is not made up of "things-in-themselves" - that is, a reality external to perceptions, or "things-behind-phenomena" - that is, a reality known through perception, but rather "things-in-phenomena" - that is, a reality in which the phenomena are an integral constituent (Barad, 2003, p.817). Reality is not a pre-existing external entity separate from our perceptions, nor is it something we only know through our perceptions. Instead, reality is constituted by the phenomena themselves, where the observed and the observer are intrinsically intertwined and co-create the reality we experience. As researchers, our ontology should not dictate our reality, rather our reality dictates our ontology and consequently what we can learn about it.

Ontology is customarily associated with two kinds of view, namely: objectivism and subjectivism. By taking a stance on independence, objectivism represents a reality in which social entities exist external to their related actors (Saunders et al., 2009). It focuses on the external, objective reality that exists independently of human understanding. It aims to provide universal, rational laws and representations that accurately depict this reality to help people function successfully within it (Huizing, 2008). Objectivism separates human subjects from objects, emphasizing objects' inherent properties over subjective, interactional meanings ascribed through human sense-making processes (Huizing, 2008).

Subjectivism, on the other hand, holds the view that reality is exclusively socially constructed from experiences, perceptions, and ensuing actions of related social actors (Saunders et al., 2009). Although both ontological views of reality contrast in their assumptions, it can be argued that they are similar on some level. They both agree to the concept of representationalism, which is, the notion that our measures and views represent reality.

4.1.1 Anti-Representationalism

In obtaining reality, this taken for granted epistemological foundation termed representationalism needs unpacking. Representationalism is based on the idea of representing nature (objectivism) or

culture (subjectivism) where "representing" is the similarity while the referent, nature or culture, is the difference. Think of it in terms of a knower (one who does the representing) acquiring knowledge (the representations) from the known (that which is supposedly represented) (Barad, 2003). This means that the representations act as a go-between the knower and the known as depicted in Figure 3. If this is the case, then these ontological gaps bring about questions relating to the accuracy of the representations. We ask, therefore, the same questions as proposed by Barad (2003): Does science accurately represent an independent reality? Does language accurately represent what it stands for? Does the law accurately represent the interests of the persons purportedly represented?

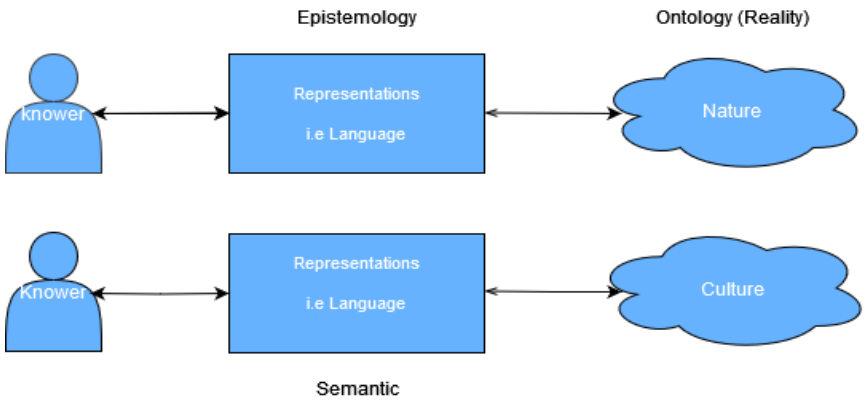


Figure 3:Representationalism

Whilst representationalism has a common-sense allure, it takes a questioning attitude to evoke its shortcomings. How is it possible that representations are more reachable than the things they assume to represent? Surely, though, if there is no special language through which we can without error directly reach out to its referent, why should we accept that there is a language that mysteriously facilitates our access to its perception or representational matter? (Rouse, 1996). Representationalism is an unexpected result of the Cartesian model of knowledge birthed by Descartes in the seventeenth century which we argue is a contingent occurrence in history, rather than an indispensable logical foundation (Barad, 2003; Bordo, 1986). Against this background, we reject representationalism.

The question of selecting either realism or social constructivism is a problem that stands on the metaphysical base of representationalism, which is established in a nature-culture, word-world dualism (Barad, 1996; Tsoukas, 2000). This is re-echoed in the separation of the epistemology from the ontology (Barad, 1996). Outside this context, this question and problem consequently become unnecessary. Moving away from the classical arguments that set both parties of dualism against each other, a more coherent and anti-representational philosophical position is considered, one wherein

the performative understanding contests and redirects the centre of attention from linguistic representations to discursive practices (Barad, 2007). The question, therefore, is no longer that of how well or to what extent descriptions mirror reality, but rather that of actions, doings and practices (Barad, 2007). This study adopts agential realism, which advocates an inseparability of ontological, epistemological, and ethical considerations (Barad, 2007). It reworks the notion of agency as an enactment, an ongoing dynamic of "doings" or "beings" through intra-activity, rather than an attribute belonging to humans or non-humans. Agential realism ontology proposes that reality is not composed of separate, pre-existing entities, but rather emerges through the intra-actions and relations between phenomena (Barad, 1996). It rejects the idea of inherent boundaries or properties, asserting that distinctions and meanings arise from the dynamic practices and discursive relationships that constitute phenomena.

4.2 Research Purpose

This research has an explanatory purpose. The reason for this is that the study explains how multiple realities of ES outcomes are performed. At the core of the research purpose, there is a need to establish causal relationships. In adopting a sociomaterial approach, the notion of causality is reworked. Causal relationships are not thought of as relations between discrete entities; rather, as relations that emerge through intra-actions. It is not the case of a pre-existing entity leaving marks on another determinate entity, but rather through the process of marking we identify the agencies of observation and the marks left on them (“the effect”) as agentially different from its cause (“the object”) (Barad, 2007).

4.3 Research Approach

In designing research, selecting a research approach is an essential task which plays a crucial role in aligning the research strategy and theoretical foundations. The research approach concerns the relationship between research and theory. It deals specifically with when the theory is presented in a study - theory following data or data following theory. There are four different types of research approaches, namely inductive, deductive, abductive and retroductive (Blaikie, 2009). The inductive and deductive approaches are the most widely used in social science research. Both approaches are very pertinent to the advancement of knowledge because they are the two halves of the research cycle that iterate over and over between observations and theory (Bhattacherjee et al., 2017).

This study adopted an abductive approach. Abduction involves iteratively moving between theory and data to develop new theoretical explanations when existing theories fail to fully account for

empirical observations. The study began with the established literature on IS implementation success and failure but used ANT as a meta-theoretical sensitizing device to identify anomalies that challenged conventional understanding.

4.4 Research Timeframe

In conducting a study, the type of research timeframe selected depends on the nature of the research question under investigation. The types of research timeframe can be categorised into the following, namely: longitudinal, repeated measure design, multiple snapshots and cross-sectional (Chen & Hirschheim, 2004). A cross-sectional timeframe was deemed appropriate since data was collected in retrospect in this study. The focus of the cross-sectional timeframe is the period dedicated to a phenomenon (or phenomena) for data collections through one snapshot at a specific point in time. This study investigated how multiple realities of ES implementation outcomes are performed post-implementation. Although the study investigated post-implementation activities and events that occurred over a period of time, the data collection process itself was retrospective and occurred at a single point in time.

4.5 Case Study Research Method

This study aimed to make sense, provide understanding, and theorise on how success or failure comes about in an ES implementation. Given the aim of this study, a case study research method was adopted. The case study method is particularly suitable for this research because it enables an in-depth examination of the complex and dynamic processes involved in ES implementation, allowing for a nuanced understanding of how multiple realities of ES outcomes are performed in their natural setting (Venugopal & Rao, 2011).

The case study method was selected based on several key considerations that align with this study's theoretical framework and research aims. First, case studies enable investigation of phenomena within their real-world context when boundaries between phenomenon and context are not clearly evident (Yin, 2009). This aligns with our sociomaterial theoretical lens that views ES implementation outcomes as emerging from entangled practices rather than as discrete, bounded events.

Second, the method supports collection of multiple types of evidence (Stake, 1995), allowing us to trace how different actor-networks and their situated practices perform competing implementation realities through interviews, documents, observations, and system logs. Case research also provides

the depth needed to examine how multiple, sometimes contradictory realities of success and failure are performed through different practices within the same implementation context (Walsham, 1995).

While other methods could examine implementation outcomes, the case study approach uniquely enables deep investigation of the sociomaterial dynamics through which these outcomes emerge in practice. This method's ability to accommodate both breadth (through multiple data sources) and depth (through intensive investigation) makes it particularly suited for understanding how ES implementation outcomes are performed through sociomaterial practices.

4.6 Selection of Case

The target population for this study was higher education institutions (HEIs) with enterprise systems implementation. HEIs represent a uniquely challenging environment for Enterprise System implementation due to their complex nature of research management and support operations. This complexity is characterized by the convergence of academic and administrative domains, diverse stakeholder interests, and an ever changing research landscape. HEIs serve as an ideal setting for this study as they offer a distinctive opportunity to examine the intricate relationship between academic and administrative spheres, which is essential for understanding the sociomaterial practices in ES implementation outcomes. Furthermore, the dynamic nature of research activities, coupled with increasing demands for accountability and transparency in higher education, makes HEIs particularly suitable for investigating the research questions at hand.

The selection of a single case study was driven by two critical considerations. First, HEIs, represent a uniquely complex environment for enterprise system implementations, characterized by intricate research management processes and diverse stakeholder interests. Second, given the limited research resources, a single case study approach allows for an in-depth, comprehensive investigation that prioritizes depth over breadth. This methodological choice aligns with Voss et al. (2002), who argue that resource constraints can be strategically transformed into an opportunity for more nuanced research.

The unit of analysis is the enterprise system implementation within the selected higher education institution, enabling a holistic examination of the sociomaterial dynamics surrounding the implementation process.

In agreement with the research timeframe, a retrospective case was selected. A current case study involves investigating an active phenomenon where events and activities are still ongoing. The

disadvantages of this approach include its high cost, the unpredictable duration of the study, and the uncertainty concerning the suitability of the case in relation to the objective of the study. A retrospective case allows examination of completed implementations where outcomes are already known and can be evaluated after the fact. However, this approach introduces potential limitations around recall and documentation of past events. These limitations were addressed through triangulation of multiple data sources

Two possible cases were reviewed based on their recent implementation endeavour. The first involved the implementation of a research information system called RIMS while the second involved the implementation of a customer relationship management system (CRM) both in large higher education institutions (HEIs) in South Africa. The first case was selected because it was a retrospective case that was accessible by the researcher.

The large public university in South Africa involved in this study had an increasingly diverse research portfolio and student base. This profile meant that the university was able to attract more funding as the domain of research management was evolving rapidly with the expanding growth of open access, collaboration and big data. Funding agencies and donors were demanding more accountability, transparency and compliance from HEIs and at the same time government funding is on the decline; hence HEIs were finding it difficult to generate funds to maintain high educational standards (Butler-Adam, 2015; Makoza, 2015). It was evident that managing and supporting research was a complicated business. In resolving these identified problems, the university implemented the RIMS system.

4.7 Data Collection Techniques

Data was collected using mixed methods. This involved using interviews, observations, documents, field notes and a system event log. Data was collected between December 2018 and October 2019 on the RIMS implementation that took place between October 2014 and May 2017.

4.7.1 Semi-Structured Interview

Following a qualitative approach, data was collected using semi-structured interviews. Interviews are a valuable data collection method when exploring complex, subjective experiences with knowledgeable participants, but become less useful when objective, quantifiable data is required or when participant biases and limitations can significantly distort the research findings. Based on the degree of formality and structure, interviews can be categorised into three different types: structured

interview, semi-structured interview and an unstructured interview. This study used the semi-structured interview because this dynamic approach was needed to understand the doings, actions and practices of participants while still being guided by topic-related subjects.

The semi-structured interview has its weaknesses, for example, the artificiality of the interview, insufficient interview time, lack of trust, restricted access levels and potential bias from high-level participants (Myers & Newman, 2007). The researcher was, however, aware of these pitfalls and had strategies in place to mitigate them. For instance, in dealing with the artificiality of the interview and lack of trust, the researcher tried to get to know the participants as much as possible before the interviews were scheduled. To mitigate issues related to restricted access levels and potential bias from high-level participants, the researcher ensured that organization permission was approved by senior management, allowing for a variety of voices to be represented. Lastly, insufficient interview time was resolved by piloting the interview process to make sure that the time allocated was adequate.

The research protocol contains the procedure, the rules and regulations that were to be followed during data collection. It includes the research instruments to be administered as well as details of whom and where the various types of data would be collected (Voss et al., 2002). The research questions (Appendix 3) were constructed using ANT concepts and adaptions from previous ANT and ES studies (Razi & Hossain, 2012; Sarker et al., 2006).

These questions were particularised to suit the sociomaterial tenets of materiality, entanglement, relationality, performativity and practice. For example, questions examining materiality asked about "the role material played (ES system, hosting platform, documents, and manual) in the outcome of the project" and ensured "interests of all actors/players/stakeholders, including the material" were considered. Questions addressing entanglement and relationality focused on how work is performed with the system, asking participants to "explain how you perform your daily work using the implemented system." For performativity and practice, questions explored how "implementation resources (human and technical) were sourced and put into operation (enacted)" and how various artifacts were used in practice. This approach was necessary and beneficial because "substantially stronger results may be obtained if researchers particularize their research instrument" (McFarland & Hamilton, 2006, p.442). Following the guidelines by Myers and Newman (2007), the interview guide was divided into several sections. The first section was about welcoming and greeting the research participant. This was then followed by a brief explanation of the research purpose and benefits. Next, ethical and confidential issues were dealt with and, finally, the participant was allowed to ask

questions. The section aimed to ensure that the research participant was comfortable with the interview process. The second section asked general and contextual questions directed towards knowing the participant better. The third section was the core of the interview; it asked topic-related questions concerning the initiation, implementation, status and outcome of the ES implementation. In section four, the interviewer recorded every spontaneous question asked during the interview. Finally, at the end of each interview the interviewer thanked the research participant, requested recommendations for new interview leads and asked permission for a follow-up session if needed.

In determining interviewees, two non-probability sampling techniques, namely purposive and snowballing, were adopted (Saunders et al., 2009). The purposive sampling technique was applied to identify key actors such as the program manager and the senior coordinator of the publication management team who were knowledgeable about the implementation of RIMS. They were selected based on their position and experience in anticipation that they would provide different perspectives on the implementation. The snowballing sampling technique was applied to identify new interviewees based on the recommendations from other interviewees. Table 3 provides details on the interviews conducted. The study comprised 34 face-to-face interviews in total: 23 initial interviews and 11 follow-up sessions, involving 21 unique participants. Five participants were interviewed multiple times. The publication management team members required multiple follow-up interviews because their sociomaterial practices and relationships with RIMS continuously evolved as they experienced the system's limitations first hand in their daily work, developing workarounds and taking on unplanned responsibilities. Implementation team members, whose engagement was primarily focused on initial technical setup rather than ongoing system use, needed fewer follow-ups since their roles and practices remained relatively stable throughout the implementation period.

Table 3 provides details for each participant, including job title, pseudonym name (utilized to protect identity and privacy), length of stay at the organization, type of participant, interview duration, and mode of interview. It is important to note that the names presented are fictitious pseudonyms employed to safeguard the anonymity and confidentiality of the research participants, while each participant's job title is also listed.

Table 3:List of interviews

Job Title	**Name**	**Length of Stay at the Organisation**	**Type**	**Interview Duration**
Departmental administrator 1	Alex	7 years	Main	1 hour
Departmental administrator 2	Emma	13 years	Main	1 hour 40 mins
Departmental administrator 3	Michael	10 years	Main	45 mins
Faculty coordinator 1	Sophia	2.5 years	Main	1 hour 25 mins
Faculty coordinator 2	Jacob	5 years	Main	40 mins
Faculty coordinator 3	Liam	8 months	Main	25 mins
Head of department/Researcher 1	Olivia	14 years	Main	35 mins
RIMS Project manager	George	16 years	Main	40 mins
RIMS implementation team member 1	Thando	2 years 6 months	Main	1 hour 30 mins
RIMS implementation team member 2	Ethan	11 years	Main	55 mins
RIMS implementation team member 3 / Former Faculty coordinator	Ava	5 years	Main	1 hour 25 mins
			Follow up	30 mins
Publication management team member 1	Mia	8 years	Main	1 hour 35 mins
			Follow up	30 mins
			Follow up	30 mins
Publication management team member 2	Noah	25 years	Main	1 hour 35 mins
			Follow up	30 mins
			Follow up	30 mins
			Follow up	30 mins
Former publication management team member 3/Research manager at different university	Abigail	1 years	Main	35 mins
Publication management team member 4	Daniel	14 years	Main	1 hour 5 mins
Publication management team member 5	Harper	5 years	Main	1 hour
Publication management team member 6	Benjamin	5 years	Main	1 hour 30 mins
			Follow up	30 mins
			Follow up	30 mins
			Follow up	30 mins
Publication management team member 7	Bolu	4 years	Main	1 hour 40 mins
			Follow up	30mins
RIMS implementation team member 4	Charlotte	2 years	Main	1 hour 10 mins
			Follow up	20 mins
RIMS implementation team member 5	James	10 months	Main	1 hour 10 mins
RIMS implementation team member 6 (vendor)	Merlin	4 years	Main	1 hour 5 mins
RIMS implementation team member 7	Fred	7 years	Main	50 mins

4.7.2 Document

As a source of data, documentary evidence such as business case, policy document, review report, user requirement specifications, user manuals, and standard operating procedures were examined for this study. Table 4 provides details such as the name of the document, a shortened name and the document source for each document. We reviewed a total of 17 documents for this study. These documents assisted in providing context to this study, supplementing collected data and suggesting interview questions. They also helped in suggesting activities to be observed and corroborated, while simultaneously disputing evidence from other data sources. This data collection technique was adopted because of its cost-effectiveness, stability, exactness and coverage (Bowen, 2009). The combination of direct observation, field notes and documentary evidence were beneficial because it allowed the comparison of evidence which assisted in avoiding biased selection and insufficient details.

Table 4:List of documents

Name of Document	**Shortened Name**	**Document Source**
New Research Strategy	New_Research_Strategy_Doc	University Website
RIMS Implementation Planning: October to December 2014	RIMS_Planning_2014_Doc	RIMS implementation team
Ìwádí Research Business Process Readiness Framework	Iwadi_Framework_Doc	RIMS implementation team
Department of Higher Education and Training (DHET) Research Output Policy	DHET_ResearchOutput_Policy_Doc	RIMS implementation team
Capturing Research Outputs Manual	ResOutput_Capture_Manual_Doc	RIMS implementation team
Manage and Controlling the Pubcount Process Manual	Pubcount_Process_Manual_Doc	RIMS implementation team
Verification and QA of Research Outputs Manual	ResOutput_Verification_Manual_Doc	RIMS implementation team
Publication Workflows Split	Pub_Workflows_Split_Doc	RIMS implementation team
Publication Workflow as is	Pub_Workflow_AsIs_Doc	RIMS implementation team
DHET Publication Count Report Technical Specification	DHET_PubCount_TechSpec_Doc	RIMS implementation team
DHET Publication Count Report Requirements	DHET_PubCount_Requirements_Doc	RIMS implementation team
Publication Report_ Research Council 2017	ResCouncil_PubReport_2017_Doc	RIMS implementation team
Post-Mortem for Publication Count 2017	PubCount_PostMortem_2017_Doc	RIMS implementation team

Name of Document	Shortened Name	Document Source
Report on the Evaluation of the 2016 Universities' Research Output	UniResOutput_Evaluation_2016_Doc	DHET Website
RIMS Internal Review Report	RIMS_InternalReview_Doc	RIMS implementation team
Faculty Fact Sheets	Faculty_FactSheets_Doc	University Website
Email Communications among Actors (12 emails)	Actor_Emails_Doc	Actors

4.7.3 Event Log

As part of the process of shadowing objects, we examined the relationships between the RIMS, publications, the pubcount practice, and end-users such as the publication management team, the researchers, the departmental administrators, and the faculty coordinators. Details of this relationship were inscribed in the RIMS event log. An event log is a system generated file that records events and activities related to the system that created them. In this study, the event log data was extracted from the RIMS in csv format, and it included event information of logged system actions that took place between November 2016 and June 2017. The log file included 1,893,258 records with details such as an identifier for each action, date performed, time performed, the user, the field the action was performed on, and the old and new value of the field. The event log data was utilized to gain insights into the interactions and activities related to the RIMS, providing a detailed record of system actions. This data was essential for understanding the system's performance and identifying any issues or inefficiencies in the pubcount practice.

4.7.4 Observation

This study employed observation as a data collection technique to gain a deeper understanding of the pubcount practice at Ìwádí University. Observation involves paying close attention to the non-verbal contextual details, behaviours, subtleties, and interactions enacted in the field of study. It assists in determining what actions are performed, why those actions are performed and by which relationships (Bowen, 2009). This approach allowed the researcher to access the taken-for-granted actions that occurred during the pubcount practice, which might have been overlooked through other data collection methods. The observation focused on the interactions and behaviors of the publication management team, faculty coordinators, and departmental administrators as they performed the pubcount practice. Specific practices observed included the submission, verification, validation, auditing, and screening of research publications. The researcher also attended user group meetings

and conducted impromptu conversations in the offices of research participants to gain further insights into the practice and its stakeholders.

To complement observations, the researcher maintained field notes, which involved taking a continuous commentary on activities, actions, and events in the case study (Eisenhardt, 1989). It is a dynamic technique that was used to intra-actively collect and analyse data which informed additional investigation and adjustments to the data collection techniques employed. More often than not, it is challenging to know what will be vital in the future; hence, this process did not involve filtering out things perceived as unimportant (Eisenhardt, 1989). The strength of the field note is its ability to facilitate the overlap between data collection and analysis.

From December 2018 to June 2019 the researcher spent at least three Fridays (full day) every month at Ìwádí and from July 2019 to October 2019 the researcher visited the research site at least twice a month. Although direct observation of the period under study (October 2014 to May 2017) was not possible due to the retrospective case, observing the current pubcount cycle provided valuable insights into the pubcount practice in general. By witnessing the annual practice involving the submission of research publications, the researcher gained a deeper understanding of the rigorous multi-stage process of sourcing, verification, validation, auditing, and screening that underpins the pubcount practice.

The observation of the pubcount practice revealed the intricate relationships between various objects, including the DHET Research Output Policy, emails, planning documents, web browsers, RIMS, publication articles, and the DHET publication count report. These objects are essential components of the ordered relations that materialize the publication count practice. Without these objects, the pubcount practice cannot exist.

In addition to observing the pubcount practice, the researcher also conducted interviews and impromptu conversations in the offices of research participants, allowing the researcher to observe them in their natural environment. Furthermore, the researcher attended two user group meetings hosted by Ìwádí in April and September 2019, which provided additional insights into the pubcount practice and its stakeholders.

4.8 Data Analysis Strategy

This study employed a multi-method data analysis approach, integrating an ANT analysis and event log analysis using process mining techniques. The ANT analysis was conducted to investigate the

sociomaterial entanglements, priorities, interests, and ontological politics surrounding the RIMS implementation at Ìwádí University. This analysis drew upon rich qualitative data sources, including interview transcripts, documents, and observational notes. It traced the emergence, reconfigurations, and potential decomposition of actor-networks over time, examining how certain issues were privileged or marginalized based on the situated sociomaterial practices, strategic interests, and discursive-material forces within different actor-networks.

Complementing the ANT analysis, event log analysis using process mining techniques was employed to extract insights from the system event data generated during the pubcount practice. This technology-centric analysis offered a window into RIMS' material agency and performativity in enabling, constraining, and interacting with the pubcount practices through its rule enforcement, data flows, and event logs. The open-source Retentioneering process mining library was utilized to visualize the trajectories of publications as an interactive graph network, revealing potential deviations or inefficiencies in the pubcount workflow.

Process mining techniques analyse event logs to discover, monitor, and improve real processes by extracting knowledge from the event data. By applying these techniques, we can visualize the actual workflows, identify bottlenecks, and understand how the system interacts with users and other elements within the process. Process mining techniques, though powerful, shape reality while depicting it, potentially favoring procedures over inherent complexity. However, by integrating these two analytical approaches, the study aimed to triangulate findings, validate insights, and uncover nuances that might have been overlooked by relying on a single analytical lens. The ANT analysis accounted for the underlying sociomaterial dynamics, priorities, interests, and politics that shaped competing realities surrounding the implementation outcome. Concurrently, the event log analysis helped substantiate how the RIMS experienced varying levels of adoption and performance across different functions and user groups within the same implementation context. This multi-method approach captured the multifaceted nature of enterprise system implementations, elucidating the inherent multiplicity and situatedness of outcomes that transcend binary success/failure depictions.

