Coping with the Unplanned: The Dynamics of Improvisation in Information Systems Evolution Within and Across Firm Boundaries

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Dedication

This dissertation is dedicated to the three most influential people in my life: My father, who passed away during my first year of PhD work; Dad, I wish you were here to experience this with me. I am sure you are watching. I hope you are proud. My mother, who has been a constant source of inspiration to me throughout this process; Mom, you are the epitome of unselfishness and living life to its fullest. Finally, My son, who has been the focal point of my life since he came into it 20 years ago; Ryan, more than anyone, I did this for you.

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Abstract

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Information systems evolve in organizations, often in unexpected ways, due to user-driven innovation known as information systems improvisation. . This dissertation explores this pervasive phenomenon by developing, a theory of Information Systems (IS) improvisation. This is the first such theory, which defines improvisation types, triggers, influential variables and organizational outcomes. The dissertation draws upon and synthesizes diverse streams of literature on improvisation, information system use, design and evolution, as well as inter-organizational information systems. The main goal of the dissertation is to build a process theory of IS improvisation through longitudinal, multiple-case-study research. The focus of the theory is explaining how specific contextual variables affect improvisation events (i.e. their frequency, type and evolution) over time during IS use. The selected theory variables pertain to such areas as organizational and inter-organizational environments, system characteristics and user types. The studied systems are inter-organizational, which extends the research scope across organizational boundaries. An interaction zone model that positions selected inter-organizational systems (IOS) into inter-organizational activity systems is utilized to facilitate IOS research design. The study data was collected and analyzed using a theory building through case study (Eisenhardt 1989) research methodology. Data includes interviews, document and archival analysis, and participant observation over a two-year period in two 1st tier suppliers in the automotive industry. Through qualitative analysis, the thesis constructs a framework of improvisation types, contexts and variables, which serve as a basis to formulate a theory of IS improvisation dynamics. Systematic comparisons between improvisation patterns and dynamics between studied companies refine and substantiate the improvisation theory. The proposed process theory helps explain why and how improvisations take place during information system use, and how such events can evolve into permanent, institutionalized, and sometimes significant organizational changes. By doing so, it offers a basis for systematic validation and expansion in future studies, which enables both academics and managers to better identify, predict, implement, and manage information system evolution and associated organizational change.

I. Introduction

We live in an environment of turbulence and constant change. The key to survival over time in every context, from species to society to business, has been the ability to successfully adapt to changing environmental conditions. Information systems are no exception. The importance of information systems evolution (ISE)[1] that results from adapting to changing requirements in business, organizational and user environments has been underscored in previous research on software engineering (Lientz and Swanson 1978; Lehman 2003). Lehman's *First Law of Software Evolution* summarizes this issue poignantly: "Software undergoes continual change or becomes progressively less useful"(1980). The struggle for organizations to combat the process of system decay has become a costly one. Studies estimate that the expense of evolving systems through software maintenance, defined as development designed to meet new requirements and removing or changing existing ones, accounts for as much as 75% of total software expense (Lientz and Swanson 1978). Although previous research has been successful in identifying issues related to the management of ISE from a software engineering perspective, the role of the business environment, the organization, and the user remain poorly understood. In this dissertation, I seek to advance understanding of ISE through the study of an important contributor to the ISE process: user-level improvisation with information systems. Improvisation in the context of information systems use is the process of users adjusting the design and use of a system to create "on-the-fly" solutions to unanticipated situations, resulting in modifications in the system or processes. (Orlikowski 1996; Moorman and Miner 2001). Research of this type focuses on ISE from the user's perspective, seeking to understand their role in systems evolution as they strive to meet new requirements driven by the business and organizational change. It is my contention that user improvisation is fundamentally significant in promoting ISE as users make incremental adjustments to systems and associated processes in response to environmental conditions. From

[1] See appendix 1 for a definition of this and all other key terminology.

this perspective, improvisation is seen as a process of ongoing information system development (ISD), where the day-to-day task of design and development shifts in part to the user. With this shift comes the opportunity for organizations to transfer some of the burden of software maintenance to users, thus defraying a portion of that cost. I argue that this process of continuous improvement through improvisation promotes the ongoing evolution of information systems. This research seeks to confirm my proposition that, with regards to information systems, organizations must improvise or die. In other words, improvisation in IS use prevents systems from dying a slow death of attrition to the turbulent environment that created them.