4.8.1 ANT Analysis

The following steps were followed in processing and analysing the data collected:

The first step was the data preparation step. During this step, the electronic interview recordings and all other supporting documents were backed up in the cloud. Each interview was listened to and

transcribed verbatim into text using a word processor. The process of transcribing the interviews was iterative as the researcher continuously re-listened and transcribed to ensure that no part of the recording was left out or incorrectly transcribed. In ensuring that anonymity was upheld, all personal related information was masked or removed from the transcripts. The transcribed interviews were stored as a Microsoft Word document and backed up in the cloud. Once the transcription was completed, the researcher imported the transcribed interviews and other supporting documents into Nvivo 12. The Nvivo 12 software was adopted to assist in organising, analysing and finding insights into the data. For ease of coding and consistency, the transcribed interviews were formatted. This format included ensuring that the structure of the transcription followed an interviewer-interviewee repeated sequence with the pseudo name of the interviewer and interviewee heading their respective section.

The second step was the data familiarisation step. In this step, the researcher read and re-read the interview transcripts and supporting documents repeatedly to get conversant with the content and gain an initial understanding of the data. During this process, the researcher began taking notes and documenting ideas as memos. This step was predominantly intertwined with the data preparation step because, in some instances, the researcher had to re-listen to the interview recordings and make corrections to the transcripts where necessary.

The third step was the inductive data coding step which involved identifying and coding important pieces of data prior to the ANT analysis. Memos and the Nvivo relationships functionality were used during the inductive coding process to capture the intra-actions and enactments. The researcher began the inductive coding process by reading the interviews and supporting documents repeatedly with the consciousness of the material-discursive practices inherent in the text. The material-discursive concept espouses the inseparability of materiality and discourse (Orlikowski & Scott, 2014). There exists an entailing mutual relationship between the discursive and the material such that the production of one is impossible without the other; matter and meaning are jointly produced (Barad, 2003). “In order to exist, discourse must be materialized in some form and in specific times and places” (Orlikowski & Scott, 2014, p.4).

The inductive coding process involved using NVivo to highlight interesting and eventful text that captured their essence and momentarily classified them as codes (open coding) through multiple reading of the interview transcripts, notes and documents. So, for example, the excerpt *“The submission comes through to me and I look at the hard copy and check that everything is highlighted,*

and everything is on the front page, for example if I have a Journal, I go to RIMS" was coded as *"pubcount validation practice"* because it outlines the performed practice of validating hard copy submissions against the RIMS system records.

This description was stored as a memo and linked to the code using the NVivo relationship functionality. Another example is the below data except that was coded as "*publication capturing for pubcount*".

They do send us a Scopus list of things that must be captured. We do get that all the time. I also get from the researcher. I also draw from the internet but the problem is that it mixes with health sciences sometimes and other department and you then have between 20 and 30 pages that you have to go through and scratch out the ones that are not related to this department. I do this last.

This excerpt illustrates how the practice of capturing publications is sociomaterially enacted through the interplay of human efforts (admins going through lists, scratching out irrelevant entries) and the constraints of the various material sources like Scopus lists, researcher submissions and online databases. The sources shape how the practice unfolds.

The purpose of applying an inductive coding approach was to generate codes that teased out the relationships, configurations, and actors that assisted in describing and explaining how the sociomaterial practices involved in ES implementation outcomes were performed. The ES implementation outcomes referred to in this study include the successful adoption and use of the RIMS system by various stakeholders, as well as the challenges and resistances encountered during the implementation process. Although the coding process was guided by the research question, its outcomes were derived from the raw data. The coding process involved creating new codes where appropriate and coding additional text segments to codes that had been previously developed during the analysis. For example, the data except *"Another thing with books is that because they want an actual book, you have to make an actual copy of the book which is laborious so we ask our cleaning staff to make a copy and we have to pay her R150 rand to make it in-between her duties. The DHET doesn't want a chapter within a book. Even if you have just one chapter in the book you have to give then the full book."* was also coded as *"publication capturing for pubcount".*

The final step was the ANT data analysis step, which involved tracing the coded data to uncover the sociomaterial actors, associations, practices, and emerging actor-networks involved in performing the ES implementation outcomes. This step followed ANT's principle of "following the actors" by

examining how human and non-human elements became entangled and enacted to produce different realities surrounding the implementation. The researcher analysed the coded data iteratively, identifying key events, intra-actions, and translations that revealed the actors' roles, interests, and agencies in shaping the implementation trajectory.

Particular attention was paid to instances where multiple, conflicting enactments appeared to manifest, tracing how different actor-networks privileged certain issues while marginalizing others based on their situated sociomaterial practices. For example, the Project Implementation Committee (PIC) network privileged issues like meeting DHET reporting deadlines and increasing research output metrics, while the RIMS end-user network privileged issues like system bugs, data errors, and manual workarounds. The PIC network enacted RIMS through practices like project meetings, status reports, and governance policies focused on meeting strategic goals and metrics. This was coded as "PIC enactment of RIMS". As one PIC member stated: "*The executive director of the research office is absolutely crucial. She's been committed from the beginning and has assisted us a lot...The project manager ensured that we were updated on both the positive and negative developments*" (PIC member). In contrast, the end-user network enacted RIMS through practices like system training, issue ticketing, and workarounds focused on localized challenges and unmet expectations. This was coded as "end-user enactment of RIMS". As one end-user stated: "*It just seemed like this glorified thing that was supposed to do all these cool things and make life easier did not do what it was supposed to*" (Ava, former faculty coordinator).

The ANT analysis traced how these competing enactments emerged through the situated sociomaterial practices and intra-actions of different actor-networks. The event log analysis provided material evidence of how RIMS both enabled and constrained the pubcount workflow, revealing both intended process flows and deviations/inefficiencies in actual use. Together, the analyses highlighted the ontological multiplicity and enacted nature of RIMS implementation outcomes, challenging binary assessments. By coding instances where different networks privileged certain issues while marginalizing others, the analysis uncovered how implementation outcomes are co-constituted through the complex entanglements between technologies, human agencies, organizational routines, and material infrastructures.

4.8.2 Event Log Analysis

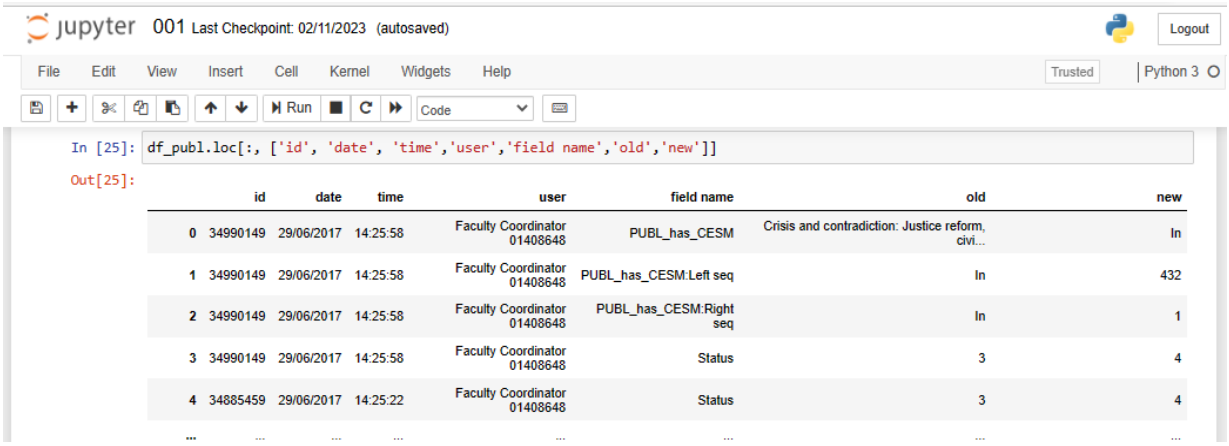
Organizational information systems like ERPs and CRMs generate event logs that record executions of business processes. Techniques like process mining, involving discovery, conformance checking,

and enhancement, now extract insights from these logs (Munoz-Gama et al., 2022). We performed conformance checking using the open source Retentioneering library to compare RIMS event logs against the formal pubcount process, revealing tensions (Maxim & Zaytsev, 2020). Process mining tools uncover divergences between codified processes and actual events, improving organizational practices.

The event log consisted of changes executed per field per publication on the RIMS. Table 5 provides a list of attributes for each record in the event log while Figure 4 provides sample records.

Table 5:List of event log attributes and description

Attribute	**Description**
Id	A unique identifier for each publication.
Date	The date a change was executed on a field.
Time	The time a change was executed on a field.
User	The username of user that executed the change on a field.
Field name	The name of the field that was changed.
Old	The old value stored on the field.
New	The new value stored on the field.



	id	date	time	user	field name	old	new
0	34990149	29/06/2017	14:25:58	Faculty Coordinator 01408648	PUBL_has_CESM	Crisis and contradiction: Justice reform, civi...	In
1	34990149	29/06/2017	14:25:58	Faculty Coordinator 01408648	PUBL_has_CESM:Left seq	In	432
2	34990149	29/06/2017	14:25:58	Faculty Coordinator 01408648	PUBL_has_CESM:Right seq	In	1
3	34990149	29/06/2017	14:25:58	Faculty Coordinator 01408648	Status	3	4
4	34885459	29/06/2017	14:25:22	Faculty Coordinator 01408648	Status	3	4
...	...	...	...	...	...	...	...

Figure 4:Sample event log records

The extracted event log files were read by a python script which checked each record and flagged it as being related to the pubcount process or not. This enabled us to see how different users interacted

with the RIMS over time. By counting the number of actions performed per user and sorting the result in descending order, we could identify both frequent users which indicated system familiarity, as well as infrequent users whose limited interactions provided indication of challenges or resistance. The different levels of user engagement revealed in the logs foreground the emergence of distinct user identities- expert users who fully embrace system, occasional users who use certain features, and resistant users who avoid the system. Examining these identities emerging through sociomaterial entanglement provide a nuanced view into how RIMS was embodied within work practices. Hence, the logs provided an opening into the intertwining of human and technological actors constituting the sociomaterial practice of the RIMS implementation. The event log files were not just analysed to identify potential interviewees/users' identities, but also to gain insight into the sociomaterial practices involved in the RIMS implementation. The Python script used for the event log analysis was developed entirely by the researcher. Details of the script is available in Appendix 4.

To identify deviations or inefficiencies in the use of the RIMS to facilitate the pubcount process we applied the rete.plot_graph() function of the Retentioneering library to visualise the trajectories of publications as an interactive graph network. Furthermore, we set the links and nodes threshold of the function to 0.015 and 0.05 respectively to avoid cluttering the graph. Any node or edge below this limit were removed from the graph. The event log contains many transitions of publications, which have both individual and common patterns that they take in transitioning between events. rete.plot_graph() combines all the paths together and shows how publications navigated through the pubcount process on the RIMS (Maxim & Zaytsev, 2020). Figure 5 shows the implementation of the rete.plot_graph() function while Figure 6 shows the resulting interactive graph network of the pubcount process. The insights gained from this log analysis are presented and discussed further in the Research Findings chapter.

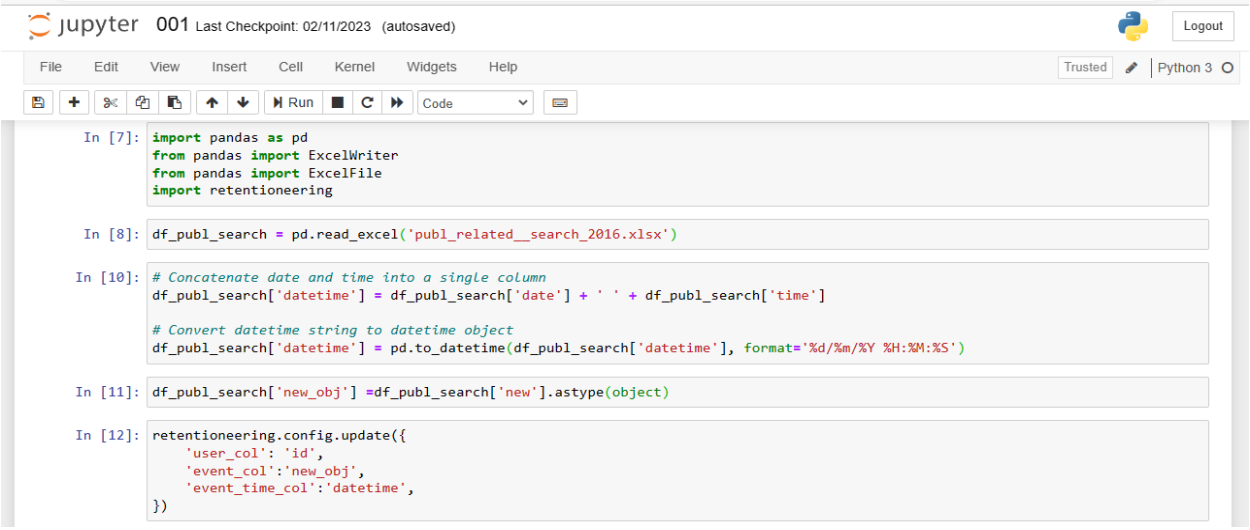


Figure 5:Implementation of the rete.plot_graph() function

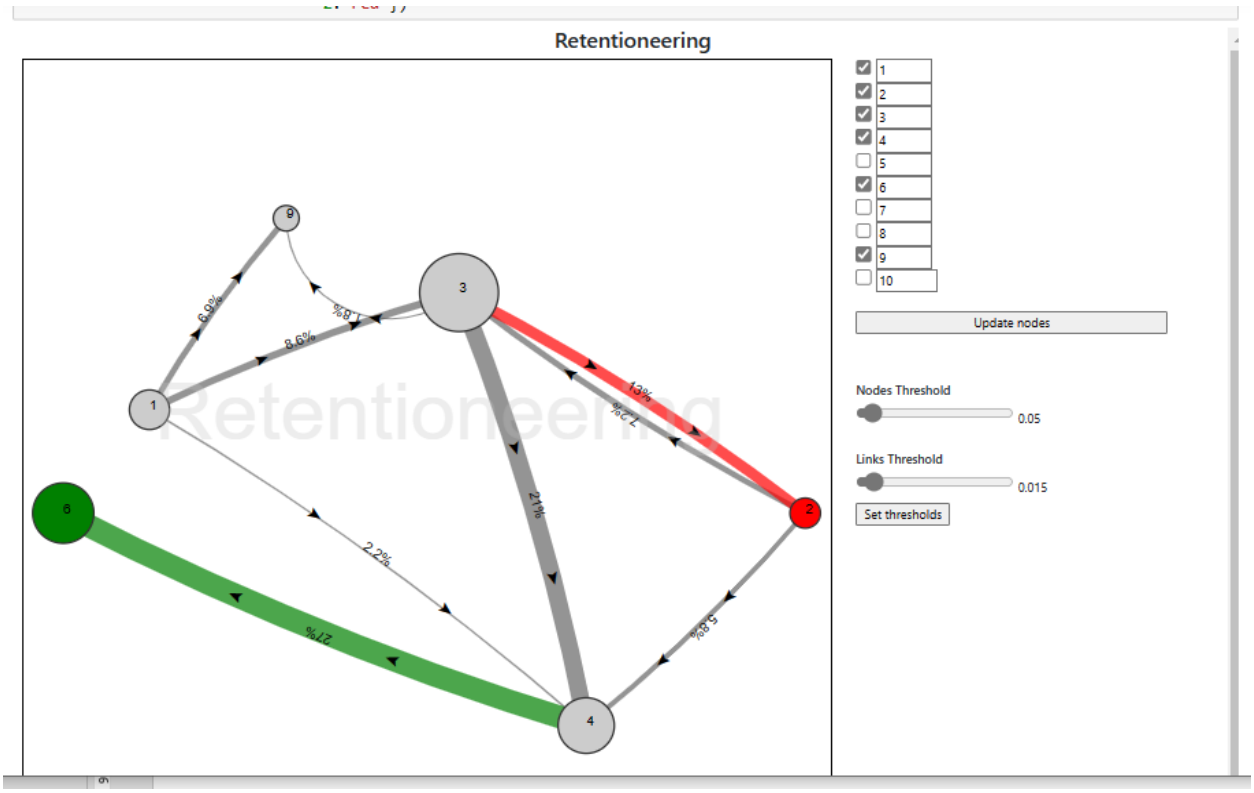


Figure 6: Interactive graph network of the pubcount process

4.9 Reliability and Validity of Research

Ensuring the reliability and validity of research is an important aspect of case study research. Internal validity and external validity are two dimensions of validity. Internal validity relates to how truthful

conclusions drawn from this study are and how they relate with reality while external validity is concerned with transferability, that is, the extent to which conclusions from this study can be generalised to other cases (Anfara et al., 2002). In ensuring internal validity, prolonged engagement in the field and triangulation of data sources were employed, while the provision of thick description and purposive sampling were used to provide a rich and nuanced understanding of the case, informing the development of theoretical propositions that can be applied to similar contexts (Anfara et al., 2002).

Reliability refers to the extent to which the activities and operations performed in a case study are repeatable and produce the same results (Yin, 2003). Reliability was achieved by ensuring that a comprehensive research protocol was provided for data collection and analysis. This involved providing detailed documentation of the inner workings, processes and decisions that were involved throughout the course of collecting and analysing data. This form of analytical openness was made available to the public for review so as to ensure replicability (Anfara et al., 2002).

4.10 Ethics

First, the researcher approached and obtained permission to conduct case study research on the participating organisation. Prior to data collection, the researcher obtained ethics approval from the Faculty of Commerce at the University of Cape Town to conduct this study (Appendix 1). This was to ensure that all moral principles in conducting research were upheld. To participate in this research was voluntary, and each human actor had to sign a consent form (Appendix 2). Before the commencement of each interview, the researcher briefed the participant on the purpose of the research and enlightened the participant on the freedom to opt-out should the need arise. All data collected was stored confidentially and securely. Pseudonyms were used in ensuring that all participants were reported anonymously in the research findings.

4.11 Chapter Summary

This chapter explains the research methodology that was employed in this study. Table 6 summarises the research design for the study.

Table 6:Summary of research design for this study

Research Design	**Summary**
Ontological perspective	Agential realism
Research underlying theory	Actor-network theory
Research purpose	Explanatory
Research approach	Abductive approach
Research design	Case study
Data collection methods	Semi-structured interviews, documents, system event log, observations, and field notes.
Data analysis	ANT analysis, Event log analysis
Research timeframe	Cross sectional

5. Case Description

This chapter presents an in-depth description of the case used for this study. It provides some insight and background information useful for analysing and making sense of the data collected.

5.1 Ìwádí University

The researcher conducted this case study at a university, which for this research has been given the pseudonym Ìwádí. Ìwádí, as measured by top university rankings, was a leading university in South Africa. One of the reasons it had been able to hold and maintain its local and international position was its quality and volume of research output. In 2014, Ìwádí declared a new ten-year strategy (2015-2025) to become a research-intensive university, and it acknowledged the need for research support to achieve its goal (Iwadi_Framework_Doc). This strategy identified excellent IT support as a positive mechanism to promote international research collaboration, increase research visibility, enhance interdisciplinary and transdisciplinary research, support engaged scholarship, and bring research into teaching.

Ìwádí had six faculties that spread across commerce, engineering, humanities, law, science, and health science (Faculty_FactSheets_Doc). In terms of research, the health science faculty was known for consistently generating huge funding income and producing a lot of research output (Faculty_FactSheets_Doc). Each faculty is linked to several academic departments and research units. Collectively, faculties at Ìwádí were related to over 200 academic departments (Faculty_FactSheets_Doc). Several support departments such as human resources, the research office, the library, finance, information, and technology services were central organisation units that were not linked exclusively to any faculty or department. They assisted with the day to day running of all academic faculties and departments.

The research office at Ìwádí was responsible for research affairs. It provided careful and dedicated support to researchers and research in both the human and technical spheres. The scope of its activities included research funding, pre- and post-award processes, research management and integrity, tracking and reporting research output, and progressing researchers' careers and standings. Thus, the research office was responsible for assisting Ìwádí in achieving its new research strategy, precisely around research support. Furthermore, to unpack the effort required to improve research support at Ìwádí, the research office employed an ex-university employee as a consultant architect. The consultant architect had a long career with the IT department of the university.

At Ìwádí, several support departments and faculties facilitated research management. Over the years, these departments and faculties have created various solutions to manage and support the increasing research processes at Ìwádí without having a university wide outlook. These solutions included acquiring and, in some cases, developing ad-hoc software solutions to address specific needs. As a result, the functions, structure and administrative systems used to administer and support research at Ìwádí have increased and developed into silos. Research support often followed a similar process; however, at Ìwádí, the different systems and processes were somewhat disjointed and separated with gaps and overlaps, creating an environment where supporting research was challenging. To resolve this problem, the consultant architect initially focused on the practice of publication count. The consultant architect identified quick wins for this practice because it was standardized practice that affected several organisational units within the university's research enterprise. Furthermore, it was an important activity because Ìwádí depended significantly on the subsidy it generated from the DHET for financing and supporting research.

5.2 The Publication Count Practice

The publication count practice commonly referred to as pubcount in Ìwádí was an annual research support activity conducted in public higher education institutions (HEIs) in South Africa. It involved HEIs submitting research publications affiliated to their institutions to the DHET for direct research subsidy as instructed in the DHET research output policy (DHET_ResearchOutput_Policy_Doc). The DHET research output policy aimed to stimulate research productivity in South Africa by rewarding public HEIs that had produced quality research publications during the year (DHET_ResearchOutput_Policy_Doc). To determine which publication must be submitted, the DHET updated the submission requirements for each publication type. For instance, before the commencement of a pubcount cycle, the DHET sent a list of accredited journals to each HEI. Therefore, a journal article must have been published in a DHET accredited journal for an HEI to count it during the pubcount practice. The DHET assigned each submitted publication with a defined unit, and the amount of research subsidy received by an HEI was dependent on the total number of assigned units (DHET_ResearchOutput_Policy_Doc). Aside from the research subsidy, the number of DHET received units indicated the HEI research strength.

The publication management team at the research office of Ìwádí University initiated the pubcount by sending out a submission call via email to all deans, directors, heads of department, faculty research committees, departmental administrators, and faculty coordinators. The submission call invited them

to submit their related research publications for the year to the DHET. The pubcount practice included five stages, namely: sourcing, verification, validation, auditing and screening, and submission as illustrated in Figure 7. Although these stages are described sequentially, in reality this was not the case as they were inextricably interwoven.

Publication sourcing involved the practice of searching for and collating published articles affiliated to the university and capturing them into an electronic system. Prior to the RIMS implementation, under the legacy Óparí system, the publication sourcing process followed a well-established workflow. Researchers would submit their research articles to their departmental administrators either through email attachments or by delivering physical copies in person. Publication sourcing submissions were a combination of metadata records and printed or electronic copies of the full text. Unofficially, the senior data analyst at the research office also assisted by sourcing metadata records of research articles affiliated to Ìwádí from the Scopus database. The sourced Scopus list of research articles were stored on a Microsoft Excel spreadsheet and distributed by the senior data analyst to each department via the faculty. In addition, some departmental administrators also searched various online research databases to source for related research articles. Finally, all sourced research articles were captured into the legacy research management system by the departmental administrators.

Ìwádí implemented the legacy research information system called Óparí in 2006, and by 2014 the users of the system did not like it very much because of its outdated look, poor data quality, high maintenance cost and delayed support from the vendor. The university implemented Óparí in isolation without integrating it into other internal or external IT systems, which created many downstream issues with user experience and reporting. Departments and researchers had to use different systems to capture and display their publications because Óparí did not have a research portal. Óparí also excluded researchers because it did not provide them with an interface to capture, view and edit their publications.

The next step of the pubcount practice was the publication verification. Publication verification involved the practice of ensuring that the publication articles met the submission requirements. At this stage, each departmental administrator verified that the submitted publications met the pubcount criteria specified in the DHET research output policy. They then submitted each publication electronically (metadata via Óparí) and in full text (hard copy) to their respective faculty coordinators. All submissions throughout the pubcount practice were made electronically (metadata) and printed

(hardcopy). Hence, each publication article existed materially on paper and as an electronic database record.

At the second level of verification, the faculty coordinators verified the submitted hard copies against the electronic metadata of the published articles. Each submission must meet the DHET's requirements; otherwise, the faculty coordinator queried the submission. The verification included checking things such as the eligibility of the publication year and the accreditation of the related journal for a journal article. Finally, the faculty coordinator submitted all the verified publications to the publication management team for validation.

The publication management team, consisting of six full-time staff members at the research office, spent approximately four months validating all the electronically submitted publication metadata using accompanying hardcopy submissions. The validation included checking things such as confirming that the publication capturer submitted the correct supporting documents required for published research output. For instance, a book/chapter needed supporting documents such as a statement from the author and a sticky note to tag relevant sections of the book/chapter. Each research article record was processed individually on Óparí; hence, the faculty coordinators and the publication management team did not have to wait for the departmental administrators to capture all the related research articles before they verified and validated the submissions.

Once the publication management team completed the validation, they contacted an external auditing firm and faculty research committees. The external auditing firm audited all qualifying journal articles while the faculty research committee vetted all qualifying books and book chapters in an internal screening meeting. Once completed, the publication management team prepared and submitted the pubcount report and the hardcopies of articles to the DHET. Finally, the DHET audited the submission from all public HEIs in South Africa and awarded research subsidies for the articles that met the submission guidelines specified in the DHET research output policy document.