Looking specifically at current ISD processes, there is increased support for the importance of improvisation. Although the design and use[2] of information systems has always been inherently complex, ISD has recently evolved from a linear process into an iterative process with a beginning, but no real end. This change in perspective on the ISD process is caused by developers and users struggling with increased fluctuation of their environment (Truex 2000). In light of this, information systems research faces a fundamental issue pertaining to espousal development methodologies. In the past, the predominant goal of ISD has been to create an exhaustive set of requirements and develop systems that meet them, thus completing the project (Gasson 1999). However, modern information systems environments are showing that development in this fashion is unrealistic (Truex 2000) . The inherent complexity and evolution of the organization and its surrounding environment (Weick 1993), combined with the bounded rationality of the actors involved (Simon 1991) and the limits of the tools in the development environment, make it difficult to design a system that meets all requirements (Strong 1995; Suchman 2002). These observations further support the need for an alternative view of information systems

[2] For purposes of this research, the “Design and Development” contexts will be examined aggregately, and will be referred to as the “Design” context. Similarly, the “Use and Implementation” contexts will be examined together and referred to as the “Use” context. Further, the overall process of “design and use” of systems will be used interchangeably with “ISD” or “information systems development”.

development, which effectively supports ISE. This new view portrays ISD as an iterative and perpetual process of feedback between users and designers (Lehman 1980; Lyytinen 1988). It also expands the role of the user to act as a designer. This fundamental shift empowers users to design during use by adjusting IT and associated processes, creating ad hoc solutions to constantly evolving requirements. This process of improvisation results in the evolution of information systems through use.

As a result, I suggest that there is an alternative realm of IS research which explores the need for openness and “freeplay” during IS use (Nachmanovitch 1990), where users are expected and encouraged to deviate from planned processes. In this realm, improvisation is viewed as an imperative to keep pace with environmental change; users are empowered to design during use with systems that are designed to be configurable. They are also skilled at meeting evolving requirements through the ad hoc adjustment of IT functionality and associated processes.

In this research, I explore ISE from this alternative perspective, by examining improvisation dynamics. Improvisation dynamics is defined as the frequency, type and evolution of improvisations into permanent organizational change. Examples of the types of improvisations discovered are: 1) configurable system features, which are designed to allow creative adjustments (resulting in a “configured improvisation”) or 2) developing new features due to shortcomings in the system (resulting in a “workaround”). An example of a “configured improvisation” is creating a customized view of a web page using a set of available options. An example of a “workaround” is the use of a messaging text field to store a vendor part number because there is no vendor part number field in the current system.

In this dissertation, improvisation will be explored in two contexts: 1) Information systems (IS) [3] as a whole, and 2) Inter-organizational (IOS)[4], examining the nature of improvisation as systems cross organizational boundaries.

Research Justification

Research on improvisation is motivated by the nature of the current business environment, which is driving the need for rapidly evolving and adaptable IS design and use. These environmental factors combine with such issues as the fast pace of current product development lifecycles and rapid implementation methodologies (Truex 2000), which decrease separation between design and use in time and space (Orlikowski 1992). The net effect is the need for users to become “designers”. This builds more of a case for improvisation, where design and use happen simultaneously (Moorman 1998); each affecting the other. Past research shows that this type of ad hoc adjustment by users in the design and use space is often the only effective means of adapting a system with its task environment (Gasser 1986; Strong 1995). Given the fast pace of evolving requirements and the need for shortened ISD cycles, more focus is needed on design that takes place in the use context. This research meets this need by exploring how users meet changing requirements through improvisation, and how these ongoing improvisations impact organizations.

Improvisation is made more complex when systems cross organizational boundaries. Known as inter-organizational systems (IOS), they involve the exchange of information for such purposes as transaction (e.g. EDI), interaction/information sharing (e.g. extranets) across the supply chain (Johnston 1988). The complexity grows as IOS functionality increases in terms of: 1) system scope, 2) diversity in user base (as many different organizations participate), 3) lack of

[3] The term Information System (IS) refers to systems within and across organizational boundaries.
[4] The term Inter-organizational system (IOS) refers to information systems which cross organizational boundaries. For purposes of this research, supply chain management systems are the IOS examined.

governance and 4) difficulty controlling requirements (Bakos 1987; Bensaou 1997) . As there is no previous research exploring improvisation in this type of an environment, this research seeks to fill that void by extending the improvisation research scope across organizational boundaries.