While the pubcount practice had been conducted using the legacy system Óparí for over a decade, in 2015 the Research Office initiated a project to implement a new research information system with the aim of improving efficiency and addressing the limitations of Óparí.

The colours in Figure 7 below represent the different stages of pubcount sourcing (orange and green), verification (blue), validation (yellow), auditing and screening (pink), and submission (grey).

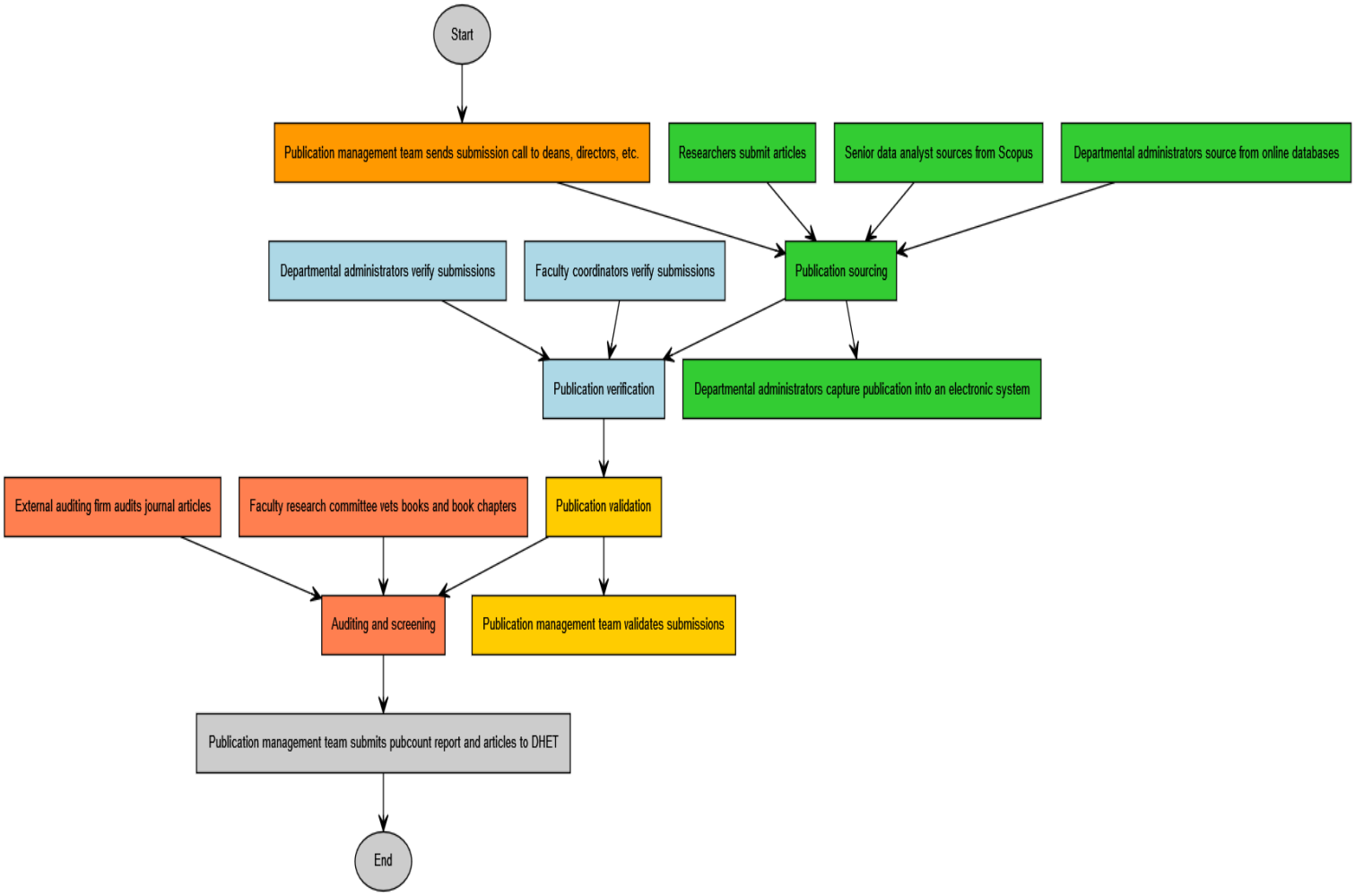


Figure 7: The Stages of Pubcount

5.3 The Practice of RIMS Implementation

Pre-implementation Phase

Ìwádí University had been using an old research information system called Óparí to manage research publications and related data for over a decade, having replaced an even earlier system around 2006. However, over time, Óparí faced several challenges related to functionality, adaptability to changing requirements and priorities, and long-term support. By 2014, the Research Office hired external consultants and initiated a business process review to examine and identify opportunities for improving efficiency in the university's research enterprise. This review, conducted by external consultants, involved an in-depth analysis of the Research Office's operations.

A significant finding from the business process review was the need for an integrated enterprise research information system to streamline and enhance research data flows and processes. The external consultants revealed that Óparí could no longer adequately meet the evolving needs, citing issues such as long delays and high costs for basic change requests, constrained reporting capabilities, difficulties integrating with external research systems and internal data sources, and an over-dependence on a small overseas vendor team for support.

The Research Office leadership had a broad vision of combining research data into a single enterprise system to enable process automation, data integration, and simplified reporting. Several key stakeholders were enthusiastic about the idea, seeing potential benefits. The Research Office leadership saw it as an opportunity to re-engineer research processes for improved efficiency. Individual faculty, departments, and research units hoped the enterprise system would simplify administration and reduce manual processes. There was optimism that automating and unifying research management processes using a single enterprise system would increase productivity. However, some members of the publication management team, who worked directly with research data, expressed doubts about the enterprise system's ability to produce useful reporting, given the fragmented nature of master data across systems.

With a broad consensus within the Research Office that Óparí needed replacement, a project team consisting of Research Office leadership, administrators, and external consultants was assembled to develop criteria and requirements, issue an RFP, and evaluate proposals. The project team reported to the project implementation committee (PIC). The formal RFP outlined key capabilities needed, including consolidating research data into a centralized repository, automating and optimizing manual research processes, improving reporting capabilities using consolidated data, and replacing the legacy research information system.

Several systems were considered, including ones from large research information systems vendors. Initially, a system from a large vendor was the first choice, but it was set aside due to concerns about high level of required customizations. As Noah (Publication management team member 2) stated "*We were particularly interested in one system which we do not have now, and I actually respect them very much in the sense that we were prepared to buy the system when they said to us, 'We are not prepared to alter our system to make it work for your needs. What you require is not available at this point.*"'

Ultimately, DC Research Limited's research information system called RIMS was selected in late 2015, as it was believed to meet the criteria. DC Research Limited is a pseudonym. The plan as per

the project charter was to deliver a phased implementation over two years, starting with the RIMS for publications management to immediately resolve concerns with Óparí before addressing the rest of the envisioned integrated research ecosystem.

The decision to select the RIMS rested on factors such as the breadth of offerings to match current (publication management) and future needs (ethics management and contract management), the vendor's market credibility and support capabilities, and financial considerations. Some members of the publication management team raised concerns during the system evaluation phase about the lack of clarity on automated report generation and how publication data would be loaded into the new system from the old system. However, these issues were set aside with the notion that technical experts would address the specifics later.

Despite requests, no detailed transition plan from Óparí or concrete details on certain capabilities of the new system were provided during the RFP evaluation stage. Nonetheless, the Research Office leadership and external consultants remained convinced that the RIMS offered the flexibility and customization potential required to meet their objectives. They viewed the RFP practice as consistent with industry practices and believed they had valid motives behind the crucial choice. These motives included an aging legacy system that could not support the university's vision, confidence in a well-known research system vendor and its product, and financial restrictions that limited options. The Research Office leadership signed a contract with DC Research Limited in April 2015 to purchase and implement RIMS.

DC Research Limited, the system vendor, viewed the selection as an overall win, as securing a top university like Ìwádí as an enterprise-wide installation reference could open additional sales opportunities within the South African HEI market. However, successfully deploying a research administration solution like RIMS for the first time required overcoming situational intricacies, including significant software customization and consulting assistance to bridge gaps between assumptions embedded in the base product design and Ìwádí's localized requirements.

Implementation Phase

After contract signing with the vendor, the Research Office leadership appointed the lead external consultant George as the project manager to lead the implementation effort. Recognizing the project team's lack of required technical expertise, George brought on technical staff from the university, new hires, and vendor consultants to create the RIMS implementation team.

In April 2015, vendor consultants installed the RIMS on Ubuntu Linux servers hosted on university infrastructure. Although the vendor recommended Red Hat Linux, the university opted for Ubuntu (a close alternative) since they lacked Red Hat experience. Unknowingly, this operating system substitution introduced performance challenges later on due to differences between platforms. Through vendor-led training, the RIMS implementation team learned the necessary skills to customize and configure the system to meet their needs. The system analysts from the RIMS implementation team engaged the publication management team via focus groups to learn about the publication management work practices and technical needs. With these discoveries documented as functional requirements, the vendor consultants and system analysts translated specifications into technical criteria to guide system set-up, customization, and integrations with internal and external systems. Once the new system implementation started ramping up, the project manager, George, locked down Óparí and made it read-only, as running both systems in parallel was seen as too complex and costly.

Final system implementation testing coincided with initial user training workshops. This strategy of using the user training workshops to test the system implementation was largely motivated by the inflexible project deadline, tied to the pubcount report submission deadline mandated by the DHET. System end-users, including the publication management team, faculty coordinators, and department administrators, expressed dismay over training gaps. They expected comprehensive training instead of feeling abruptly put into using the system without adequate guidance. The training happened close to the deadline for the 2016/2017 pubcount cycle, so there was intense pressure right away.

Despite complaints over rushed preparations, the system end-users commenced publication capturing and validation on the new system by year end. For them, waiting idly to address concerns about the imposed system was not an option, as the external deadlines set by the DHET had financial implications, ruling out any soft launch plans or rollout delays. This aggressive timeline led to the emergence of crucial gaps post-launch, as expedited testing left embedded system issues undiscovered, and it did not give users the knowledge and skills needed to confidently use the new system.

Once the new system launched for the 2016/2017 pubcount cycle in December 2016, system end-users encountered multiple functionalities, workflow, and data quality issues in their daily use. Complaints flooded in about system bugs impeding publication imports, unfamiliar interfaces complicating usage, response lags and freeze-ups slowing performance, missing integrations causing manual work, and inaccurate or incomplete data triggering validation failures. As Jacob, a faculty coordinator, described, "*Oh, the headache. It was a nightmare...you couldn't access a file once it had been saved, then you*

couldn't find the file, then the file went missing, and then it was appearing again, so it was like, so disorganized"

At Ìwádí University, department administrators had traditionally been responsible for capturing publication data on behalf of researchers over the past 10 years. Even though the system was highly configurable and the project team localized it to an administrator-centric workflow, it exhibited rigidity as some features could not be fully adapted. For example, the publication harvesting feature only allowed importing one researcher's publications at a time. This limitation did not suit administrators who needed to import publications for multiple researchers simultaneously. Initially, the vendor had presented the harvesting functionality as a way to replace manual data capture, saving administrators substantial time. However, after implementing the RIMS, it exhibited limitations, and it became evident that this feature did not adequately scale for the administrator use case at Ìwádí University. The inability to accommodate the needs of administrators managing publications on behalf of multiple researchers revealed deficiencies in supporting publication capturing practices at Ìwádí University.

RIMS end-users' (publication management team, faculty coordinators, and department administrators) complaints triggered a time-consuming sequence of reporting via support tickets, tracking of fixes, following up for status updates, and confirmation of resolutions. For end-users, pubcount was only a fraction of their portfolio of duties, hence these new system obstacles compounded frustrations and distracted them from primary job responsibilities. The publication management team found themselves overwhelmed, as their previous role of providing high-level non-technical subject matter guidance and validating publications had transitioned overnight into a fire hose of basic technical how-to inquiries and bug mitigation via workarounds. They lacked both the experience and manpower required to handle this excessive surge of support requests, as support tickets were not utilized while using the old system Óparí.

Concurrent organizational restructuring within the Research Office, triggered by the business process review recommendations, further exacerbated the launch issues. Employees were worried about their jobs, being reshuffled to new functional groups, and adjusting to new managers and unfamiliar colleagues. This concurrent organizational reshuffling aggravated launch issues, impacted knowledge sharing, and disrupted normal work practices. Motivation levels among the publication management team decreased during this time of change and uncertainty, and the collaboration needed for system rollout was replaced by tension between the publication management team and the RIMS

implementation team. With the publication management team impaired by a non-conducive working environment, support for the pubcount practice was constrained. These lapses shattered the expectations the department administrators and faculty coordinators had for a smooth transition, as they had hoped that the implementation of the RIMS would produce benefits that made the effort worthwhile. However, once implemented, they realized that the burdens imposed were greater than anticipated.

Post-implementation

After a difficult rollout, the RIMS implementation team's main focus was to stabilize system performance and address issues impacting the RIMS end-users reliant on the new system for pubcount. Onboarding additional end-users, applying system fixes, refining processes, and managing users' expectations occupied most efforts in the months post-launch. The publication management team escalated support tickets to the RIMS implementation team, but they also struggled to keep up with the high volume of requests and lacked specialized knowledge to address many of the issues as evidenced by Thando (RIMS implementation team member 1): "*that process was very difficult in the beginning because there was a lot of backlog into our internal ticket system*"

To ensure the Research Office could complete the 2016/2017 pubcount cycle with the new system, the RIMS implementation team prioritized support tickets and complaints addressing the most urgent issues. These prioritized requests centered on reducing publication capture time, fixing system performance issues, and expediting the DHET report over internal pubcount reports. Other support tickets were closed and parked for future review so the team could focus on the urgent issues. First, to reduce publication capture time, the RIMS implementation team bulk uploaded records to avoid manual data entry. Next, the vendor identified that an operating system incompatibility had caused system freezing and deployed a software patch to improve performance. Finally, a dedicated vendor report specialist assisted with expediting the delivery of the DHET reports.

The implementation of the new system was painful for department administrators who relied on it for capturing publication data. The impromptu imposition of a new system without choice, coincided with a major internal reorganization, compounded negative sentiments among end-users like department administrators, faculty coordinators, and the publication management team. As Jacob (Faculty coordinator 2) put it, "*I was forced into the system; well, we were all forced into the system*". Reactions included resentment over changes and doubts that the promised capabilities would materialize. Inadequate upfront training and ineffective change management around the rollout created confusion,

frustration, and lack of confidence in using the new system among these end-users. The publication management team struggled through the first chaotic pubcount cycle in crisis mode, accumulating publication validation backlogs, without a backup plan other than being forced to make the RIMS work. Unreliable system performance due to operating system compatibility issues added disruption.

In the end, the absence of thorough end-to-end analysis with detailed requirements gathering from end-users, underestimated complexities, and an overreliance on software flexibility as a catch-all solution by the RIMS implementation team contributed to technology-organization misalignments and unmet expectations in the challenging implementation phases to follow. The RIMS was built with design assumptions that required researchers to capture their own publications, but at Ìwádí, administrators handle most of the publication data entry, suggesting a mismatch between how the technology was designed and how research administration actually works at the university. The RIMS implementation was deemed a failure by end-users including department administrators, faculty coordinators, and the publication management team directly labelling it as such in their interviews and feedback. Thando (RIMS implementation team member 1) noted "*a lot of [support] calls and a lot of issues*," while inadequate user acceptance testing led to predictable problems. Manual workarounds persisted, contradicting promises of automation. Benjamin (Publication management team member 6) and Thando (RIMS implementation team member 1) bluntly stated that the first cycle was a failure, citing inadequate planning and rushing to go live. Ava (Faculty coordinator) highlighted the mismatch between expectations and reality: "*It just seemed like this glorified thing...did not do what it was supposed to do*."

From the PIC's standpoint, the RIMS implementation enabled consolidated administration and reporting of publication outputs across all faculties on the first trial of the new system for the 2016/2017 pubcount cycle leading to increased research subsidy from the DHET. Previously, compiling the pubcount report submission for the DHET required sourcing people and organizational data manually, as the previous system wasn't integrated with the relevant internal systems. The new system facilitated streamlined annual pubcount reporting and research subsidy claims from the DHET. The implementation of the new system was in line with the university's strategic push towards digital transformation and automated business processes, as it replaced the legacy system with a modern one that fitted perfectly with that long-term vision.

In the 2017 annual research report to the university senate committee, the PIC reported the new system implementation as a success, citing wins such as consolidated reporting, streamlined processes,

increased research subsidy and alignment with the digital transformation vision. As a result, they approved funding for the system implementation project to be extended for an additional two years. During this time, the project team was tasked with resolving the teething issues experienced during the 2016/17 pubcount cycle and configuring the system for other research areas such as pre-awards and ethics processing.

Table 7 contains the sequence of significant implementation events that occurred during the pubcount RIMS implementation. The researcher constructed this sequence using data sources such as interview transcripts, field notes, emails, system log files, meeting notes and other documents.

Table 7:The sequence of key implementation events

Event	**Date**	**Implementation Phase**
Business process review identified need for integrated research information system	Mar 2014	Pre-implementation
RIMS system from DC Research Limited selected after RFP process	Jan 2015	Pre-implementation
Contract signed with DC Research Limited for RIMS	Apr 2015	Pre-implementation
RIMS installed on Ubuntu Linux servers (instead of recommended Red Hat Linux)	Jun 2015	Implementation
User requirements gathered, system configured and customized	July - Nov 2015	Implementation
Óparí system (legacy) locked down and made read-only	Oct 2015	Implementation
User training conducted close to pubcount deadline, combined with system testing	Nov 2016	Implementation
RIMS went live for 2016/2017 pubcount cycle amidst issues like bugs, poor performance	Dec 2016	Implementation
Publication team overwhelmed with high volume of support requests from end-users	Jan-Mar 2017	Post-implementation
Efforts to stabilize system, address urgent issues, manage expectations	Jan - May 2017	Post-implementation
Implementation explicitly categorized as failure by end-users due to system problems, manual workarounds, unmet promises	Mar 2017	Post-implementation
Annual report cited implementation as success based on increased research subsidy	Nov 2017	Post-implementation
Project extended for 2 more years to resolve teething issues and configure other modules	Dec 2017	Post-implementation

5.4 Chapter Summary

This chapter has discussed the contextual setting where this research occurred. We presented a description of the selected case with a particular focus on the process and implementation within which the phenomenon under study occurred. This was necessary as it ensured that this study provided a rich understanding of the phenomena being examined and helped in enhancing the generalisability and transferability of the findings.

6. Research Findings

This chapter unveils the empirical findings from investigating the RIMS implementation at Ìwádí University. Drawing from an Actor-Network Theory analysis and event log analysis, it elucidates the sociomaterial complexities surrounding the implementation. The findings expose how multiple, divergent realities of success and failure emerged through ontological politics across different organizational networks.

6.1 Tracing Sociomaterial Reconfigurations: An ANT Analysis Findings

The findings draw from an ANT analysis examining the sociomaterial entanglements surrounding the RIMS implementation at Ìwádí University. ANT provides concepts for tracing how heterogeneous actor-networks continually emerge, transform, and potentially decompose through intra-actions and practices over time. Key ANT and After ANT concepts applied include translation, performativity, sociomateriality, agential cuts, and multiplicity. The analysis tracks how the RIMS implementation was iteratively enacted and reconfigured within different interrelated actor-networks. It pays close attention to destabilizing events, issues, breakdowns, and adaptations that disrupted network relations.

Ultimately, the analysis takes an ontological turn by examining how competing realities of the implementation outcome (success/failure) were performed across distinct actor-networks. It applies the concept of ontological politics to reveal how these assessments emerged relationally, shaped by the priorities, incentives and strategic interests influencing what got included/excluded in sociomaterial "reality-making" across networks. Through this rigorous ANT approach, the analysis generates rich insights into the multifaceted sociomaterial dynamics surrounding large-scale technological implementations within organizations.

While the language used in this section may suggest a separation between actors, it is crucial to recognize that this separation is an analytical agential cut employed to make sense of the entangled phenomena under investigation and not a reflection of inherent separability. These elements are inherently entangled and co-constituted. The agential cut allows focused analysis while acknowledging their underlying inseparability within the sociomaterial configuration.

6.1.1 The Emergence of the Research Administration Modernization Network

The origins of the RIMS implementation vision stemmed from a business process review conducted by the university's Research Office leadership looking to modernize outdated research administration practices. Research data was managed in siloed, decentralized systems across the university and this created inefficiencies. Reporting and monitoring had also become increasing difficult. This frustration aligned with the new ten-year institutional strategy that identified IT support as a positive mechanism to facilitate Ìwádí become a research-intensive university. Research administration presented an ideal use case - high profile yet bound by legacy research systems inhibiting long term research process integration. Key initial actors were thus Research Office leadership, along with external consultants they enlisted to articulate and rationalize the use case. Together they outlined, objectives, drafted initial requirements and business case; and moved to enroll additional allies towards making their vision a reality. The actors - including the Research Office leadership, external consultants, the business case and the new ten-year institutional strategy - formed an initial network with the goal of implementing the IT to support research administration.

A significant milestone in the network's expansion was the contracting of a renowned software vendor, DC Research Limited, and their enterprise research information system called RIMS. Although DC Research Limited had not previously implemented RIMS at a South African HEI, its enrollment was influenced by intra-actions producing its perceived capacity as an established system for research universities globally. This capacity emerged through entanglements of technical functionalities, research governance discourses, and institutional needs for data consolidation and streamlining, shaping RIMS's agency within the actor-network. Ìwádí's interests were inscribed into a contract signed with DC Research Limited specifying required functionality, modules to be delivered, and project timelines. Formalizing this alliance also enrolled DC Research Limited technical implementation consultants into the network. Following the contract signing, George, the lead external consultant, was appointed as the project manager. To address technical expertise gaps, he assembled a team comprising university staff, new hires, and vendor consultants to create the RIMS implementation team. The Research Office leadership was accountable to the Project Implementation Committee (PIC), which oversaw the governance of the RIMS implementation. This committee comprised actors representing various stakeholders, including the research office

leadership, the project manager, and delegates from different organizational units across the university.

The publications module was identified as the first RIMS component for implementation given external DHET reporting deadlines tied to government funding. This priority set a hard, non-negotiable go-live deadline before system implementation could occur. Looming DHET regulatory compliance mandates and financial implications infused urgency that influenced network decision-making and resource allocation. The core actor-network was initially centered on strategizing, implementing, and deploying this module, which had a publication harvesting functionality aimed at automating and accelerating the publication capturing process. Additional key actors at this stage were thus the DHET requirements and reporting deadlines, RIMS, RIMS implementation team, DC Research Limited consultants, PIC and the RIMS publications module with its publication harvesting functionality. The initial actor-network formed around the RIMS publication module implementation set the stage to negotiate implementation objectives, scope, resources, and delivery timelines documented in the project charter. This actor-network is called the Research Administration Modernization Network, as illustrated in Figure 8.

The color scheme in Figure 8 helps visually group related actors while the connecting arrows and descriptive text illustrate how these actors are related and interact within the Research Administration Modernization Network. This visual representation helps trace how the actor-network emerged and how different components are interconnected. Coral/Orange is used to represent key initiating and leadership actors, specifically the Research Office Leadership and External Consultants who were instrumental in launching the initiative. Green denotes vendor-related actors and the core system, including DC Research Limited and RIMS, highlighting the technological and service provider components. Purple indicates internal project governance and implementation actors, encompassing the Project Implementation Committee (PIC), Project Manager, and RIMS Implementation Team, who were responsible for overseeing and executing the implementation. Light Blue represents system components and functionalities, specifically the RIMS Publications Module and Publication Harvesting Functionality, illustrating the technical features and capabilities. Red signifies external regulatory and compliance factors, namely the DHET Requirements and Reporting Deadlines, which influenced and constrained the implementation process. The shapes do not carry special meaning.

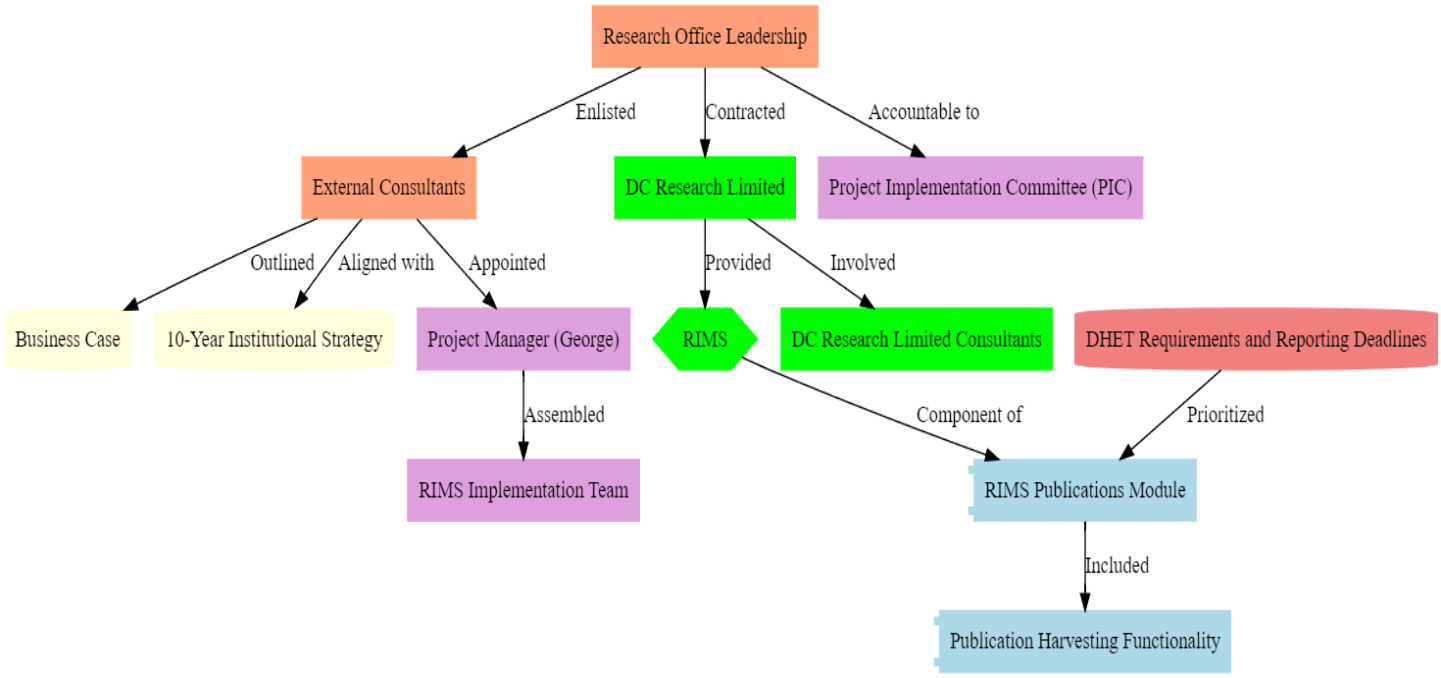


Figure 8: Tracing the Emergence of the Research Administration Modernization Network

6.1.2 Ontological Divergences and Assumption Unsettling

As the RIMS implementation unfolded, the Research Administration Modernization Network materialized around actors such as the DHET requirements and reporting deadlines, RIMS publication module, publication harvesting functionality, RIMS implementation team and DC Research Limited consultants. The Research Administration Modernization Network should not be confused with the RIMS because the former is an assemblage while the latter is the technological system. The Research Administration Modernization Network formed relationships centered on the implementation of the RIMS publication module for the 2016/2017 pubcount cycle. This implementation heavily depended on the RIMS's flexibility in configuration and its comprehensive feature set. The harvesting functionality was intended to ease the publication capturing practice and facilitate bulk importing of publications data to meet DHET reporting deadlines.

The collaboration within this network involved the RIMS implementation team and vendor consultants working together to prototype and determine system requirements for the RIMS publication module at Ìwádí. However, the lack of previous RIMS implementations at a South African HEI meant those involved had to take a repeated cycle of testing and refinement, involving hands-on prototyping within the network. This process involved "*figuring things out on the go and a lot of*

guesswork" as Thando (RIMS implementation team member 1) described it, around understanding RIMS' capabilities and configuring it for Ìwádí's pubcount needs.

This process revealed ontological divergences - mismatched assumptions and realities - between the two groups, as illustrated in Figure 9. While the vendor portrayed RIMS as a highly configurable system that could seamlessly adapt to organizational processes, Ìwádí's publication management team remained skeptical about the effort required to align it with their complex pubcount practices, given their intimate knowledge of the intricacies involved. A knowledge gap emerged as differing expertise created blind spots on each side. The vendor consultants possessed deep technical knowledge of RIMS but lacked an intimate understanding of Ìwádí's localized publication administration practices and nuanced requirements. Conversely, the Ìwádí team had comprehensive insight into their internal processes and needs but limited visibility into the system constraints and boundaries within which RIMS operated. This asymmetry of knowledge meant that neither the vendor nor publication management team conveyed their full realities to the other, fostering a mismatch of assumptions that contributed to the ontological divergences between them.

While vendor-user knowledge asymmetries are common in ERP implementations, ANT reveals how these asymmetries performed competing realities rather than just creating communication gaps. The analysis shows how different expertise and practices enacted distinct versions of RIMS through specific sociomaterial configurations. The vendor's technical knowledge and the publication management team's operational expertise didn't just create implementation conflicts - they produced fundamentally different ontological realities of what RIMS could and couldn't do. These competing realities emerged through distinct actor-networks, priorities, incentives and strategic interests shaping which version gained prominence. This theoretical lens exposes how RIMS was not a singular system but multiple realities performed through different network relations and practices.

Through experimentation, certain limitations emerged, such as RIMS' publication harvesting functionality being unable to support Ìwádí's practice of administrators capturing researchers' publications. This highlighted the divergence between the vision of RIMS as an adaptable solution and the multiple realities involved in implementing it within Ìwádí's specific organizational context.

These interactions between the vendor consultants and publication management team enacted an agential cut through their testing and requirements gathering practices. Prior to this cut, there was an entangled assumption that RIMS was infinitely configurable and could seamlessly adapt to local needs. The cut created new boundaries through hands-on prototyping practices that revealed RIMS' limitations, separating the idealized vision of a flexible system from the material constraints that emerged in practice. After the cut, new identities emerged; the publication management team's role expanded to include training, while the RIMS implementation team had to focus on backend development rather than rollout. This reconfigured the network by establishing clear distinctions between what RIMS could and couldn't do within Ìwádí's context.

The ontological divergences between different sociomaterial configurations enacted through design practices and implementation practices at Ìwádí disrupted assumptions of seamless adoption. As Thando explained, "*The system was not a fit...We had to bend the system backwards and forwards to try and get it to work for us*". This unsettling of a priori assumptions revealed how RIMS was performed differently through distinct sociomaterial practices. For instance, in publication capturing practices, RIMS materialized as a constraint requiring manual workarounds, while in reporting practices, it emerged as an enabler of DHET requirements. Through daily work practices, the assumed boundaries between 'system' and 'practice' were continuously redrawn. What constituted RIMS shifted from its anticipated identity as an automated solution to a system requiring extensive manual intervention.

In the context of ES implementations, the entanglement of design intentions and actual use practices can lead to ontological divergences. These divergences emerge as the designed configurations of the system meet the multiplicities of localized practices and realities within the organization. The interaction between these configurations and the enacted realities can unsettle pre-existing assumptions about what the system is and what it can do.

Proposition 1: *Ontological divergences arise when the interests and assumptions underpinning enterprise system design encounter the multiplicities of localized use practices. These divergences unsettle and disrupt a priori assumptions, leading to implementation outcomes that reflect a performative enactment of the system's configurations within specific sociomaterial contexts.*

The failure of RIMS to permit bulk importing of publication records through its harvesting functionality exposed shortcomings that extended beyond the system itself, impacting the overall implementation practice and the relationships among the actors involved. The interactions surrounding this issue facilitated a reshaping of identities and roles within the actor-network. Notably, the RIMS implementation team had to step back from the planned rollout to instead focus on developing a data ingestion pipeline that could bulk import publications via the system's backend. The changing sociomaterial arrangements enacted significant shifts in network relationships. When the RIMS implementation team redirected their focus to data engineering, their position within the network was fundamentally altered. They moved from being central facilitators of the implementation to becoming more technically isolated, weakening critical relationships with end users. Consequently, the publication management team, who were not originally responsible for training, had to quickly acquire the necessary skills to support the rollout by conducting preliminary training sessions. These sessions were intended to familiarize end-users with the system before it was fully implemented. As Mia, a member of this team, stated, "*Training others was never part of my job description*." This proactive measure was driven by the urgency to meet the DHET reporting deadline, necessitating that end-users have at least a basic understanding of the system upon its go-live date.

Nonetheless, after just two days of training from a vendor consultant, the publication management team was instructed to conduct system training sessions, regardless of whether they felt they had the capacity or knowledge to do so effectively. This propelled the constitution of new 'trainer' agencies and competencies for the publication management team through their spontaneous system training practices. The limitation of RIMS' functionality effectively reshaped their roles and required them to develop new competencies on the fly. This shift in roles and responsibilities had significant implications for the configuration of the Research Administration Modernization Network. The publication management team, who were not originally responsible for training, now had to take on this new role in addition to their existing duties. This placed additional strain on their time and resources. Furthermore, the rushed and insufficient training they received meant that the publication management team lacked the necessary expertise to conduct effective training sessions. This eroded end user confidence in their ability to support the system. The strained relationships between the publication management team and end users undermined the stability of the Research Administration Modernization Network.

At the same time, the RIMS implementation team had to step back from the planned rollout to focus on developing a data ingestion pipeline. This weakened their central role within the network. Their identity shifted from trusted implementation partners to remote technical specialists. Thus, the rushed and insufficient training of the publication management team, combined with the RIMS implementation team's shift in focus, reconfigured the roles, identities and relationships within the Research Administration Modernization Network. This had implications for both the success and failure of the RIMS implementation. Ultimately, addressing the system deficiency required more than just a technical fix to resolve the strained relationships and realigned roles caused by RIMS' limitations. All actors had to adapt: the RIMS implementation team stepped back from the rollout process, the publication management team took on training roles despite lacking experience, and the RIMS enacted new identities as its inability to support bulk uploads constructed it as inadequate and creating more manual work instead of efficiencies. The altering of RIMS' identity remained localized internally within the Research Administration Modernization Network. In contrast, RIMS retained an external perception across Ìwádí as an advanced, globally proven system. Within the network, this external identity of RIMS persisted even as its internal enactment revealed significant limitations requiring manual workarounds and process adaptations. This tension between RIMS' external perception and internal reality contributed to the ontological reconstitution of key actors that ultimately prevented the stabilization of the Research Administration Modernization Network.

Figure 8 depicted the initial formation of the Research Administration Modernization Network with single-headed arrows showing straightforward relationships between actors, while Figure 9 below illustrates how the network evolved over time using double-headed arrows to show reciprocal interactions and dashed lines to indicate strained relationships. Figure 9 introduces new elements like "Ontological Divergence" and highlights the breakdown of relationships, particularly with the Publication Management Team, showing a more complex and problematic state that emerged during implementation. The simplified structure of Figure 9, with fewer actors but more nuanced relationship indicators, better captures the dynamic tensions and transformations that occurred as the network matured, moving away from the formal organizational structure shown in the first diagram.

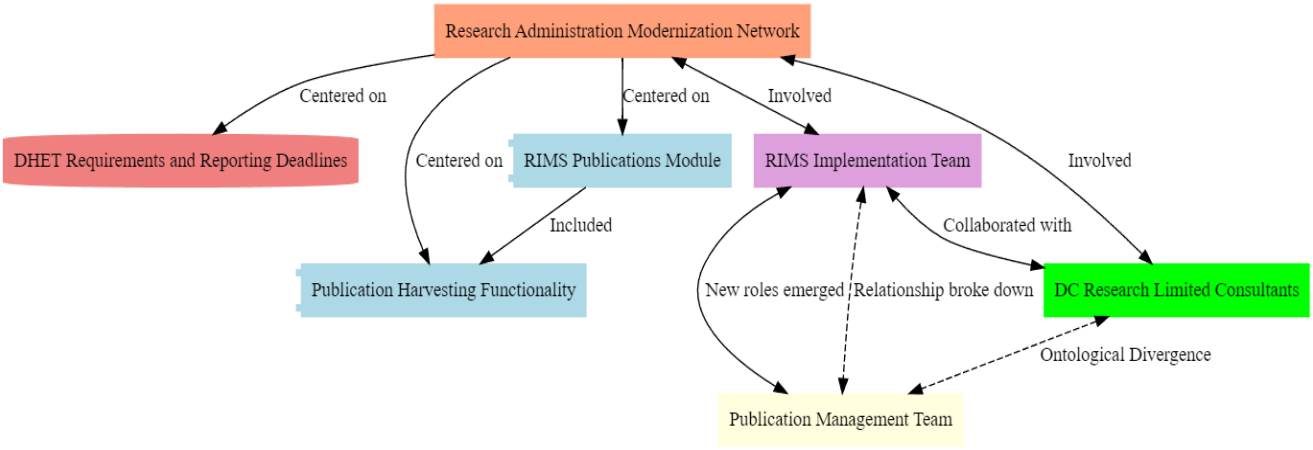


Figure 9: Ontological Divergences and Reconfigured Relationships

6.1.3 Enactment of the RIMS End-User Network

At this moment, we uncover how the initial alignment of interests and expectations surrounding RIMS underwent a reconfiguration (disintegration) during the enactment of its rollout and system use practices. Beyond the formation of the Research Administration Modernization Network, we investigate the early disconnections, tensions, and breakdowns that manifested, along with the frustrations that emerged during the rollout process and the ongoing challenges associated with sustaining the network. These occurrences ultimately hindered RIMS's ability to achieve the desired translations between the heterogeneous actors enrolled within the network. This examination reveals the unfolding of unintended consequences as technological solutions, failing to account for the participative construction of organizational realities and the inclusive engagement of end-user actors, interact within the network. It emphasizes the need for an agile approach that continuously mobilizes cross-functional actor-networks and adapts based on the evolving needs and interests of the actors, thereby fostering network sustainability as identities, roles, and realities undergo transformations.

Amidst the unveiled system challenges, constraints, and the DHET's looming deadline for the pubcount submission, the Research office leadership faced a critical decision: whether to postpone the rollout of the RIMS until the following year or proceed with the implementation. Delaying the rollout would have allowed ample time to address the identified system issues. However, due to the project's timeline constraints (with an end date of December 2017), cost considerations, and the lack of substantial progress, the Research office leadership decided to proceed with the RIMS rollout for

the 2016/2017 pubcount cycle. This decision was communicated to the RIMS implementation team and the DC Research Limited consultants.

To meet the deadline, the RIMS implementation team had to prioritize their focus and redirect resources toward ensuring that the RIMS could generate the pubcount report. This strategic decision came at the expense of addressing the identified issues and limitations, which were left unresolved. The Research Administration Modernization Network extended its relations through the publication management team to faculty coordinators and departmental administrators. Through the training and testing practices surrounding RIMS, the identities of these administrators became reconfigured as 'system users' in addition to their conventional roles. Their use of RIMS was driven more by compliance than buy-in, as the implementation team lacked the time and resources to customize RIMS to their needs. The interactions between the Research Administration Modernization Network, faculty coordinators, and departmental administrators focused on training administrators to use RIMS and granting them production access, rather than aligning RIMS with their interests and gaining true adoption. The rushed rollout prioritized basic usage over addressing user needs and obtaining stakeholder investment in the success of the new system. As Jacob (Faculty coordinator 2) put it, "*I was forced into the system; well, we were all forced into the system*". This extension of the Research Administration Modernization Network to include new actors like faculty coordinators and departmental administrators is depicted in Figure 10.

Despite the lack of customization and stakeholder buy-in, the sociomaterial intra-actions between RIMS and the work practices of the administrators performed a distinct reconfigured version of the system. The primary focus of this interaction was the sociomaterial entanglement of the Research Administration Modernization Network with the pubcount practices of the departmental administrator, faculty coordinator, and publication management team. The routine sociomaterial practices of capturing, verifying, rejecting, and validating publications using RIMS iteratively co-constituted the identities and competencies of the actors as particular kinds of 'end-users', while simultaneously shaping how RIMS became enacted as a situated system. This entanglement involved an interdependence between the RIMS technology and the pubcount practice it became embedded within. However, to ensure that RIMS could effectively support the pubcount cycle, a more direct engagement with the end-users was necessary.

The RIMS implementation team developed test cases to evaluate RIMS. This was the first time they directly engaged with the departmental administrators and faculty coordinators. Previously, the publication management team served as a proxy for understanding how the departmental administrators and faculty coordinators used RIMS. Through hands-on engagement with the end-users (departmental administrator, faculty coordinator, and publication management team) while they used RIMs, the RIMS implementation team could assess RIMS impact on work practices and identify and address gaps that could prevent it from supporting the 2016/17 publication counting cycle. As Thando, a member of the publication management team, noted, "*One of the major things we found out only during the testing/training session, which I think was a week or two before going live, was that there was a missing workflow step where the faculty coordinator needed to verify things before, they reached the research office. That set us back a few steps because configuring a new workflow step and changing everything else in place is quite tricky, challenging, and time-consuming. But it was also done right in time, I think.*"

The December 2016 go-live marked a distinct reconfiguration, identifiable through three analytical markers: the shift from Óparí to RIMS changed established work practices; new relationships emerged as publication staff became trainers and administrators developed workarounds; and RIMS' material limitations became visible through required manual interventions and workflow constraints. Compliance overshadowed buy-in as the predominant mode of adoption. The intra-action of end-users with RIMS reconstituted their work practices, roles, and identities through sociomaterial performativities. Even after training and the implementation of workarounds, the interactions between end-users and RIMS were hindered by various challenges. These included struggles with new interfaces, import failures, missing data, response lags, system freezes that impacted performance, and persistent system bugs.

The enactment of RIMS within the faculty coordinator's verification practices significantly transformed publication management at Ìwádí University. Jacob, the science faculty coordinator, found his role fundamentally shifted from simple verification to becoming the primary trouble-shooter for system issues and technical support for departmental administrators. The verification process became more complex, requiring dual checking of both physical and digital records to ensure accuracy and completeness. System limitations created new challenges - files would become inaccessible after saving, records would disappear from the system only to reappear later, and data

entry errors were common. These technical constraints led to bottlenecks in the verification workflow, particularly when submissions failed to meet quality standards. To manage these new complexities, faculty coordinators had to develop additional verification steps, establish new communication channels with departmental administrators, and create tracking systems to monitor submissions. The role expanded to include training and support responsibilities that weren't previously required, making the position more demanding and requiring greater attention to detail. This reconfiguration of work practices revealed how RIMS' technical limitations directly impacted the efficiency and effectiveness of the publication management process.

Within the departmental administrators' work practices, the RIMS implementation produced impacts on workflow efficiency. While the system successfully automated data pulling from HR and student systems, the critical failure of the bulk publication import functionality created significant additional manual work. This interplay between automation and manual processes resulted in the task of publication capturing reverting to departmental administrators, fundamentally transforming their work practices and professional identities. The administrators' role underwent reconstitution through their engagement with RIMS. Their position evolved from general administrative staff who handled publications as one of many tasks to becoming specialized publication data managers. This transformation manifested in new responsibilities including extensive manual data entry, meticulous verification processes across multiple systems, regular troubleshooting of technical issues, and the development of system workarounds. They also became informal trainers and technical support for other users, despite lacking formal preparation for these roles. This shift represented a significant departure from their established professional identities and conventional administrative duties.

The sociomaterial configuration of RIMS, work practices, and human agencies enacted a temporal reconfiguration, where the conventional boundaries of working hours were disrupted. As Alex, a departmental administrator, explained "*It takes up a lot of our time because we do not have one dedicated person doing it. It is not just your job to do that. We have other deadlines also because we all work in finance... During my free time on weekends, I like to churn out some articles*". The entanglement of RIMS, workloads, and competing responsibilities reconstituted the temporal dimensions of their work, necessitating continuous spillover into personal time. This ongoing temporal reconfiguration reflected how the sociomaterial arrangements around RIMS generated new

work patterns and practices that fundamentally altered when and how administrators performed their roles, creating a persistent state of adaptation and adjustment to meet the demands of the new system.

When the sociomaterial configuration of RIMS was enacted within the publication management team's work practice of validating publication records, a disruptive intra-action ensued. The team's practices became entangled with manual editing and manipulation of data on the RIMS and generated reports, as they strived to achieve compliance with the submission requirements set by the DHET. As Benjamin, a member of the publication management team articulated, *"I think the editing has to be minimized a lot more before we can call it a success. We make it a success because we have to, we go through the records and it ended up being very manual and we make things add up.*" This utterance exemplified the sociomaterial performativity, where the team's practices were reconfigured to compensate for the limitations and resistances posed by the RIMS, ultimately rendering their work highly manual and labor-intensive. Furthermore, the sociomaterial intra-action between multiple elements - the RIMS, manual data manipulation practices, publication records, system limitations, support requests, and the publication management team's expertise - reconstituted the roles and identities of the publication management team. Despite lacking the requisite experience and training, their role morphed into that of technical support specialists, responding to technical system queries raised by departmental administrators and faculty coordinators. This unintended reconfiguration of roles and responsibilities emerged as a consequence of the entanglement between human agencies, material constraints, and the evolving sociomaterial configuration enacted within the organization.

Rather than enacting an identity of easing operations, the sociomaterial configuration of RIMS was performed as a system actively hindering the pubcount practice. Dissatisfaction emerged within the RIMS end-user network as the RIMS failed to deliver on initial promises surrounding its capabilities. A key insight lies in how early choices and divergence of priorities seeded the gradual disintegration of the actor-network over time. The reconfiguration of the Research Administration Modernization Network highlights how unexamined assumptions can fracture networks when the sociomaterial complexities surrounding work practices are obscured. Technological transformations often struggle without reconciling strategic aims with the realities of practitioners through participative translation. The RIMS implementation team overconfidently relied on software flexibility as a catch-all solution, over-indexing on technical solutionism and making a choice of limited upfront stakeholder engagement. This created gaps that set-in motion end-users' frustrations, issues, and unmet

expectations, eventually reconstituting the identity and role of the RIMS, preventing it from being embedded locally. The end-users created manual workarounds to compensate for the system gaps, increasing labor intensity. The negative impact of the RIMS on the work practices of end-users resulted in its inability to become an integral part of the organizational fabric.

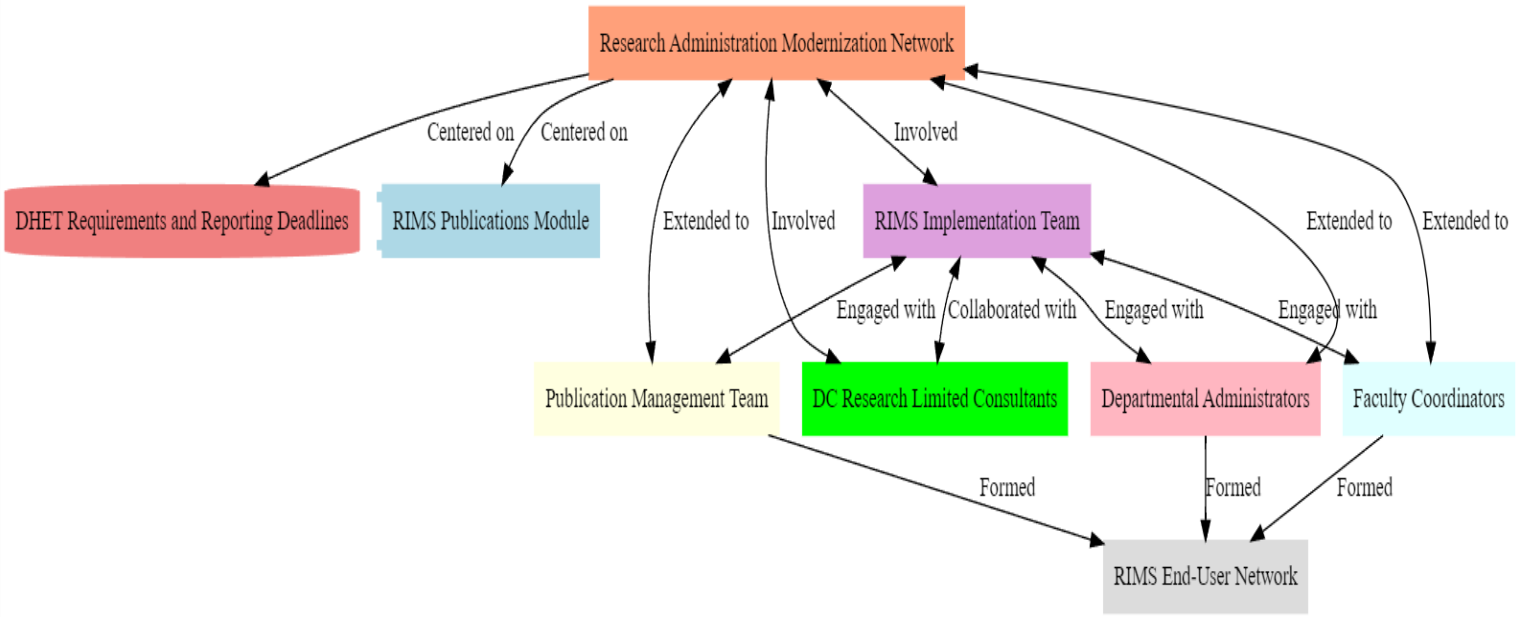


Figure 10: Enacting the RIMS End-User Network

6.1.4 Decomposition and the PIC Network's Enacted Reality

The reconfiguration of the Research Administration Modernization Network continued through the enactment of the RIMS in pubcount practices from December 2016 to April 2017. This enactment led to the gradual decomposition of the initial sociomaterial configuration as illustrated in Figure 11. George, the project manager ensured that the PIC received timely updates on both the positive and negative developments of the implementation. In reporting the project status to the PIC, he utilized the principle of least surprise. Once he anticipated a risk, he immediately discussed it with the PIC and kept them informed as the risk materialized. This discursive practice enacted a translation of potential risks into the committee's awareness, shaping their reality and subsequent actions.