There are two primary theoretical contributions of this dissertation: 1) Combination of improvisation in the use context with the organizational context, showing how improvisations by users evolve into permanent organizational change through a complex network of dependencies, 2) Expanding the scope of improvisation research to include inter-organizational systems. These contributions are significant, as past improvisation research has been limited to studying types of organizational process change resulting from improvisation without looking at the entire improvisation process (Orlikowski 1996; Weick 1998). Further, there has been research on software evolution (Lehman 2003), which looks at software changes over time, but has not examined the role of user improvisation in the ISE process. I adopt a more holistic perspective by looking at the entire improvisation process and its impact on the evolution of information systems. Finally, past IS improvisation research has been focused on information systems within organizational boundaries (Orlikowski 1996; Bansler 2003). I expand the scope of IS improvisation research by looking at improvisation as it takes place within and across organizational boundaries. My primary interest is to illustrate the interplay between these contexts and clarify the dynamics of the resulting evolution of both organizations and systems across boundaries.

In summary, my contribution is a theory of improvisation dynamics that explores the process from initial triggers of an improvisation event to its final stage of evolution into permanent organizational and IT change. This is articulated through the Improvisation Dynamics Model (see figure 5a). This process model covers all triggers and contextual variables that drive improvisation frequency, type and evolution. Inherent in this model is a framework of improvisation and evolution contextual variables, and a classification scheme for improvisation and improvisation trigger types.

This study engages in theory building research to explain the dynamics of improvisation as it occurs during IS use. Through this research, I seek answers to the following research questions:

1. What types of improvisations occur in the use of IS?
2. What are the contextual variables that enable or inhibit the improvisation process in IS environments?
3. How do the contextual variables impact the dynamics (frequency, type and evolution) of improvisation?
4. How do improvisations evolve into IS and organizational changes?
5. How do improvisation dynamics differ in the IOS context?

The remainder of this thesis is organized as follows: Chapter 2 includes a review of past research on improvisation, ISE, IS design and use (showing a model which integrates the design and use contexts into improvisation research), and inter-organizational systems (presenting the interaction zone model, which guides IOS research). In Chapter 3, I offer a descriptive framework for research in improvisation**,** explaining its components and showing how improvisations evolve. In Chapter 4, research design and methods used in this dissertation are discussed. Chapter 5 is a data summary and analysis of results. In Chapter 6, I interpret these analyses, using them to build a theory on improvisation dynamics. Chapter 7 concludes with a comparison of findings with the extant literature, offers an outline of limitations, and discusses implications for practice. Finally, I offer concluding comments with regards to practice implications and future research opportunities.

II. Literature Review

The goal of this chapter is to expand on the concept of IS improvisation by examining its various related literature streams, such as improvisation in the management and IS contexts, organizational change, innovation, IS design and use and inter-organizational systems. Through this review, I assemble various components of the IS improvisation process, which will guide the formation of the improvisation research framework. Management contexts and the Jazz Metaphor are used to assist in expanding on definitions of improvisation by exploring the nature of the improvisation process and its various elements. I also offer models, which were constructed from a combination of the literature and preliminary data. These models are designed to guide research in the design and use and inter-organizational contexts. I will conclude this chapter by explaining how all of these facets of improvisation relate to IS use and evolution in the context of this dissertation.

Improvisation Literature Review

Research on improvisation has received increased recognition within the contexts of organizational change (Ciborra 1996; Moorman 1998), management (Mangham 1991; Weick 1998), bricolage (Lanzarra 1999), tailorability (Morch 1995) and information systems development and implementation (Orlikowski 1996; Bansler 2003). The literature defines its other foundational areas as sense making (Weick 1995), innovation (Weick 1999; Kamoche 2001), emergent change (March 1981; Mintzberg 1985), adaptive structuration (Desanctis and Poole 1994), and metamorphosis (Escher 1986). A pervasive theme in the literature is that improvisation is widespread, and that understanding it is vital to advancing research in organizational change and information system use because it “strikes a balance between structure and flexibility, as it redefines the concept of structural boundaries to permit creativity, innovation and continuous learning” (Kamoche 2001). The management literature describes the magnitude of improvisation by describing it as "more than just a metaphor; it is an action that pervades every aspect of society" (Lewin 1998). Its application in IS use is apparent, as it allows the ability to be innovative in the moment, which is a key requirement for users and organizations as they face evolving requirements driven by the turbulence of the current business environment (Crossan 1998).