Despite the ongoing challenges, the PIC remained committed and increased support for the RIMS implementation. This commitment manifested through the approval of additional vendor consulting

resources to assist the RIMS implementation team in accelerating the development of the reporting module needed to generate the DHET pubcount report. The project manager, George, highlighted the supportive and committed stance of the executive director of the research office, who chaired the PIC, stating, "*The executive director of the research office is absolutely crucial; she's been committed from the beginning and supportive and has assisted us really well.*" The executive director performed material support through specific actions that shaped the implementation trajectory: she approved additional vendor consulting resources when technical challenges emerged, extended project timelines to accommodate system customization needs, allocated extra budget for addressing system limitations, and actively defended the implementation's value in steering committee meetings. Through these concrete interventions, she reinforced the stability of the actor-network and facilitated continued support for RIMS implementation, despite the material resistances encountered in the form of system limitations and user challenges.

Through regular project update meetings, the criteria for evaluating the RIMS implementation emerged as an influential actor. This was enacted by stipulations in two key documents - the project charter and DHET research output policy. These documents outlined expectations regarding project timelines, costs, and ability to deliver the mandated DHET report. The PIC monitored progress against these prescribed evaluation criteria. In doing so, this intra-action enacted a distinct version of *RIMS (the version of RIMS constituted within the PIC network), one that was both connected to and distinct from the RIMS within the RIMS end-user network. The use of the asterisk * before RIMS indicates that it is not the original or primary RIMS system itself, but rather an alternate enactment of RIMS that emerged through the sociomaterial intra-actions and network relations surrounding the PIC's monitoring and evaluation practices.

The PIC’s intra-actions with the RIMS focused on monitoring and evaluating periodic project status reports. Their recurrent entanglements enacted a distinct PIC network. This network connected human actors (PIC members, project manager) with nonhuman elements (project charter stipulations, timelines, budget constraints, strategic priorities, DHET requirements). Through assessing progress based on predefined metrics of timelines and costs, their sociomaterial intra-actions generated a reality for a *RIMS that aligned with initial strategic promises rather than reflecting evolving complexities faced by end-users. Despite limited insight, committee discourse and work practices constituted an indeterminate *RIMS reality that guided decision-making. Their translations

continually reinforced network relations, preventing destabilization despite recognizing issues in end-user reports.

This version of the *RIMS differed from the version within the RIMS end-user network because there were detailed local configurations, customizations, sociomaterial complexities of work, and workarounds applied to RIMS that were not reflected in the summary project report shared with the PIC. The time delay also created a drift between the RIMS and *RIMS because the PIC network did not have real-time visibility into the current state of the RIMS actor, only what was described in the report they received and discussed in their project status meetings. Nonetheless, both versions were also related because the project manager met regularly with the PIC, where the principle of least surprise was used to ensure that they were in sync with the current state of the RIMS. Ultimately, two different versions of the system were created – RIMS and *RIMS. They came about as a result of the different relationships and intra-actions surrounding them. Rather than just different views of the same system, they were two distinct but interrelated real-life versions with divergent identities, each shaped by their own network of relationships. Both of these RIMS manifestations played a role in the final implementation outcome.

The *RIMS was enacted in the PIC network through the vendor's proof of- concept demonstration during the RFP stage. During this demo, the vendor showcased live system workflows, reporting features, and data management capabilities, materializing RIMS as an advanced research management solution. This demonstration practice enacted a specific version of RIMS that aligned with strategic aspirations, leading to the signing of the implementation contract. Furthermore, by integrating project reports into standard work practices of governing the RIMS implementation, the PIC network, via discourse and work activities, enacted a reality that included the *RIMS, based on which it made decisions that impacted the implementation. Despite the initial difficulties and challenges faced during the implementation, the rationale for continued support provided by the PIC was in line with the overarching implementation goal of getting a modern system in place that could be built upon, allowing them to move beyond the limitations of the legacy system. The *RIMS had greater potential in the long run if the challenges could be addressed. These implementation struggles highlighted the complex interplay between the strategic visions promoted for the RIMS, the design assumptions embedded in the software, and the intricate realities of everyday work practices at Ìwádí.

Proposition 2: *Enterprise system implementations surface multiple ontologies through unexamined sociomaterial entanglements between strategic rhetoric, design assumptions inscribed into software, and the complex realities of everyday work. Sustainable alignment requires traversing these ontological boundaries through participative translation*.

This proposition theorizes how the decomposition of the Research Administration Modernization Network stemmed from the ontological divergences manifesting through these unexamined sociomaterial relations. The mismatch between the idealized IT solution rhetoric, the configurability and best practice assumptions inscribed in the software, and the constraint-laden sociomaterial realities of Ìwádí's work practices performed conflicting ontologies that gradually destabilized the network. Although continued support was offered due to the long-term potential, sustainable implementation demanded actively closing the ontological gaps through a participative translation process that aligned strategic visions, software design, and localized work needs. The proposition highlights that the implementation challenges went beyond mere technical misalignments, arising more significantly from competing ontologies performed through the unaccounted sociomaterial interdependencies between rhetoric, design assumptions, and complex practice.

When RIMS went live, end-users struggled with interfaces, data problems, and bugs, which hindered operations, increased labor intensity, and failed to deliver on initial promises. The resulting user frustration reshaped RIMS' identity and affected its embedding into existing practices. Ultimately, the lack of participative translation -a process involving iterative feedback loops, co-design sessions, and continuous communication to ensure that the enterprise system aligns with the evolving needs and interests of its heterogeneous actors - and reconciling strategic goals with user realities caused the fracturing of assumptions underlying the Research Administration Modernization Network. The decomposition of the Research Administration Modernization Network and the emergence of new networks (– the RIMS end-user network and the PIC network) had consequences for the overall implementation outcome and the enactment of RIMS within the organization's sociomaterial configurations.

By January 2017, it became clear that the RIMS was causing significant challenges for end-users in their day-to-day work. At this point, switching to a different system was no longer a realistic option. Discussions between the RIMS implementation team and the publication management team explored

running both the Óparí system and RIMS in parallel for the first cycle. However, the RIMS implementation team rejected this proposal to save time and effort from double data capture. This decision weakened the relationship between Óparí and the pubcount practice, creating a reality that incentivized ensuring the success of RIMS. Significant time, resources, and reputation had been invested, making the abandonment of RIMS unlikely.

The end-users opened several internal tickets requesting that the reported challenges be addressed. However, due to the limited time, resources, and the impact of not meeting the DHET pubcount report submission deadline, the project manager parked these requests. Resources were dedicated toward developing the RIMS reporting functionalities. Mia, from the publication management team, expressed her concern, stating, "*…I just saw that all the calls that I logged closed, but it wasn't resolved*." Though this decision frustrated end-users, leaving them feeling unheard and disregarded, it nevertheless ensured that the publication management team could appropriate RIMS in the practice of generating and submitting the DHET report.

Once the DHET submission was complete, the PIC requested the pubcount output unit report from the publication management team. The output unit determines the research grant the DHET will award to Ìwádí University. The research grants form a sizable portion of the university's research budget. The publication management team reported an 11.44% increase in output units and a 9.38% increase in research grants to the PIC. The pubcount output unit review enacted an agential cut by identifying the *RIMS as the crucial element that drove the 2016 pubcount cycle's increment and resulting revenue growth for the university. This cut highlighted the *RIMS as the primary factor in the success narrative within the PIC network, despite the constraints and challenges materialized in the end-users' experiences. Consequently, the PIC network's sociomaterial practices, including regular project update meetings, iteratively enacted a specific reality where the RIMS implementation was performed as a success, despite the constraints and challenges experienced by end-users. The PIC reported the RIMS implementation as a success to the university's senate committee, leading to the approval of a two-year extension to the project to resolve issues and improve functionality. In contrast, the intra-actions (such as the daily use of the system, the documentation of system issues in support tickets, and the development of manual workarounds to compensate for the system's limitations) among the RIMS end-user network enacted a competing reality where RIMS was performed as a failed implementation due to the system's inability to align with the evolving needs

and interests of its heterogeneous actors. The publication management team disputed the enactment of the RIMS implementation as a success within the PIC actor-network. As explained by Mia, the RIMS implementation was characterized as successful due to the increase in output units when, in reality, it was due to the addition of new indices (Scopus, Scientific Electronic Library Online (SciELO) SA and Norwegian Register for Scientific Journals) by the DHET, which increased the number of eligible publications considered for the pubcount process.

The sociomaterial practices within the end-user network enacted a different RIMS and produced a competing assessment. The intra-action among its actors created assessment criteria as an important actor that played a crucial role in characterizing the RIMS implementation failure. Despite the RIMS being used for the 2016/2017 pubcount cycle, the RIMS end-user network's sociomaterial practices iteratively enacted a specific reality where the RIMS implementation was performed as a failure due to the disconnect between its envisioned strategic goals and the realities experienced by end-users. The system failed to deliver on its promised capabilities, leading to increased manual labor, frustrations, and the creation of workarounds to compensate for its limitations. Noah (Publication management team member 2) noted that they had to "*continue relying on spreadsheets and manual processes that the new system was supposed to eliminate*". This was evidenced by the overwhelming number of support calls, with Thando (RIMS implementation team member 1) stating that "*there were a lot of calls and a lot of issues that came up*", and the need for manual workarounds, such as Mia's team (Publication management team member 1) having to "manually underline authors" on the DHET report, demonstrated the system's inability to meet user needs. Ava (Faculty coordinator) succinctly put it, "*It just seemed like this glorified thing that was supposed to do all these cool things and make life easier did not do what it was supposed to.*"

Rather than streamlining and enhancing publication management practices, the RIMS actively hindered and disrupted these processes. The failure to align the RIMS with the evolving needs and interests of its heterogeneous actors resulted in a gradual disintegration of the initial actor-network, preventing the system from becoming an integral part of the organizational fabric. This disintegration was characterized by the end-users' reliance on manual processes and workarounds to compensate for the system's limitations, the publication management team's disputes over the enactment of the RIMS implementation as a success within the PIC actor-network, and the overwhelming number of support calls and system complaints that highlighted the system's inability to deliver on its promised

capabilities. While the RIMS facilitated the generation of the required pubcount report, its implementation fell short of achieving the desired translations and sustainable embedding within the local work practices and sociomaterial configurations of the university.

While inadequate planning, insufficient testing, and a rushed go-live timeline certainly contributed to the RIMS implementation's failure, from an ANT perspective, these factors primarily manifested as ontological divergences between RIMS' designed configurations and the localized sociomaterial realities of Ìwádí's work practices. Benjamin's (Publication management team member 6) assessment that "*I think the first cycle I would say was a failure because I don't think it was thought through fully*" and Thando's statement that "*I would say it was rushed, pushed for go live. The first round was very bad in my view. I would say it was a failure*" further underscore the implementation's failure.

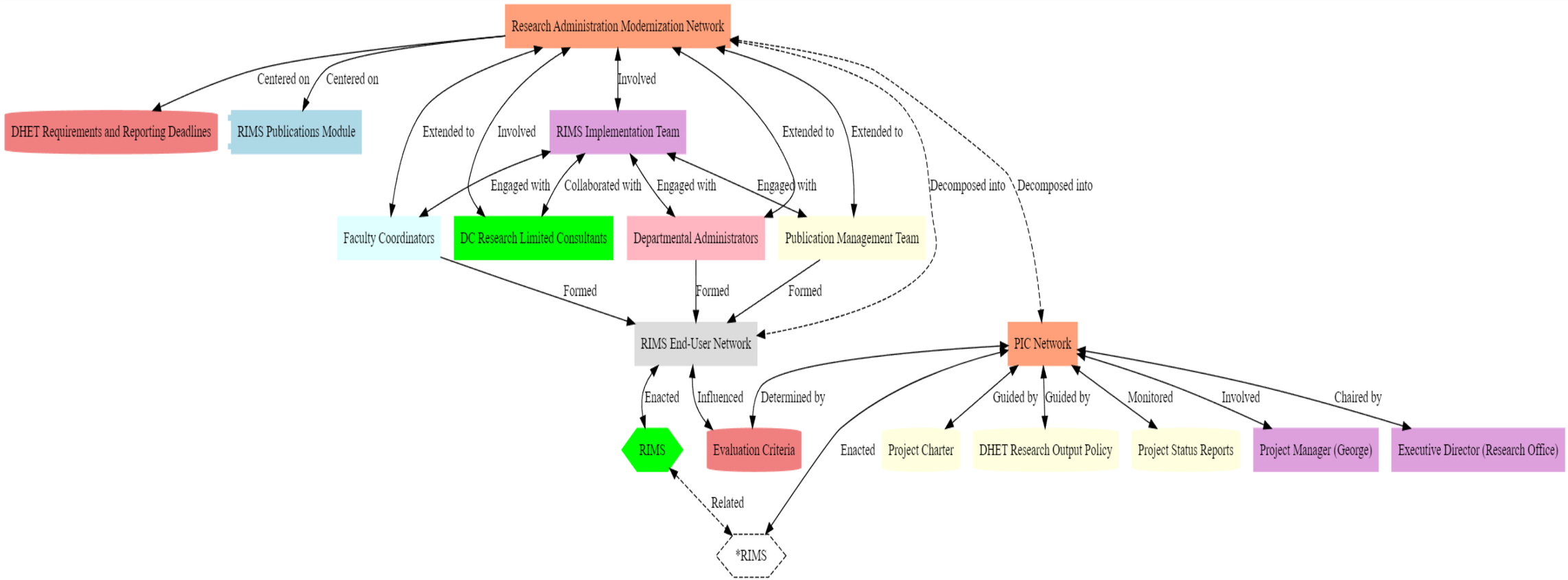


Figure 11:Decomposition of the Research Administration Modernization Network into RIMS End-User and PIC Networks

6.1.5 Ontological Politics of Multiple Realities

The prior analysis in previous sections shows the emergence, reconfiguration and decomposition of the Research Administration Modernization Network and enactment of competing and concurrent assessment of the RIMS implementation. It sets the foundation and provides evidence to support our investigation of the central research question: how are the competing realities of ES implementation outcomes performed? By examining how realities are performed, this analysis takes an ontological turn. The concept of ontological politics from ANT provides a useful lens for answering ontological questions about the multiplicity of realities enacted through the ES implementation. We examine how ontological politics functioned to enact different sociomaterial practices and how through the gradual emergence of agencies of assessment within these practices overtime, competing forms of assessment and objects of assessment concurrently arose.

While traditional IS implementation literature often treats implementations as discrete events with binary outcomes, the ANT analysis reveals how the RIMS implementation was iteratively performed into multiple, divergent sociomaterial realities through situated practices and arrangements within different actor-networks. For the PIC network, the *RIMS implementation succeeded by enabling compliance with the DHET reporting deadline and increasing the university revenue. This *RIMS diverged from the RIMS enacted within the end-user network. Their reality was upheld by quantitative output measures that fit the university's strategic aims. It was upheld through committee meetings and implementation status report. In contrast, the RIMS end-users network enacted a distinct version of the RIMS implementation constituting a failure reality based on their ongoing daily struggles with data errors, manual workaround and unmet expectations in using the system. Their lived frustrations manifested through negative reviews during training sessions, system complaints via emails and support tickets reinforced this reality qualitatively.

These realities emerged through the introduction and enactment of RIMS within specific organizational context rendering specific issues visible while concealing others. The PIC network privilege increased research outputs fitting institutional goals. End-users' network conveyed localized RIMS challenges that impeded ease of use. Different practices created different realities. Thus, 'success' and 'failure' are not inherent in the same RIMS system. The RIMS implementation was not a singular event rather an unfolding realization constituted differently across networks.

In enacting the contrasting RIMS implementation realities, certain coordination mechanisms enabled sociomaterial arrangements that defined and stabilized these realities. For the PIC network, assessment criteria such as research output metrics, funding increases, and project milestones acted as immutable mobiles (a concept from ANT referring to elements that maintain their form and meaning as they are transported across different contexts). These criteria transported an enduring reality of success across meetings because they retained their form and meaning, consistently conveying a stable perception of achievement despite the complexities and challenges faced in the implementation process. Conversely, for the end-users' network, recurring support tickets and workarounds confirmed an entrenched reality of ongoing RIMS implementation failure.

These coordination mechanisms performed agential cuts by materially structuring what could be measured and made visible. Within the PIC network, monthly project status meetings created boundaries through standardized reporting templates that captured strategic measures like research outputs and funding increases, while systematically excluding end-user experiences. These meetings limited participation to senior stakeholders, creating a material practice that privileged strategic perspectives while backgrounding operational realities. The structure and format of these meetings materially enacted cuts that determined what aspects of RIMS implementation became visible and actionable at the governance level. Similarly, the end-user network's coordination mechanism of support tickets performed cuts through their material documentation practices. These tickets created boundaries by structuring how system issues could be reported, focusing on specific technical problems and documenting operational challenges. The materiality of the ticketing system shaped what could be captured about end-users' experiences while excluding broader strategic benefits or institutional outcomes.

These material practices afforded and constrained possible actions, favoring certain performances while discouraging alternatives. The practice of using research output metrics afforded the PIC network to demonstrate success aligned with institutional goals but constrained their visibility into localized challenges faced by end-users. Conversely, the practice of documenting system issues in support tickets afforded RIMS end-users network to voice frustrations but constrained recognizing strategic outcomes achieved. Through these distinct coordination mechanisms, different aspects of reality were temporarily stabilized while others were backgrounded, materially enacting different

versions of the RIMS implementation. This disconnects highlights how ES implementation outcomes emerge through situated sociomaterial practices that privilege certain issues while obscuring others, leading to the proposition:

Proposition 3: *ES implementation outcomes enact multiple, divergent realities across actor-networks through situated sociomaterial practices that privilege certain issues while obscuring others, shaped by coordination mechanisms that stabilize partial perspectives.*

These multiple, differing realities stabilize as networks emphasize issues aligned with their respective interests. No single portrayal fully captures the "whole truth" – assessments take shape through ongoing entanglements between configurations of humans, technologies, and processes. Specific coordination mechanisms, like status meetings or support tickets, provisionally solidify particular evidence while excluding alternatives. Thus, implementation realities diverge across actor-networks, performing as partial realities grounded within provisional arrangements, which refer to the temporary stabilization of certain sociomaterial practices and perspectives through coordination mechanisms like status meetings and support tickets.

There are political interest and incentives underlying the making of reality. The multiple competing realities of RIMS implementation reflect differing political interest. For the PIC network, adhering to the DHET report submission deadline and research output metrics upholds institutional legitimacy and research funding. The PIC network had the political motivation to support the enactment of the RIMS implementation as a success to justify the time and budget invested as well as enable additional funding and project extension. Their reporting routines selectively performed elements (such as increased DHET research subsidy and automated system integrations) fitting this reality. The consequence appears less severe for end-users as system challenges threatened the day to day use of the RIMS reflecting limited involvement in implementation decisions affecting work. Neither the *RIMS nor RIMS fully captures an apolitical ‘whole truth’. Rather, they are distinct sociomaterial productions arising from situated practices. Reality arises from local, situated intra-actions. Hence, acknowledging partiality makes it possible to question what gets included, excluded and neglected when performing assessments.

This suggests that by selectively including and excluding elements (such as research output metrics, system bugs and support tickets) that support existing interest and agendas, different networks reinforce differences in whether the implementation is defined as successful or failed. Competing realities emerge relationally depending on what arrangements each network privileges within their practices. This study proposes that:

Proposition 4: *Ontological politics mediate ES implementation outcomes, as competing realities manifest relationally from the incentives and strategic interests underlying the sociomaterial practices that perform reality within different network.*

The realities surrounding the RIMS implementation at the university illustrate this premise. The PIC network, comprising institutional leadership, framed RIMS as a successful implementation, shaped by their interests in strategic decision-making, institutional discourses around research metrics and rankings, and pressures to comply with government policies for funding. In contrast, end-users experienced RIMS quite differently, enacting a "failure" reality bound by the micropolitics of localized work contexts - facing operational challenges, system limitations, and lacking involvement in decisions impacting their practices. These divergent realities were not pre-given or fixed, but rather actively co-constituted through contextualized sociomaterial intra-actions, as further proposed:

Proposition 5: *The realities of ES implementation outcomes are co-constituted through the agential cuts performed by the sociomaterial intra-actions between end-users, technologies, organizational actors, and the material-discursive practices that enact specific versions of the ES within distinct organizational contexts.*

The ANT analysis delineates how power geometries, situated discursive practices, and institutional narratives effectively "policed" what issues gained salience as reality-makers versus being marginalized across different networks. The PIC's institutional positioning enabled their framing as the "official" assessment, reinforced through project meetings and strategic priorities endorsing research metrics. Conversely, end-users' realities foregrounded day-to-day operational issues given their grounded, localized perspectives - yet lacked authority for this "failure" reality to gain primacy. In accounting for these differential boundaries and inclusions/exclusions co-constituting multiple, partial realities, the analysis highlights the emergent, enacted nature of implementation assessments

rather than representing a single, stable truth. Certain issues, metrics, narratives, and other factors gained salience in defining "success" or "failure" within a given context, shaped by the situated interests, incentives, and strategic priorities that influenced each network's sociomaterial practices.

6.2 The Event Log Findings

To identify the role of the RIMS in materially enacting the pubcount practice, we analysed the system event logs using process mining techniques. Process mining enables the discovery of process models based on system event logs data. We visualised the event data as a process flow diagram modelling the progression of publications through the various pubcount steps. The visualisation of the event logs provided a window into the performativity of RIMS in modelling workflows and actions around the pubcount practice. It advances past representational findings to examine the material agency of RIMS. It shows how the technology performed in practice during the pubcount cycle. Figure 7 shows the interactive graph network of the pubcount practice as a process.

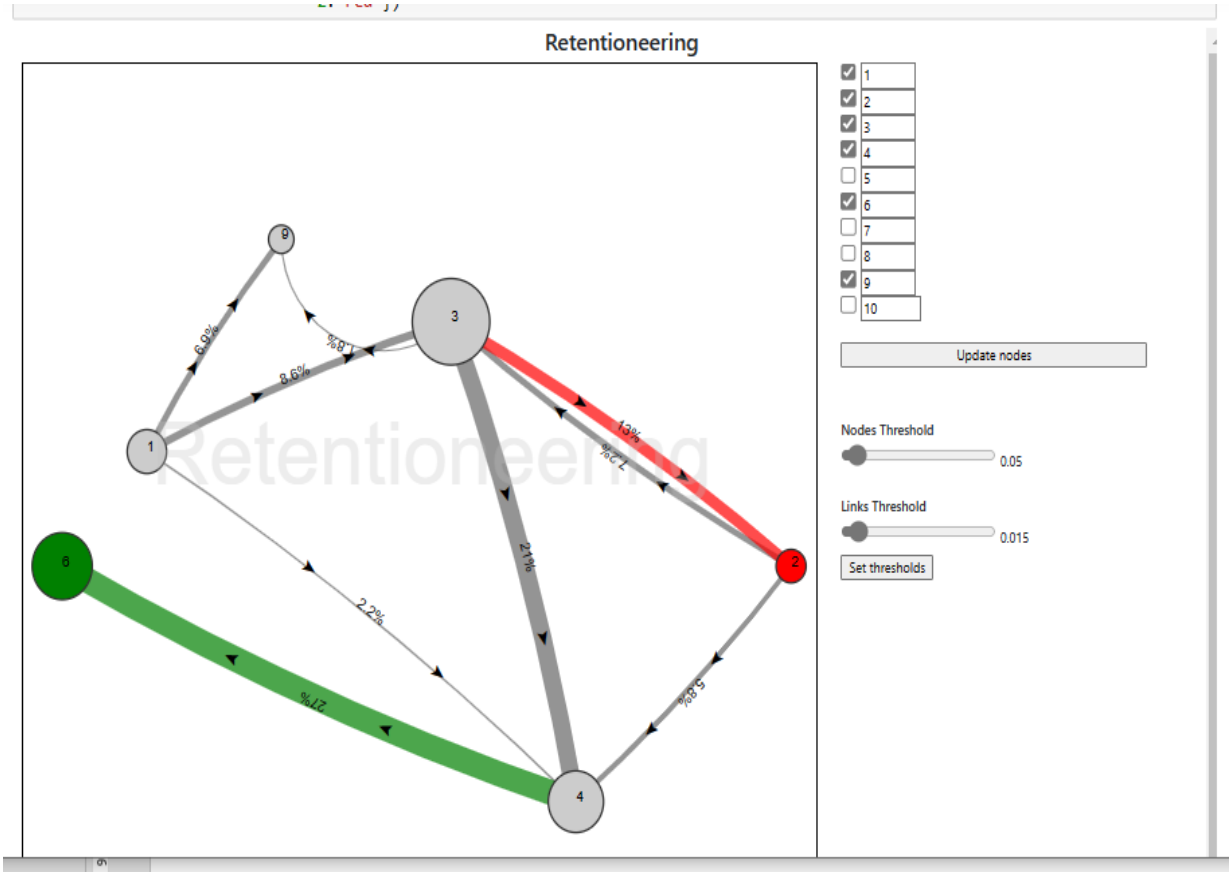


Figure 6: Interactive graph network of the pubcount workflow practice

Table 8 provides a description for each node in Figure 6**.** Each node represents a step in the pubcount workflow practice (Pub_Workflow_AsIs_Doc). Table 8 contains the legend describing each node.

Table 8: Descriptions of nodes in graph network of the pubcount workflow practice

Node	**Description**
1	Draft
2	Returned for clarification
3	Faculty coordinator assessment
4	Pubcount review by Research Office
5	Pubcount review by Faculty Research Committee Chair
6	Pubcount final review by Research Office
7	Review by library
8	Validated
9	Archived

Based on the graph network of the pubcount workflow practice, Table 9 ranks the log events for the 2016 pubcount cycle.

Table 9:Log events ranking for the 2016 pubcount cycle

Description	**Event**	**Percentage of this event across all events in dataset**	**Ranking of percentage**
Pubcount final review by Research Office	Movement of publications from initial review by research office to final review by research office	27%	1st
Pubcount review by Research Office	Movement of publications from faculty coordinator assessment to publication review by research office	21%	2nd
Return of publication for clarification	Movement of publications from faculty coordinator assessment to returned for clarification	13%	3rd
Archiving publication	Movement of publications from draft to archived (6.9%) Movement from node faculty coordinator assessment to archived (1.8%)	8.7%	4th

The visualisation of event logs reveals informative findings about the role of the RIMS in the pubcount practice. Publications did not stay at a pubcount step for too long- the event log show the

forward movement of publication records with limited looping. This indicates that the RIMS enabled the movement of publications through the necessary pubcount steps. Publications moved in the right order through the expected pubcount steps. This enforcement suggests that the rules and configurations on the RIMS successfully structured the pubcount appropriately. A lot of events on the RIMS were related to publications being sent to the Research office for review and confirmation that the publications were reviewed (top two ranked events). This alignment with the pubcount practice indicates that the RIMS performed its intended purpose. Overall, the event logs show that the RIMS kept publications progressing properly through each pubcount step without undue deviations, highlighting that the system executed key elements of the pubcount as intended. From an ANT perspective, this technological performance provides material evidence of how RIMS acted as a mediating actor within the network, successfully enforcing the prescribed workflow and rules inscribed during implementation. This performance helps explain the PIC network's enactment of RIMS as a success, as the system demonstrably facilitated the pubcount process and enabled DHET reporting compliance. However, when viewed alongside the sociomaterial complexities revealed in the ANT analysis, these same event logs also expose the partial nature of this 'success' reality through the frequent correction loops and manual interventions that substantiate the competing 'failure' reality enacted within the end-user network. Thus, the event log analysis enriches our ANT-based understanding of how multiple, divergent realities of the implementation outcome emerged through different sociomaterial practices and network relations.

The event logs analysis also reveals several observed inefficiencies. Numerous events involved sending publications back to the publication capturers for review (third ranked event). The frequency of this rework event indicates a notable back and forth to resolve issues before approval. The visualisation also exposed the deleting and archiving of publications thus indicating data quality issues (fourth ranked event). The recurrence of this suggests this is a prevalent issue. The routine of corrections and retries points to consequential inefficiencies, rework and data quality issues. As described in the implementation story, end-users had to manually intervene frequently to troubleshoot problems, fix issues, coordinate information across sources and manipulate data to fit the RIMS specifications.

The event logs analysis reveals the RIMS exhibiting agency in coordinating the pubcount workflow as intended. But, the routine of corrections and deviation from prescribed behaviour also occurred. While the RIMS implementation story highlights end-users' difficulties, the event log analysis reveal

that the RIMS still facilitated the progression of publications through the pubcount steps which ensured the submission of the DHET report. Contrary to the failure narrative, this shows some success in the RIMS's performance. Nonetheless, the prominent inefficiencies in the event logs equally confirmed descriptions of challenges during the rollout. The widespread corrections and workarounds corroborate the reported system defect, data issues and end-user frustrations.

The event log analysis expands on the ES implementation. However, it is limited because it narrowly focusses on the technological processing of publication. Triangulating insights from the event log analysis with the ANT analysis better evoked the intertwined sociomaterial intra-actions surrounding the RIMS implementation.

6.3 Integrating ANT and Event Log Analyses of RIMS Implementation

The ANT analysis traced the emergence, reconfigurations, and decomposition of the actor-networks involved in the RIMS implementation. It surfaced the underlying sociomaterial entanglements, priorities, interests, and ontological politics that performed competing realities of success and failure across different networks like the PIC and end-users. Complementing this rich sociomaterial accounting, the event log analysis offered a technology-centric view into RIMS' material agency and performativity in actually executing the pubcount workflow practices. The event logs revealed how RIMS enforced the intended process rules, modeling the prescribed pubcount steps that publications progressed through as expected. This aligns with Proposition 2 in Table 10, which highlights how enterprise system implementations surface multiple ontologies, including the design assumptions inscribed into the software about how processes should work.

The top two ranked events from the event log analysis showed publications being sent to the research office for review and confirmation, aligning with the core pubcount process flow as intended based on the RIMS configuration (Proposition 2). However, the event logs also exposed consequential deviations from this designed process flow, providing evidence for Proposition 1 in Table 10 about the divergences between system design and the realities of actual use. The third highest ranked event involved sending publications back to capturers for review, pointing to frequent rework and back-and-forth issues before approval. This frequent revision loop provides material evidence that substantiates the previously identified workarounds and disruptions discussed in the ANT analysis. The event logs validate how the multiplicities of real-world use "unhinge/unsettle/disrupt a priori

assumptions" built into the RIMS design (Proposition 1), offering concrete documentation of the sociomaterial tensions already surfaced through our analysis of end-user practices. Deleting and archiving of publications, the fourth ranked event, exposed data quality issues that required manual user interventions to resolve. This aligns with Proposition 4 in Table 10 regarding how the realities of ES outcomes are performed through the sociomaterial intra-actions between users and technologies, shaped by the contingencies of local contexts.

While the ANT analysis highlighted the sociomaterial complexities and competing narratives surrounding the implementation, the event logs provided material evidence of both RIMS' ability to coordinate the pubcount process as intended based on its rules and configurations, but also the accumulation of inefficiencies, rework, and breakdowns that manifested in actual system use. This duality substantiates Proposition 3 about how ES implementation outcomes enact multiple, divergent realities through the privileging or obscuring of different issues across different practices.

Collectively, the two analysis approaches triangulate the contrasting perspectives of success and failure that emerged relationally across different actor-networks, as described in Proposition 5 regarding the ontological politics mediating competing realities. The ANT analysis accounts for the underlying sociomaterial dynamics, priorities, interests and politics that performed these competing realities. Simultaneously, the event log analysis demonstrates how RIMS actively enabled and constrained the pubcount practice through its material agency, further evidencing the multifaceted nature of the implementation outcome.

Combining the sociomaterial richness from the ANT analysis with the technology-centric process evidence from the event logs elucidates the paradoxical coexistence of performance and underperformance within the same implementation. This highlights the inadequacy of binary success/failure assessments for large-scale IT projects. Organizations persist in applying such binary labels despite their limitations, driven by institutional pressures for clear accountability metrics, funding justifications, and the need to demonstrate return on investment. At Ìwádí, the PIC network's enactment of RIMS as a 'success' served strategic interests, justifying the significant resource investment and securing additional funding for system improvements. Meanwhile, end-users' competing reality of 'failure' was marginalized despite materially impacting daily operations. This tension between organizational imperatives for simplified assessment metrics and the complex,

multiple realities of implementation outcomes reflect broader institutional dynamics where strategic interests influence what gets labelled as success or failure. The findings emphasize how implementation outcomes inevitably involve multiplicity, with realities of success and failure emerging through distinct sociomaterial intra-actions and practices, rather than being inherent qualities.

Table 10: Propositions on the performative emergence of ES implementation outcomes

Proposition	**Description**	**Key Details/Findings**	**Sociomaterial Practices**	**Coordination Mechanisms**	**Event log Analysis Findings**
1	Ontological divergences arise when the interests and assumptions underpinning enterprise system design encounter the multiplicities of localized use practices. These divergences unsettle and disrupt a priori assumptions, leading to implementation outcomes that reflect a performative enactment of the system's configurations within specific sociomaterial contexts.	*RIMS failed to meet expectations for seamless adoption due to limitations in configuring it for local practices like bulk publication imports. *Iterative design process revealed misalignments between RIMS capabilities and Ìwádí's needs. *RIMS became a localized hybrid with workarounds and reconstituted user identities.	*System configuration (enacted by RIMS implementation team and DC Research Limited consultants) *Prototyping (enacted by RIMS implementation team, vendor consultants, and publication management team) *Training (initially attempted by the RIMS implementation team, later enacted by publication management team)	*Focus group meetings *Hands-on testing sessions	*Event logs showed frequent rework loops of sending publications back to capturers, highlighting divergences between RIMS design and real-world use cases.
2	Enterprise system implementations surface multiple ontologies through unexamined sociomaterial entanglements between strategic rhetoric, design assumptions inscribed into software, and the complex realities of everyday work. Sustainable alignment requires traversing these ontological	*Strategic rhetoric portrayed RIMS as highly configurable, clashing with complex local realities. *System design assumptions about best practices differed from Ìwádí's particularities.	*Business case development (enacted by Research Office leadership and external consultants) *Requirements gathering (enacted by RIMS implementation team and DC Research Limited consultants)	*Project meetings *RFP process	*Event logs showed RIMS enforcing intended pubcount process flow based on configured rules, reflecting design assumptions inscribed into software

Proposition	Description	Key Details/Findings	Sociomaterial Practices	Coordination Mechanisms	Event log Analysis Findings
	boundaries through participative translation.	*Limited stakeholder engagement obscured sociomaterial complexities. *Suggests participative translation between visions and needs for sustainable alignment.	*System demos (performed by DC Research Limited consultants)		
3	ES implementation outcomes enact multiple, divergent realities across actor-networks through situated sociomaterial practices that privilege certain issues while obscuring others, shaped by coordination mechanisms that stabilize partial perspectives.	*Project leadership focused on metrics fitting strategic aims, enacting RIMS success. *End-users faced daily challenges like data issues, enacting RIMS failure. *Coordination mechanisms like meetings and support tickets provisionally solidified each reality.	*Status reporting (enacted by George/project manager to PIC) *Publication capturing (enacted by departmental administrators and faculty coordinators) *RIMS use for pubcount (enacted by end-users: publication management team, departmental administrators, faculty coordinators)	*Project meetings *Issue tracking system	*Event logs revealed RIMS both enabling pubcount process but also breakdowns/inefficiencies, substantiating how outcomes enact multiple realities.

Proposition	Description	Key Details/Findings	Sociomaterial Practices	Coordination Mechanisms	Event log Analysis Findings
4	Ontological politics mediate ES implementation outcomes, as competing realities manifest relationally from the incentives and strategic interests underlying the sociomaterial construction of reality within different networks.	*PIC motivated by funding/legitimacy interests, enacting RIMS success. *End-users less involved in decisions affecting work, experiencing failure. *Realities emerge through privileging arrangements aligned with interests.	*Prioritization practices (enacted by PIC and Research Office leadership) *Resource allocation (enacted by project manager and PIC) *Decision-making (enacted by PIC and Research Office leadership)	*Project meetings *System usage	*The event logs substantiated competing realities shaped by divergent network interests - for leadership, successful workflow execution aligned funding priorities; for end-users, breakdowns reflected operational challenges. *The events foregrounded in the log data corresponded to the situated realities privileged by each network based on their motivating strategic interests, illuminating the ontological politics mediating implementation outcomes.

Proposition	Description	Key Details/Findings	Sociomaterial Practices	Coordination Mechanisms	Event log Analysis Findings
5	The realities of ES implementation outcomes are co-constituted through the agential cuts performed by the sociomaterial intra-actions between end-users, technologies, organizational actors, and the material-discursive practices that enact specific versions of the ES within distinct organizational contexts	*RIMS success/failure co-constituted by intra-actions across networks. *Project leadership's priorities and interests positioned metrics as reality-makers. *End-user experiences bound by localized work contexts. *Institutional discourses on metrics/rankings shaped what "mattered".	*Decision-making practices (enacted by PIC and Research Office leadership) *RIMS use for pubcount (enacted by end-users: publication management team, departmental administrators, faculty coordinators) *Reporting (enacted by publication management team to PIC and DHET)	*Project governance meetings *Training sessions	*Data quality issues requiring user interventions showed how realities are co-constituted through user-technology intra-actions

6.4 Chapter Summary

The complementary analyses provided a multifaceted account of the RIMS implementation, revealing the paradoxical coexistence of success and failure. The findings challenge binary success/failure assessments, highlighting how such outcomes inevitably involve multiplicity emerging through distinct sociomaterial practices. The theoretical propositions contribute nuanced insights into the constitutive complexities and relations underlying large-scale IT project reality

7. How the Realities of ES Implementation Outcomes are Performed

This chapter explored how the realities of ES implementation outcomes are performed through an in-depth case study analysis using an ANT lens. The analysis revealed a multi-step process through which competing realities of success and failure emerged for the same ES implementation at Ìwádí University. Presenting the analysis findings as a multi-step process serves as an analytical device to systematically trace how different actor-networks emerged and produced competing realities, rather than claiming the actual unfolding was strictly linear.

7.1 A Multi-Step Process of Performing the Realities of ES Implementation Outcomes

The analysis findings reveal a multi-step process through which the competing realities of success and failure for the RIMS implementation were performatively enacted. This process unfolded as follows

1. Emergence of the Initial Actor-Network and Sociomaterial Practices:

The initial actor-network, known as the Research Administration Modernization Network, emerged through a series of sociomaterial practices and interactions among key actors, including the Research Office leadership, external consultants, institutional strategy documents, and the RIMS system itself. The sociomaterial practices within this network centered around strategizing and implementing the RIMS publications module to modernize research administration processes. These practices brought together the network's goal and the material capabilities of the RIMS technology in a relational network (Cecez-Kecmanovic et al., 2014; Orlikowski & Scott, 2008a).

2. Reconfiguration of the Actor-Network and Emergence of Misaligned Practices:

The ANT analysis findings highlight the dynamic and emergent nature of sociomaterial entanglements during ES implementation. The initial actor-network envisioned for the RIMS implementation underwent significant reconfiguration as misalignments and tensions between different actors' practices surfaced. The sociomaterial practices of the RIMS implementation team, focused on system configuration and customization, clashed with the localized practices of the

publication management team, who had deep knowledge of the existing publication capture practices. This mismatch revealed the limitations of RIMS in adapting to the specific requirements of Ìwádí University, where administrators capture publications on behalf of researchers. The sociomaterial practice of iterative trial-and-error design and hands-on prototyping enacted by the teams brought to light the inability of RIMS to fit the existing practices. This enactment reshaped understandings of RIMS, recalibrated the initial priorities of the actor-network, and reconstituted the identities and roles of actors involved (Jones, 2014; Orlikowski & Scott, 2008a). This exemplifies how "materiality is integral to organizing" and the "recursive intertwining of humans and technology in practice" (Orlikowski, 2007, p. 1436). For example, RIMS' inability to support bulk publication imports forced the publication management team to develop manual data capture practices, while their localized needs simultaneously required material modifications to RIMS through backend customizations and workflow changes. The findings highlight how RIMS was not a pre-existing system that was simply implemented, but rather was performatively produced and enacted through specific sociomaterial practices. RIMS emerged as different versions through its ongoing production within distinct networks of relations and practices. The initial assumptions about RIMS and its fit with existing practices were disrupted through the enactment of sociomaterial practices, leading to a reconfiguration of the actor-network. This highlights the need to recognize the influence of extended chains of intra-action on the focal assemblage, rather than treating it as a discrete, pre-existing object (Jones, 2014).

3. Emergence of Distinct Actor-Networks and Competing Realities:

The emergence of distinct actor-networks and competing realities highlights the dynamic and evolving nature of actor-networks. Changes in the roles, relationships, and interactions among actors can lead to the disintegration of an existing network and the formation of new ones (Cecez-Kecmanovic et al., 2014). This process underscores the fluid and dynamic nature of actor-networks, where stability is temporary and subject to constant renegotiation and reconfiguration (Gad & Jensen, 2010). While the dynamic and evolving nature of actor-networks means that stability is temporary and subject to constant renegotiation, organizations should aim for networks that are both adaptive and resilient.

The reconfiguration of the initial actor-network (Research Administration Modernization Network) led to its gradual decomposition and the emergence of two distinct actor-networks:

a. The RIMS End-User Network: This network comprised the publication management team, departmental administrators, faculty coordinators, publication management processes, RIMS, user work practices, and system bugs. It enacted sociomaterial practices centered around using RIMS for pubcount, troubleshooting system issues, and navigating ongoing challenges. Within this network, the roles and identities of actors were reconstituted through their relations and practices. For instance, the publication management team's role expanded from providing guidance to offering technical support, while the departmental administrators' identities were reconstituted by the need to manually capture publication data outside of regular working hours. This exemplifies ANT's core tenet of relational materiality, where actors within an actor-network are not fixed entities but are continuously performed and reconfigured through their relations and practices (Law & Singleton, 2014).

b. The PIC Network: This network consisted of the project implementation committee, project status reports, project manager, project timeline, strategic priorities, DHET reporting requirements, research output metrics, and the enacted version of *RIMS. The PIC network enacted a particular version of *RIMS through their specific practices and relations, just as the end-user network enacted their own version through different practices. Both versions were performatively produced but took on distinct identities based on their situated enactment. The PIC network engaged in practices focused on governance, monitoring project timelines, costs, and the delivery of the required DHET report. Through recurrent practices like meetings, reports, and policy enforcement, the PIC network sociomaterially enacted roles and agencies bound up with upholding strategic priorities. This network exemplifies the concept of irreversibility, where the strong inscriptions and established practices made it difficult to deviate from the defined course of action once the network was stabilized (Sidorova & Sarker, 2000).

The RIMS itself was enacted differently within each network, taking on divergent identities and agencies based on the specific entanglements and practices it was part of. For the PIC network, *RIMS was enacted as a system enabling compliance and increased revenue, while for the RIMS end-user network, it was enacted as a system hindering day-to-day operations. As Orlikowski and Scott (2008b) explain, "people and things only exist in relation to each other... In other words, entities (whether humans or technologies) have no inherent properties, but acquire form, attributes, and capabilities through their interpenetration" (p. 455).

4. Performative enactment of competing realities (success and failure) through the sociomaterial practices within each actor-network

Within these distinct actor-networks, different sociomaterial practices emerged, leading to the performative enactment of competing realities of the RIMS implementation.

a. RIMS as Success: The PIC network enacted the reality of a successful RIMS implementation through practices such as steering committee meetings, project reports, and the assessment of quantitative metrics like research output and increased university revenue. Their practices privileged high-level deliverables and institutional goals, while excluding localized challenges and complications.

b. RIMS as Failure: The RIMS end-user network enacted the reality of a failed RIMS implementation through sociomaterial practices that involved struggling with system issues, manual workarounds, and unmet expectations. Their daily experiences of frustration, negative reviews, and system complaints reinforced this reality qualitatively.

This finding highlights the ontological multiplicity of information systems, where different actor-networks and their sociomaterial practices can produce competing realities of the same system implementation (Alcadipani & Hassard, 2010). The performative perspective shifts the focus from seeking a single, objective assessment of success or failure to understanding how these realities are enacted through the entanglement of social and material elements in practice. It challenges the notion of a fixed, singular reality and emphasizes the importance of exploring the practices and mechanisms that lead to the emergence of multiple realities within complex sociotechnical systems (Cecez-Kecmanovic et al., 2014).

5. Ontological Politics and Coordination Mechanisms Stabilizing Realities:

The competing realities of success and failure were not merely different perspectives but were actively performed and stabilized through practices shaped by ontological politics and coordination mechanisms within each actor-network.

a. PIC Network: The PIC network relied on coordination mechanisms like formal meetings, written reports, documented policies/charters, and governance reporting mechanisms to enact and stabilize the reality of success. These mechanisms performed practices that selectively included elements supporting the enactment of success, such as high-level deliverables and institutional goals, while excluding localized challenges and complications faced by end-users. The practices within the PIC network thus performed an agential cut that constituted the reality of a successful RIMS implementation.

b. RIMS End-User Network: The reality of failure was reinforced by coordination mechanisms such as training sessions, hands-on prototyping sessions, support ticketing systems and email communication channels. These practices enacted a boundary around the struggles and frustrations experienced by end-users, while obscuring strategic outcomes and high-level deliverables.

The selective inclusion and exclusion of elements within each network's practices reflected underlying ontological politics and political interests, such as upholding institutional legitimacy, securing research funding, or addressing day-to-day work concerns. Mol (1999) highlights how "once we start to look carefully at the variety of the objects performed in a practice, we come across complex interferences between those objects" (p. 82). In this case, while the focal object was the RIMS implementation, the performances also interfered with other network effects and outcomes like institutional reputation, research metrics, and user experiences.

Maintaining a balance between the strategic vision and addressing localized concerns is crucial for sustained support and successful implementation (Wagner et al., 2010). As Mol (1999) argues, "there is no sign that this situation [of multiple interfering realities] is changing" (p. 78), so approaches are needed to grapple with the "open-endedness" and "tragic dilemmas" (p. 82) stemming from ontological multiplicity. To achieve this balance, a more inclusive and iterative approach is necessary. This approach should recognize the sociomaterial nature of information systems, which can help bridge the gap between the envisioned reality of success and the actual reality experienced by end-users (Wagner et al., 2010).

In summary, the realities of ES implementation outcomes are performed through the enactment of distinct sociomaterial practices within emergent actor-networks. These practices, entangled with coordination mechanisms like formal meetings and project reports, ontological politics, and the co-constitution of actors, roles, and agencies, lead to the performative emergence of competing realities, such as success and failure, even for the same ES implementation. The realities are not inherent properties but rather emerge relationally through the specific arrangements and practices privileged within each actor-network. The process involves the following key steps:

1. Emergence of an initial actor-network and sociomaterial practices around the ES implementation vision.
2. Reconfiguration of the actor-network due to misaligned practices and emerging tensions between actors.
3. Gradual decomposition of the initial actor-network and the emergence of distinct actor-networks enacting different sociomaterial practices.
4. Performative enactment of competing realities (success and failure) through the sociomaterial practices within each actor-network.
5. Stabilization of competing realities through practices shaped by ontological politics and coordination mechanisms that selectively include and exclude elements within each network's practices.

This process highlights the central role of sociomaterial practices in performatively enacting the realities of ES implementation outcomes and emphasizes the relational and emergent nature of these realities within the complexities of organizational life.

7.2 Chapter summary

The analysis of the RIMS implementation outlines a multi-step process through which the realities of success and failure were performed within emerging actor-networks and their associated sociomaterial practices. This process highlights the relational, practice-based nature of ES implementation realities, challenging intrinsic notions of success and failure. The findings emphasize the need for a more inclusive, iterative approach attuned to the sociomaterial entanglements that shape how realities emerge in practice across strategic and localized levels during ES implementations.

8. Conclusion

8.1 Introduction

The conclusion to this study is presented in seven sections. Section 8.2 presents an overview of this study with a particular focus on what was achieved in chapters 1-7. Section 8.3 presents a summary of the key research findings. Section 8.4 presents the research contributions of the study to theory and practice. Section 8.5 highlights the limitations of this study and section 8.6 offers suggestions for future research. Section 8.7 presents an evaluation of this study.

8.2 Chapter Summary

In Chapter 1, the introduction, the research problem and research questions were presented. Chapter 2 offered insights into the performativity of IS implementation outcomes through a literature review. Chapter 3 justified the use of ANT as the theoretical lens for the study. ANT provided concepts used to answer the main research question. Chapter 4 discussed the study's explanatory purpose, using qualitative methods and following an abductive approach. It employed the agential realism perspective and a case study design, collecting data through interviews, observations, documents, field notes, and an event log. Chapter 5 described the case context, including Ìwádí University, the publication count practice, and the RIMS implementation process. Chapter 6 presented empirical findings from an ANT and event log analysis, revealing how competing realities of success and failure emerged through different networks' sociomaterial practices. Chapter 7 built on this to explain the multi-step process through which these realities were relationally performed, challenging intrinsic outcome notions. Finally, a summary of the key research findings and contributions were presented in this chapter.

8.3 Summary of Research Findings

The main objective of this study was to investigate the performance of IS implementation outcomes. To accomplish this, we adopted an ANT approach. The ANT provided the research framework for data collection and analysis. Hence, this study was able to answer the below research question:

- How are the competing realities of ES implementation outcomes performed?

The research question was answered using the below sub-sections:

8.3.1 Emergence and Reconfiguration of Actor-Networks

The realities of ES implementation outcomes emerged through a fluid process of actor-network formation, reconfiguration and decomposition over time. Initially, the Research Administration Modernization Network took shape, comprising actors like the university's Research Office leadership, external consultants, strategic documents, and the RIMS enterprise system itself. The sociomaterial practices within this network centered on strategizing and implementing RIMS to modernize research administration.

However, as implementation activities progressed through iterative prototyping and hands-on trials, ontological mismatches surfaced between the assumptions about RIMS' configurability versus the complex realities of adapting it to Ìwádí's localized publication management practices. This revealed limitations in the initial framing of RIMS as a seamlessly customizable solution. The sociomaterial practices of system configuration and testing by the implementation team clashed with the intimate knowledge of existing processes held by the publication management team.

These ontological divergences disrupted the alignment of interests within the initial actor-network, leading to a reconfiguration of roles, relationships and a gradual decomposition as the network could no longer be stabilized around the original goals and assumptions.

8.3.2 Distinct Actor-Networks Enacting Competing Realities

The destabilization of the Research Administration Modernization Network gave rise to two new distinct actor-networks - the PIC network and the RIMS end-user network.

The PIC network comprised institutional leaders, project governance bodies, documented policies/charters, and an enactment of *RIMS centered on monitoring strategic deliverables like costs, timelines and the DHET research output report. The sociomaterial practices within this network, such as review meetings and report assessments, performed a reality wherein the RIMS implementation was deemed a success based on increased metrics and revenue.

In contrast, the RIMS end-user network consisted of the publication management team, administrators, faculty coordinators, their localized work practices, and the RIMS technology as experienced on the ground. The sociomaterial practices of using RIMS, facing system challenges, creating workarounds and logging support tickets enacted a competing reality where the

implementation was considered a failure due to misalignments with processes, unmet expectations and increased manual effort.

The RIMS technology itself emerged as ontologically multiple - enacted as a strategic enabler within the PIC network versus a hindrance to operations in the end-user network based on the distinct sociomaterial entanglements it became part of in each context.

8.3.3 Coordination Mechanisms and Ontological Politics

The competing realities of success and failure did not just reflect different perspectives, but were actively performed and stabilized through practices shaped by key coordination mechanisms that enacted particular versions while obscuring others. Within the PIC network, agential cuts were made through mechanisms like formal meetings, written project reports, and centralized governance policies/frameworks that prioritized strategic metrics and deliverables. This served to include elements such as project meetings and reports, that enacted the RIMS implementation as a success while excluding contextualized challenges faced by end-users.

Conversely, in the end-user network, the failure reality was reinforced through sociomaterial practices like hands-on system training, issue ticketing flows, and localized communications foregrounding the frustrations and roadblocks experienced in RIMS usage. These coordination mechanisms focused on operational frictions while backgrounding the strategic outcomes achieved. The selective inclusions and exclusions exhibited by the coordination mechanisms of each network reflected the underlying ontological politics and priorities, interests shaped by divergent interests - such as institutional priorities around growth and compliance for the PIC versus seamless task execution for end-users.

8.3.4 Multiplicity of Relational Realities

The analysis highlighted that there was no single reality of the RIMS implementation outcome as an inherent success or failure. Instead, multiple realities were continually co-constituted through the complex sociomaterial intra-actions between technologies, organizational actors, institutional narratives, and the distinct localized practices enacted within each network over time.

Assessments of success or failure did not pre-exist but rather emerged relationally and performatively based on the specific arrangements, priorities, interests and situated discourses that gained saliency through the practices of a given actor-network. What counted as a success or failure was bound up in

how realities were enacted through the entangled sociomaterial practices privileging particular issues while rendering others obscure.

The analysis challenged binary notions by surfacing the ontological multiplicity and emergent nature of ES implementation outcomes as relational realities actively performed across interconnected networks. An inclusive approach bridging strategic requirements and local user needs through iterative translation and participative alignment is crucial to navigate this multiplicity productively during large-scale system implementations.

8.4 Research Contributions

This study offers both theoretical and practical contributions. These contributions are discussed in the following sections:

8.4.1 Theoretical and Methodological Contributions

The multi-step process in Chapter 7 outlining how the realities of ES implementation outcomes are performed represents a significant theoretical contribution to our understanding of the sociomaterial dynamics underlying large-scale IT projects. This contribution challenges the traditional view of implementation outcomes as inherent, binary states of success or failure, offering a more nuanced perspective by building upon and extending the work of Cecez-Kecmanovic et al. (2014). While Cecez-Kecmanovic et al. (2014) introduced the performative perspective and argued that IS success/failure assessments are sociomaterially enacted through practices within actor-networks, the multi-step process provides a more comprehensive and granular understanding of the specific mechanisms and dynamics through which competing realities of ES implementation outcomes emerge, stabilize, and coexist across an organization.

The theoretical contribution lies in articulating how implementation realities are not pre-given or fixed, as suggested by the representational perspective, but rather performatively enacted through the dynamic interplay of sociomaterial practices across emergent actor-networks. It elucidates the relational and emergent nature of these realities, co-constituted through the entanglements of human and non-human actors, their practices, and the agential cuts performed by practices that are shaped by coordination mechanisms, which selectively include or exclude certain elements based on underlying ontological politics and interests. By tracing the emergence, reconfiguration, and decomposition of actor-networks, and the enactment of competing realities through their situated sociomaterial practices, this contribution provides a lens for understanding the multiplicitous and

constitutive nature of ES implementation outcomes. It shifts the focus from essentialist assessments - such as binary success/failure categorizations or simplistic metrics like return on investment; to an appreciation of the complex sociomaterial dynamics that shape how realities are performed within organizational life. This theoretical contribution offers a foundation for further theoretical development and empirical investigations into the complex processes underlying the emergence of multiple, divergent realities within large-scale IT project contexts, challenging the notion of inherent success or failure outcomes and highlighting the need for more inclusive, iterative approaches attuned to sociomaterial entanglements.

The theoretical propositions generated by this study represent a significant theoretical contribution to our understanding of the sociomaterial dynamics underlying ES implementations. While Cecez-Kecmanovic et al. (2014) introduced the performative perspective to studies on IS implementation outcomes, arguing that IS success/failure assessments are sociomaterially enacted through practices within actor-networks, the propositions in this study provide more granular insights into the complex practices and networks through which competing realities of ES implementation outcomes emerge, stabilize, and coexist across an organization.

These theoretical propositions are in line with Gregor's (2006) theory of explaining as they shed light into how and why the multiple concurrent realities of ES implementation outcomes are performed.

Proposition 1 highlights the ontological divergences that can arise between the interests underpinning system design and the multiplicities of actual use, challenging assumptions about seamless adoption and highlighting the need for localization. Proposition 2 extends this by emphasizing the importance of participative translation across boundaries to bridge strategic visions, system assumptions, and localized work practices. Propositions 3 and 4 contribute to theorizing the ontological multiplicity and political nature of ES implementation outcomes. They posit that implementation realities are not singular or intrinsic but rather multiple, divergent realities that emerge through situated sociomaterial practices across different actor-networks, shaped by ontological politics and strategic interests. Proposition 5 further contributes by articulating how implementation realities are co-constituted through the sociomaterial intra-actions between various actors, technologies, and material-discursive practices, influenced by priorities, interests, situated discourses, and institutional factors.

Collectively, these theoretical propositions contribute a nuanced understanding of the entangled sociomaterial dynamics, ontological multiplicity, and political processes that underlie ES implementation outcomes. They challenge traditional representational perspectives (Delone &

Mclean, 1992, 2003), offering a performative, practice-based lens that recognizes the relational and emergent nature of implementation realities. By theorizing the role of sociomaterial practices, coordination mechanisms, and ontological politics in shaping implementation outcomes, these propositions provide a foundation for rethinking our approach to studying ES implementations. They call for a shift away from deterministic models and binary success/failure narratives, towards a more inclusive and iterative appreciation of the complex entanglements that performatively enact implementation realities within organizational life.

The theorizing of ontological politics and coordination mechanisms in shaping ES implementation realities represents a significant theoretical contribution of this study. It theorizes how ontological politics mediate competing realities across actor-networks, manifesting relationally from underlying incentives and interests shaping sociomaterial reality construction. Actor-networks selectively include/exclude elements aligned with interests, enacting distinct success/failure realities through situated practices. Furthermore, it contributes understanding of how coordination mechanisms like meetings and reports stabilize particular realities by performing agential cuts, solidifying specific evidence while excluding alternatives, effectively "policing" which issues gain salience as reality-makers across networks. Theorizing this interplay between ontological politics and coordination mechanisms provides a perspective on how implementation realities are performed and negotiated. It highlights how priorities, interests, discourses, and institutional factors influence the boundaries and inclusions/exclusions co-constituting enacted realities. This nuanced contribution moves beyond simplistic success/failure narratives, emphasizing exploring processes underlying multiple, divergent sociomaterial realities.

The integration of ANT and process mining techniques for sociomaterial analyses represents a methodological contribution of this study. ANT provides a rich sociomaterial conceptual foundation for tracing actor-network emergence, transformations and entanglements surrounding implementations. Complementing this, process mining analyzes event log data, revealing the ES's material agency and performativity in shaping organizational practices - coordinating intended processes but also exposing deviations and breakdowns in actual use. Integrating these approaches enables comprehensive understanding of implementation realities, capturing sociomaterial complexities and technological performativities in their inseparable entanglement. This methodological contribution holds theoretical implications, providing a robust analytical framework to study the constitutive processes underlying the emergence of multiple, divergent realities in large

IT projects. By triangulating sociomaterial analysis and process mining insights, researchers can develop nuanced understandings of how outcomes are performatively enacted through human-nonhuman interplays. Overall, this approach advances understanding of intricate sociomaterial dynamics shaping organizational realities surrounding ES implementations.

8.4.2 Practical Contributions

As practitioners of IS implementations, there are several important lessons that can be learned from an ANT study on the performativity of ES implementation outcomes. These lessons are discussed below:

1. Recognizing the multiplicity of realities in ES implementations challenges the conventional view of outcomes as universally perceived successes or failures, revealing how multiple, divergent realities can coexist surrounding the same initiative. These differing realities manifest through distinct sociomaterial practices enacted by various stakeholder groups, shaped by their unique interests, priorities, and lived experiences with the system. For practitioners, this highlights the importance of adopting a pluralistic stance that actively seeks out and surfaces these multiple perspectives across different organizational units, hierarchy levels, and functional domains. Rather than privileging any single narrative as the authoritative truth, a more inclusive approach is needed to reconcile the divergent realities through open dialogue, mutual translation, and the negotiation of shared understandings among stakeholders. This approach can deliver benefits such as improved alignment between strategic visions and localized realities, enhanced stakeholder engagement and collaboration, increased adaptability and responsiveness to changing circumstances, and improved decision making and problem solving.

2. Importance of inclusive stakeholder engagement: While inclusive stakeholder engagement may be considered common knowledge and best practice, the analysis underscores its critical importance in mitigating the risk of misalignments between strategic visions, system capabilities, and the complexities of localized work practices that can contribute to the emergence of ontological divergences and conflicting realities. To achieve this, practitioners should embrace participative processes that bring together strategic decision-makers, business/IT professionals, and frontline end-users from the outset. Upfront immersion activities, such as ethnographic studies and end-user shadowing, can uncover critical gaps between system assumptions and real world work practices early on. Ongoing feedback loops, facilitated through mechanisms like cross-functional design workshops, enable the mutual translation of perspectives between technical experts and end-users,

fostering a shared understanding of system constraints and work realities. Furthermore, inclusive governance structures that actively involve end-user representatives ensure that their voices shape implementation roadmaps and design decisions alongside strategic objectives, delivering benefits such as improved alignment between strategic visions and localized realities, enhanced stakeholder engagement and collaboration, increased adaptability and responsiveness to changing circumstances, and improved decision making and problem solving.

The ANT analysis of the RIMS case demonstrates why traditional governance approaches often fail to prevent network decomposition and competing realities, as seen when the PIC network relied primarily on project metrics and status reports that performed agential cuts excluding critical operational realities. To address this, governance structures should be reconceptualized as active translation mechanisms between networks, with the publication management team serving as network mediators in PIC meetings to demonstrate how RIMS materially constrained their work practices.

3. Attunement to sociomaterial entanglements: The findings illustrate how ES implementation outcomes are produced through the intricate entanglements between technologies, human agencies, organizational routines, institutional logics, and material infrastructures. Practitioners need to develop a heightened attunement to these sociomaterial forces and analyze how they may facilitate or constrain particular system use cases, work practices, and stakeholder interests. Techniques such as mapping actor-networks and analyzing sociomaterial entanglement can reveal overlooked interdependencies that may destabilize implementation efforts if left unaddressed. Implementation plans should proactively identify and manage critical sociomaterial tensions that may require system re-configurations, work practice adaptations, or the development of compensating mechanisms. By accounting for these sociomaterial complexities, practitioners can better anticipate and navigate the intricate web of relationships and dependencies that shape ES implementation trajectories.

The ANT analysis revealed critical sociomaterial entanglements that constrained the successful adoption of RIMS. If the implementation team had proactively mapped the actor-network and identified these tensions early on, they could have engaged in more upfront stakeholder immersion to uncover gaps between system assumptions and localized work practices, facilitated cross-functional design workshops to enable mutual translation of perspectives, and developed compensating mechanisms like workarounds and training programs. By developing a heightened attunement to the sociomaterial forces at play and taking proactive steps to manage critical tensions, practitioners can better navigate the complex dependencies that shape ES implementation trajectories.

4. Balancing strategic oversight with localized adaptations: The findings highlight the importance of striking a balance between strategic oversight and localized adaptations during ES implementations. Governing bodies, such as steering committees, should have balanced representation that ensures localized user perspectives are heard alongside strategic and management voices. Implementation decision-making processes should consider both high-level metrics, targets, and strategic objectives, as well as qualitative input about operational challenges and frontline needs from end-users. When quantitative data conflicts with qualitative experiences, the lived realities and perspectives conveyed through personal accounts and narratives should be given precedence. Reporting processes should transcend mere project milestones and metrics to also surface sociomaterial breakdowns, issue patterns, and user sentiments. Continual translation between strategic objectives and frontline realities allows for dynamic refinements to system designs and rollout plans based on emerging learnings from the field. By fostering this balance, practitioners can better align ES implementations with both organizational priorities and the realities of day-to-day work, increasing the likelihood of sustained adoption and effective utilization. For example, the PIC network could have included end-user representatives in steering committee meetings, considered both high-level metrics and qualitative input from end-users, and transcended mere project milestones in reporting processes. This would have surfaced operational challenges and frontline needs earlier on, providing a more holistic picture of implementation realities. By striking this balance, the PIC network could have increased the likelihood of sustained adoption and effective utilization of RIMS.

5. Iterative, adaptive implementation processes: The dynamic reconfigurations of actor-networks and the emergent nature of sociomaterial entanglements revealed in the findings challenge the efficacy of traditional, rigid, plan-based implementation methodologies. Such approaches, which enforce pre-defined, inflexible plans, may be ill-suited to the fluid sociomaterial shifts inherent in ES rollouts. Instead, the ANT analysis provides insights into how practitioners could adopt more agile, iterative implementation processes that respond to the emergent and performative nature of ES implementations. For example, the implementation team could have embraced prototyping, pilots, and phased rollouts to create contained spaces for hands-on experimentation and surfacing critical tensions before broader deployment. They could have encouraged iterative development that enables system designs to evolve through recursive cycles of use, feedback, and refinement, improving sociomaterial alignments over time. By adopting these iterative, adaptive approaches informed by the ANT analysis, practitioners can better respond to the emergent and performative nature of ES

implementations, increasing the likelihood of achieving sustainable embedment within the complex sociomaterial fabric of organizations.

The overarching theme across these practical contributions is the need for practitioners to proactively recognize, engage with, and adapt to the sociomaterial complexities surrounding large-scale ES implementations. This requires embracing inclusive, iterative, and emergent approaches that foster continual translation between strategic aims, system capabilities, and the lived realities of end-users. By doing so, organizations can navigate the inherent multiplicity and performativity of ES implementation outcomes, increasing the chances of successful, sustained adoption and value realization.

8.5 Limitations of the Study

One potential limitation of the research is that it is based on a single in-depth case study at one university. While this allows for a rich and nuanced understanding of the phenomenon, some may question the generalizability of the findings to other contexts beyond the studied university. However, as Lee and Baskerville (2003) argued, criticizing a theory or findings from a case study for a lack of statistical generalizability to other settings would be inappropriate. Instead, the generalizability of interest for case studies is generalizing from the empirical descriptions and rich details of the case to theoretical statements and concepts. To mitigate this limitation, the research leveraged the higher education institution setting as a complex context suitable for exploring ES implementation outcomes. The presence of multiple domains, stakeholders, and the intertwining of academic and administrative processes within the university setting provided a fertile ground for investigating the emergent realities surrounding ES implementations. The study's thick descriptions of sociomaterial practices and theoretical propositions can be further generalized from theoretical statements to empirical statements (Type TE generalizability) by researchers studying ES implementations in other contexts where similar sociomaterial dynamics may be present (Lee & Baskerville, 2003).

Another potential limitation arises from the retrospective nature of the case study. Since the research examined an ES implementation that had already occurred, there was a risk of missing or overlooking important events, interactions, or details that were not adequately documented or recollected accurately by the participants involved. To mitigate this limitation, the research employed data triangulation from multiple sources, including interviews, documents and system event logs. By corroborating and cross-verifying information from various sources, the study aimed to overcome

potential gaps or inaccuracies in participants' recollections. The use of system event logs, in particular, provided a concurrent record of specific actions and workflows related to the ES implementation, complementing the qualitative data sources.

There is a potential limitation of researcher bias influencing the data collection and analysis processes. The researcher's own perspectives, assumptions, and preconceptions could potentially shape the interpretation of data and the findings. To mitigate this limitation, the research incorporated several measures to enhance the reliability and validity of the study. First, the researcher engaged in prolonged engagement in the field, spending extended periods observing and interacting with participants, which helped to build trust and reduce potential biases. Additionally, the use of data triangulation from multiple sources provided a means to cross check and validate findings, reducing the influence of potential biases.

8.6 Suggestions for Future Research

This study has contributed valuable insights into the performance of ES implementation outcomes. However, there are still several areas that require further investigations.

The current study provides a rich, in-depth analysis of how ES implementation realities are performed through a single case study at a university. However, to further enhance the generalizability and transferability of the findings, conducting multi-case studies across different organizational contexts could be valuable. By exploring ES implementations in diverse settings, such as different industries or sectors, researchers could investigate how the emergent sociomaterial practices and competing realities manifest in varied environments. Such studies would allow for a comparative analysis, helping to validate and refine the proposed theoretical propositions, as well as uncover potential contextual nuances that shape the performative emergence of implementation realities.

The current study examines a retrospective case of an ES implementation, relying on recollections and documented evidence from the past. While this approach provides valuable insights, conducting longitudinal studies that follow the unfolding of ES implementations in real-time could offer additional perspectives. Such longitudinal studies would enable researchers to directly observe and capture the dynamic nature of actor-network reconfigurations, the emergence of competing realities, and the role of sociomaterial practices as they unfold over an extended period. This temporal dimension could shed light on how implementation realities shift and evolve through different phases, potentially revealing turning points that shape the trajectory of the implementation.

One of the key findings of the study highlights the significance of coordination mechanisms (such as meetings, reports, and support ticketing systems) and ontological politics in stabilizing and transporting competing realities across different actor-networks. Future research could delve deeper into the specific mechanisms and dynamics involved in these processes. By examining how coordination mechanisms, which are the formal and informal processes, routines, and practices that facilitate communication, collaboration, and decision-making within and across actor-networks, selectively include or exclude certain elements, and how ontological politics shape the boundaries of enacted realities, researchers could gain insights into strategies for more inclusive and participative ES implementations. Such insights could inform approaches that effectively bridge strategic visions and localized realities, fostering a more holistic and sustainable integration of ES within organizational practices.

The analysis in the current study touches upon the influence of priorities, interests, institutional discourses, and strategic interests in shaping the boundaries and inclusions/exclusions of enacted realities surrounding ES implementations. However, there is an opportunity for future studies to explicitly explore the complex interplay of these factors in greater depth. By examining how organizational priorities, interests, dominant narratives, and institutional discourses impact the performative emergence of implementation realities, researchers could uncover the underlying mechanisms that privilege certain perspectives while marginalizing others. Such insights could contribute to a more nuanced understanding of the sociopolitical forces that shape the multiple realities surrounding ES implementations.

Building upon the insights gained from this study's emphasis on sociomaterial practices and the relational emergence of implementation realities, future research could focus on developing practical intervention strategies or frameworks to guide more inclusive and iterative ES implementation approaches. These strategies could provide guidance on how to effectively balance strategic visions with localized concerns, foster participative translation across different actor-networks, and embrace the sociomaterial complexities that shape implementation realities. By translating the theoretical insights into actionable frameworks, researchers could contribute to improving the success and sustainability of ES implementations by acknowledging and navigating the multiplicity of realities involved in such complex sociomaterial endeavors.

8.7 Evaluation of the Research

The final step in any research project is evaluating the findings. This process involves asking seven key questions: What is new? So what? Why so? Well done? Done well? Why now? Who cares? (Whetten, 1989). Table 11 provides a summary of these questions, even though answers to these questions can be found in various sections of this thesis.

Table 11:Evaluation of the study's contribution (Whetten, 1989)

Question	Supporting Answer
What is new?	The study offers a multi-step process tracing how ES implementation realities of success and failure emergently unfold as multiple, competing enactments across actor-networks through sociomaterial practices shaped by ontological politics. It challenges the notion of success/failure as inherent properties by demonstrating their relational emergence. The study provides theoretical propositions that offer insights into the sociomaterial complexities surrounding ES implementations.
So what?	The theoretical propositions offer researchers and practitioners nuanced insights into the paradoxical coexistence of success and failure within ES implementations. These insights challenge unitary depictions and emphasize recognizing the multiplicity inherent in large-scale technology projects. For researchers, it highlights attending to the sociomaterial entanglements, ontological politics, and relational constitutions underlying competing implementation assessments. For practitioners, it suggests more inclusive, iterative approaches that bridge strategic visions with localized realities through participative translation to foster sustainable alignment during implementation.
Why so?	The performative approach using ANT is essential as it acknowledges the complex, dynamic and multiple realities involved in ES implementations which traditional representational approaches cannot adequately capture. It examines the agency of human and non-human actors, and how implementation outcomes are enacted through their sociomaterial configurations across different contexts, enabling a more holistic and nuanced understanding. The performative lens moves past seeking a single objective assessment to examining the practices and mechanisms that lead to the emergent multiplicity surrounding large-scale IT projects.
Well done?	The study is methodically thorough. It began with a detailed review of prior literature to understand the research area and identify gaps. The choice of ANT as the theoretical framework was well-motivated as suitable for achieving the research purpose of a performative approach. The ANT concepts were carefully operationalized to the specific context. The research approach and methods are rigorously documented, supporting verification and replication by other researchers.
Done well?	The thesis is written coherently and logically, presenting content in an organized and straightforward manner that facilitates effective understanding for the reader

Question	Supporting Answer
	without excessive verbosity. The clear writing style and structured organization contribute to the overall quality of the scholarly work.
Why now?	There is increasing implementation of ES by organizations seeking benefits like integrated processes, efficiency and real-time information access. However, the inherent complexity, dynamism and plural nature of ES implementation outcomes pose difficulties for traditional research approaches. Adopting the performative lens enables a more holistic, nuanced understanding needed for these large-scale, evolving technology projects. Furthermore, the rapid advancement of technology and rising organizational dependence on ES make research into understanding the performance of implementation outcomes highly relevant and timely.
Who cares?	The study's insights are relevant for both IS implementation stakeholders and academic researchers. From a practical perspective, stakeholders like program/project managers can gain novel perspectives on strategies to foster successful implementation outcomes by understanding how multiple realities emergently unfold shaped by sociomaterial practices and ontological politics. Academics can benefit from the study's unique performative perspective that complements and challenges prior knowledge about ES implementations.

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APPENDICES

Appendix 1: Faculty ethics approval

Faculty of Commerce
Private Bag X3, Rondebosch, 7701
2.26 Leslie Commerce Building, Upper Campus
Tel: +27 (0) 21 650 4375/ 5748 Fax: +27 (0) 21 650 4369
E-mail: com-faculty@uct.ac.za
Internet: www.uct.ac.za
@Commerce UCT UCT Commerce Faculty Office

27 November 2018

Dr Adedolapo Akin-Adetoro
Department of Information System
University of Cape Town

Dear Adedolapo Akin-Adetoro,

REF: REC 2018/011/147

The Performance of Information Systems Implementation Outcomes: The case of an Enterprise System Implementation at a South African University.

We are pleased to inform you that your ethics application has been approved. Unless otherwise specified this ethical clearance is valid for 1 year and may be renewed upon application.

Please be aware that you need to notify the Ethics Committee immediately should any aspect of your study regarding the engagement with participants as approved in this application, change. This may include aspects such as changes to the research design, questionnaires, or choice of participants.

The ongoing ethical conduct throughout the duration of the study remains the responsibility of the principal investigator.

We wish you well for your research.

Modie Sempu
Administrative Assistant
University of Cape Town
Commerce Faculty Office
Room 2.26 | Leslie Commerce Building

Office Telephone: +27 (0)21 650 4375
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"Our Mission is to be an outstanding teaching and research university, educating for life and addressing the challenges facing our society."

Appendix 2: Request to conduct research and interview participation consent form

Department of Information Systems
Leslie Commerce Building
Engineering Mall, Upper Campus
OR
Private Bag X3 Rondebosch 7701
Tel: +27 (0) 21 650 2261 Fax: +27 (0) 21650 2280
Internet: http://www.commerce.uct.ac.za/informationsystems/

17 October 2018

Request to conduct research and interview participation consent form

Dear Sir/Madam,

In terms of the requirements for completing a PhD at Department of Information Systems in the Faculty of Commerce at the University of Cape Town, a research study is required.

The researcher, in this case, **Akin-Adetoro** has chosen to conduct a case study entitled **[The Performance of Information Systems Implementation Outcomes: The case of an Enterprise System Implementation at a South African University]**. The researcher would like to request permission to conduct this case study at your organization. The objective of the research is to understand how the realities of an enterprise system implementation outcomes are performed post-implementation.

You participation in this research is voluntary. Due to the nature of the study you will need to provide the researchers with some form of identifiable information however, all responses will be confidential and used for the purposes of this research only. No individual names will be published. You can choose to withdraw from the research at any time for whatever reason, in accordance with ethical research requirements.

The primary data collection method will be one on one interviews with relevant stakeholders involved in the implementation of the current research information system. The interviews will be conducted on campus and will last 45 minutes.

Should you have any questions regarding this research, please feel free to contact me on 073 907 4069 or email: aknade006@myuct.ac.za

This research has been approved by the University of Cape Town's research Ethics committee. Your participation in this study would be greatly appreciated.

Sincerely,

Signed by candidate

Akin-Adetoro Adedolapo
Researcher \ PhD Student
Department of Information Systems
University of Cape Town
Email: aknade006@myuct.ac.za

Lisa Seymour
Research Supervisor
Department of Information Systems
University of Cape Town
Email: lisa.seymour@uct.ac.za

Research Participant Consent

I, _____, consent to participate in the research on "The Performance of Information Systems Implementation Outcomes: The case of an Enterprise System Implementation at a South African University".

I am aware that participation is voluntary and that respondents may choose to withdraw from this study at any time, should they choose to do so.

_____ Signature

_____ Date

Appendix 3: Interview Protocol

Section 1: Greetings and welcome

Section 2: Interviewee Demographics

Interviewee	
Full Name:	
Position:	
Organisation:	
Department:	
Business Unit or Team:	
Career	
Number of years with organisation:	
Number of years in career	
Number of projects you have worked on (Estimate)	
Previous Positions (in , organisation elsewhere):	
Interview Data	
Date:	
Venue:	

Duration:	

Section 3: Interview Questions

Introduction

1) Introduce yourself and the role you play in the project? (What other roles have you played?)
2) Give an overview of the project and its main objectives (how was the main objective documented? How was it circulated?)
3) What are the sub-goals/sub-objectives of the project (how were these crafted? Documented? And circulated) (power of actor association)
4) What was your business case/need? (What were you solving for? Was this documented? What were the identified benefits?)
5) Who were the other related actors/players/stakeholders (materials included) and in a few words kindly explain their roles and stage of involvement (enrolment)
6) What were their interests? What were they going to gain from the implementation (Translation)
7) How did you get to know about this interest (did speakers or representatives represent actors i.e. an IT vendor can speak on behalf of an application system, was this documented?)
8) Were all the interest of all actors/players/stakeholders, including the material (ERP, hosting platform, reports), taken into consideration. If yes how? If no why?
9) How were your interests aligned with the rest of the other actors/players/stakeholders (materials included) (any incentive offered?) relate to OPP (Translation)
10) Were these interests addressed? How?

Initiation and implementation

1) Kindly explain how this project was initiated (who initiated it? Who scoped it?)
2) Who was part of the initial working group? How that group produced (enacted) why them?
3) How was the vision of the project presented to other actors/players/stakeholders (was this documented) can I review this document?
4) How did they respond to the vision (the outcome of intéressemment)
5) How were the vendors selected?
6) How were implementation resources (human and technical) sourced and put into operation (enacted)?
7) How were the various focus/core/working group sourced and put into operation
8) Was there a BPR (business process re-engineering) How was this implemented? Was this documented?
9) How often and how were implementation meetings (demo sessions, requirements gathering, testing and training sessions) conducted? (Who attended these meetings, any

report, document, manual and system artefact presented? How were these circulated and accessed by everyone) (inscription)

10) Were there any other forms or methods used in updating actors/players/stakeholders about implementation progress? Did these forms /methods have an impact (i.e. communication strategies?) (Inscription)

Implementation status

1) Kindly explain how you perform your daily work? (constitutive entanglement in practice)
2) Kindly explain how you perform your daily work using the implemented system? (constitutive entanglement in practice)
3) What problems and issues have you encountered?
4) What benefits have you realized?
5) Did the implementation deliver on its goal?
6) How best can you describe the implementation outcome? Success/failure/abandoned/put on hold? Briefly explain why you say so
7) Why were the set-out objectives not met? What went well and wrong? Why was the implementation abandoned or suspended? (betrayal)
8) What role did the material play (ES system, hosting platform, documents, and manual) in the outcome of the project?
9) What actors/players/stakeholders were key to the success of the implementation?
10) What should have been done for a successful implementation (what should have the actors
    Concentrated on? Why wasn't this done?)
11) What could have been done differently? (Why wasn't this done?)
12) What was learnt from this experience?
13) Would you like to add anything?

Section 4: Unplanned questions

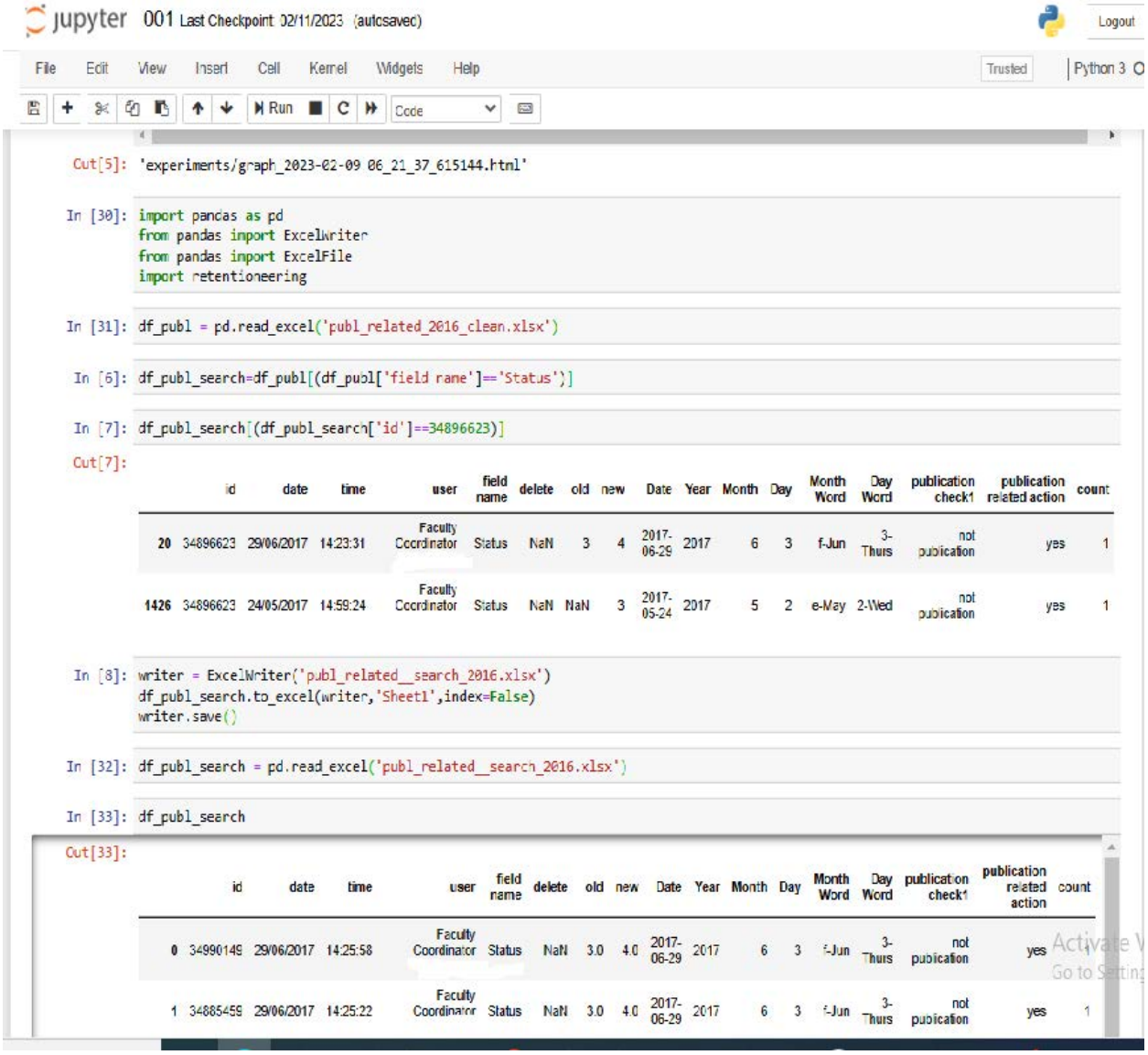
Section 5: Conclusion

1. Are there any questions you would like to ask?

Interviewer summarizes the interview session.

Thank you very much for your time.

Appendix 4: Log analysis using the retentioneering python library



jupyter 001 Last Checkpoint 02/11/2023 (autosaved) Logout

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3

Run Code

Out[5]: 'experiments/graph_2023-02-09 06_21_37_615144.html'

In [30]:
```
import pandas as pd
from pandas import ExcelWriter
from pandas import ExcelFile
import retentioneering
```

In [31]:
```
df_publ = pd.read_excel('publ_related_2016_clean.xlsx')
```

In [6]:
```
df_publ_search=df_publ[(df_publ['field name']=='Status')]
```

In [7]:
```
df_publ_search[(df_publ_search['id']==34896623)]
```

Out[7]:

	id	date	time	user	field name	delete	old	new	Date	Year	Month	Day	Month Word	Day Word	publication check1	publication related action	count
20	34896623	29/06/2017	14:23:31	Faculty Coordinator	Status	NaN	3	4	2017-06-29	2017	6	3	f-Jun	3-Thurs	not publication	yes	1
1426	34896623	24/05/2017	14:59:24	Faculty Coordinator	Status	NaN	NaN	3	2017-05-24	2017	5	2	e-May	2-Wed	not publication	yes	1

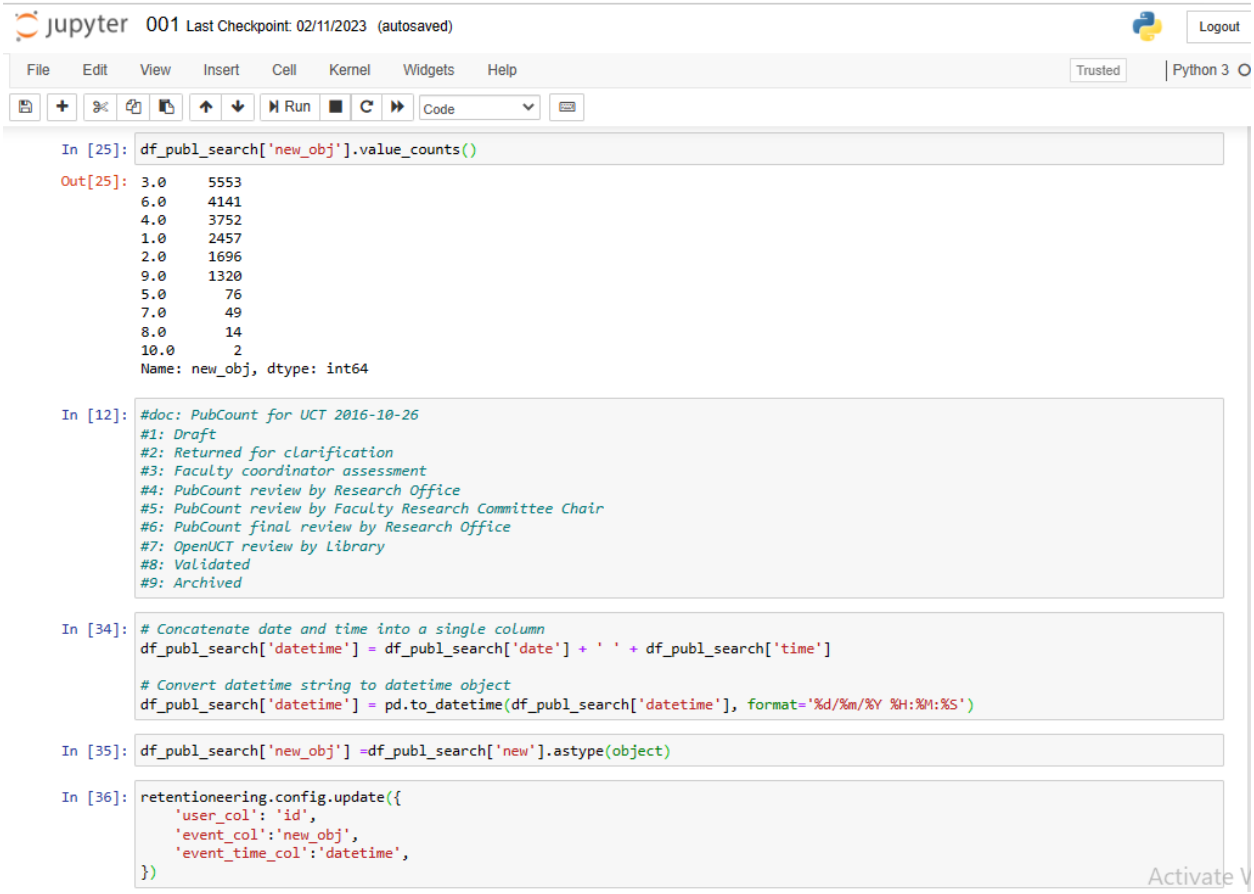
In [8]:
```
writer = ExcelWriter('publ_related__search_2016.xlsx')
df_publ_search.to_excel(writer,'Sheet1',index=False)
writer.save()
```

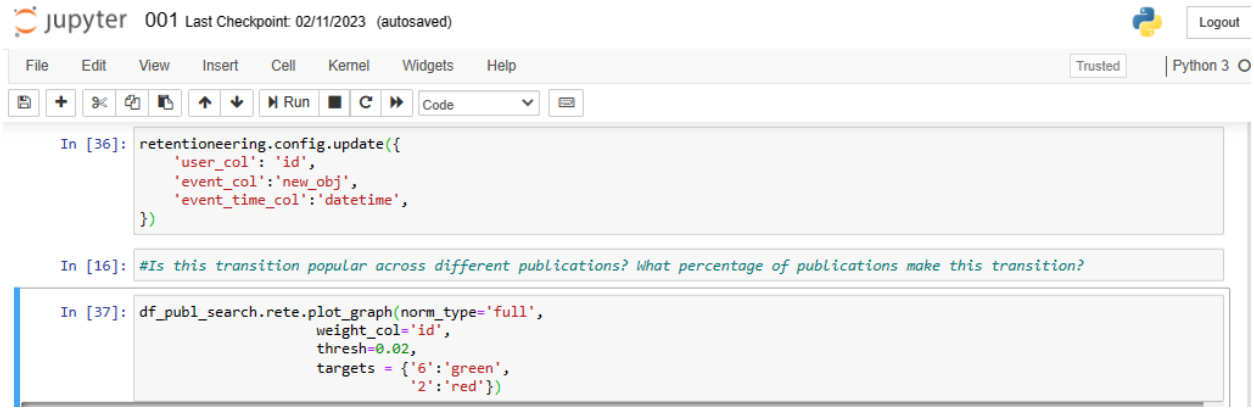
In [32]:
```
df_publ_search = pd.read_excel('publ_related__search_2016.xlsx')
```

In [33]:
```
df_publ_search
```

Out[33]:

	id	date	time	user	field name	delete	old	new	Date	Year	Month	Day	Month Word	Day Word	publication check1	publication related action	count
0	34990149	29/06/2017	14:25:58	Faculty Coordinator	Status	NaN	3.0	4.0	2017-06-29	2017	6	3	f-Jun	3-Thurs	not publication	yes	1
1	34885459	29/06/2017	14:25:22	Faculty Coordinator	Status	NaN	3.0	4.0	2017-06-29	2017	6	3	f-Jun	3-Thurs	not publication	yes	1


jupyter 001 Last Checkpoint: 02/11/2023 (autosaved)
Logout
File Edit View Insert Cell Kernel Widgets Help
Trusted
Python 3
Run
Code
In [25]:
df_publ_search['new_obj'].value_counts()
Out[25]:
3.0 5553
6.0 4141
4.0 3752
1.0 2457
2.0 1696
9.0 1320
5.0 76
7.0 49
8.0 14
10.0 2
Name: new_obj, dtype: int64
In [12]:
#doc: PubCount for UCT 2016-10-26
#1: Draft
#2: Returned for clarification
#3: Faculty coordinator assessment
#4: PubCount review by Research Office
#5: PubCount review by Faculty Research Committee Chair
#6: PubCount final review by Research Office
#7: OpenUCT review by Library
#8: Validated
#9: Archived
In [34]:
Concatenate date and time into a single column
df_publ_search['datetime'] = df_publ_search['date'] + ' ' + df_publ_search['time']
Convert datetime string to datetime object
df_publ_search['datetime'] = pd.to_datetime(df_publ_search['datetime'], format='%d/%m/%Y %H:%M:%S')
In [35]:
df_publ_search['new_obj'] =df_publ_search['new'].astype(object)
In [36]:
retentioneering.config.update({
'user_col': 'id',
'event_col':'new_obj',
'event_time_col':'datetime',
})


jupyter 001 Last Checkpoint: 02/11/2023 (autosaved)
Logout
File Edit View Insert Cell Kernel Widgets Help
Trusted
Python 3
Run
Code
In [36]:
retentioneering.config.update({
'user_col': 'id',
'event_col':'new_obj',
'event_time_col':'datetime',
})
In [16]:
#Is this transition popular across different publications? What percentage of publications make this transition?
In [37]:
df_publ_search.rete.plot_graph(norm_type='full',
weight_col='id',
thresh=0.02,
targets = {'6':'green',
'2':'red'})

Appendix 5: Data collection process for section 2.1

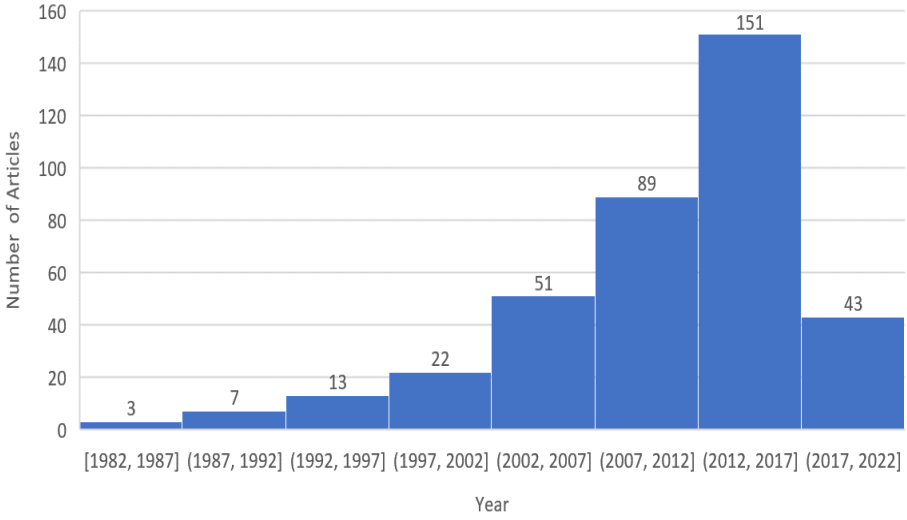
To gain a far-reaching understanding of research on IS success and failure, data was collected from EBSCOhost- an information system related database. This database was adopted for this study because it provides comprehensive coverage of scholarly articles on IS and related disciplines. The literature search started with a broad scope using Boolean search to query for articles on IS success and failure. Key terms used alone or in combination included: "information system success", "information system failure", "information systems success" and "information systems failure". This search resulted in 600 hits across different publication types and, to improve the quality of this study, we restricted the outcomes of the search result to peer-reviewed journal articles. This exclusion reduced the total number of articles to 462. Next, metadata such as title, keyword and abstract were extracted from each article. The abstract is used in building our dataset because it eliminates noise and summarises the critical points of an article.

Of the 462 articles, 402 articles were written to an Excel sheet because EBSCOhost eliminated 62 duplicated articles that appeared in multiple databases. Using Excel's duplicate value function, 12 more duplicates were identified thereby reducing the number of articles to 390. For each article, a researcher reviewed the extracted abstract, publication year and manually extracted the related journal names. Journal names were standardised because of the variation across different databases. For example, "BMC Medical Informatics & Decision Making" and "BMC Medical Informatics And Decision Making" refer to the same journal. Next, to ascertain that each article is related to the subject in focus, a researcher read the article titles and abstracts. This process assisted in getting the researcher familiarised with the data corpus. For example words like DeLone, MacLean, TAM, e-learning, nursing and reuse appeared frequently. After this process 10 articles were eliminated; 6 articles because they had no abstract and the remaining 4 articles because they did not relate to this study. At the end of this section, 379 articles proceeded to the analysis step.

Journal	Number of Articles
Journal of Management Information Systems	12
Information & Management	11
Computers in Human Behavior	11

Studies In Health Technology And Informatics	10
Behaviour & Information Technology	10
Decision Support Systems	9
Computers, Informatics, Nursing	7
Internet Research	6
MIS Quarterly	5
Information Systems Research	5

Top 10 Journals based on number of articles



Number of articles by year

Appendix 6: Data analysis process for section 2.2

To conduct a comprehensive analysis of the collected articles, we employed Latent Semantic Analysis (LSA), a machine learning technique that enables the discovery of hidden concepts in textual data. LSA was selected for this study because it effectively handles large volumes of textual data and allows for the identification of thematic relationships that might not be immediately apparent through traditional analysis methods. The analysis process began with text preprocessing of the 379 article abstracts. This involved tokenization of the text, where each abstract was broken down into individual terms. The terms were then normalized using WordNet lemmatizer to convert words to their base form, ensuring that variations of the same word (e.g., "systems" and "system")

were treated as identical terms. All terms were converted to lowercase, and stop words (common words such as "and", "the", "a") were removed as they carry no substantial semantic meaning.

Following the preprocessing stage, we created a term-document matrix (TDM) to represent the relationship between terms and documents. The resulting matrix had dimensions of 2448 unique terms by 379 documents, where each cell contained the frequency of a term's occurrence in a particular document. To improve the analysis quality, we applied a term frequency-inverse document frequency (TF-IDF) weighting to the TDM. This transformation ranked the importance of words by penalizing frequently used terms and rewarding uncommonly used terms, providing a more nuanced representation of term significance within the corpus. The weighted matrix then underwent singular value decomposition (SVD), the core component of LSA, which decomposed the matrix into three separate matrices: the term by concept matrix (U), the singular value matrix (Σ), and the document by concept matrix (VT).

To determine the appropriate number of dimensions for analysis, we considered recommendations from prior studies, such as Deetwester et al. (1990) who suggested 100 dimensions for 1000 documents, and Bradford (2008) who recommended 50 dimensions for 485 documents. Based on these guidelines and our dataset size, we selected 37 dimensions as appropriate for explaining the trends in IS success and failure research. This resulted in a term by concept matrix of shape (2448, 37) and a document by concept matrix of (379, 37). To interpret the LSA results, we generated sorted lists of terms and documents based on their loading values under each dimension. The meaning of each dimension was determined by examining both the high-loading terms and their corresponding documents contextually. This process led to the identification and labeling of 37 distinct themes, which were subsequently categorized into five broad categories: model/theory, user, information technology artifact, factors, and context.

Through this systematic analytical approach, we were able to identify and characterize the major themes and topics in IS success and failure research, providing a comprehensive overview of the research landscape while maintaining methodological rigor.