Proposed Definition of Improvisation

Based on the above review and on the scope of this research, I offer the following definition of improvisation:

The creative practice of adaptation in the design and use of IS, employed within the confines of existing system (technical and organizational) parameters, as actors react to technical opportunities, unanticipated problems, evolving requirements, and environmental fluctuations, which result in temporary adjustments of systems and processes through workarounds or configuration changes.

This definition incorporates concepts from the following literature review including the spontaneous and emergent nature of improvisation, contextual variables that influence it, and the resulting adjustments and evolutions. It describes an environment that requires creative innovation in meeting system requirements without the benefit of prior planning, but within the constraints of the existing environment.

Improvisation Defined and Deconstructed

The word improvisation is from the word “proviso”, meaning to provide for something in advance. The prefix “im” gives it the opposite meaning: without prior planning or stipulation (Weick 1998). Some of the deepest understandings and descriptions of improvisation are in the realm of Jazz composition. Jazz musicians are most astute at improvisation, as this skill is the mark of a true master in this genre. Therefore, they have developed a vocabulary, which has been used as a metaphorical tool for organizational research. This metaphor can be transposed to research contexts, such as management and information systems in an effort to understand the improvisation that occurs within them. The characterizations of jazz improvisation by composers describe it as “playing extemporaneously” and “composing on the spur of the moment” (Schuller 1968) or “on-the-spot surfacing, criticizing, restructuring and testing of intuitive understandings of experienced phenomena” (Schon 1987). A more general definition of improvisation that was used to inform this study is from Berliner: “improvisation involves reworking pre-composed material and designs in relation to unanticipated ideas conceived, shaped and transformed under the special conditions of performance, thereby adding unique features to every creation”. (1994).

In the management literature, traits such as spontaneity, creativity, serendipity and bricolage are utilized to describe improvisation. Examples of statements that define the parameters and conditions of this phenomenon are: “action as it unfolds without the benefits of elaborate prior planning” (Cunha 1999), “understood in terms of fortuity, serendipity, and unexpected discovery of solutions as well as its tendency to occur in turbulent environments” (Miner 1996), “often occurring in times of crisis” (Kamoche 2001), “said to occur when organizational memory is low and environmental turbulence is high” (Moorman 1998). The above foundational concepts provide the basis for understanding the nature of improvisation and its components. With this understanding, it is apparent which literature streams to examine to delve more deeply into this phenomenon. The foundational literature also indicates the importance of understanding the environmental conditions that enable or inhibit it. This establishes the need for research into the variables that drive the improvisation process.

The Dualistic Nature of Improvisation

The above interpretations form a duality that is present within improvisation. Improvisation consists first of planned components which are the pre-established fundamentals of experience, discipline, and practice (Berliner 1994) which serve as its basis and rules. The other half of the duality is using intuition and spontaneity in the process of creation and composition. This is the unplanned component. A juxtaposition of this duality in the contexts of management and jazz composition, shows that they share such features as: simultaneous reflection and action, simultaneous rule creation and rule following, and the continuous mixing of the expected with the novel (Mangham 1991). Leveraging this duality, managers and musicians[5] participating in this process have the capability of using their experience of "having been there" to recognize "that one is now somewhere else and that 'somewhere else' is novel and potentially valuable" notwithstanding the 'rules' which declare that one cannot get here from there" (Mangham 1991).

I found that understanding this tension between structure and creative freedom is important to make sense of IS development, as the literature has shown a need for both (Orlikowski 1996). Rules are needed to provide the overall focus for IS initiatives. They are a means to effectively manage the project, govern its scope and assure that primary system specifications are met. However, due to environment fluctuations and tool/actor limitations, permitting user improvisation within these constraints is vital. This understanding assisted me in the construction of the contextual variables framework that follows; specifically those variables that describe the

[5] One shortcoming of the jazz metaphor in the management setting is the fact that in a jazz setting, all actors are more or less equal in their ability to contribute to improvisation. In the management setting, a more rigid hierarchy and set of constraints is present. Therefore the nature of improvisation will be different. One could thus argue that, in a jazz environment, improvisation will flow more freely than in a constrained management setting.

organizational and inter-organizational environment, as they capture the mix of structure and creativity in the design and use process.

The Improvisational Process

The improvisation process as described by (Weick 1998), is how managers “simultaneously discover targets and aim at them, create rules and follow rules, and engage in directed activity often by being clearer about which directions are not right than about specified final results. Their activity is then characterized as controlled, but not pre-determined”. In this process, he discusses an improvisation continuum, which ranges from “interpretation” (taking minor liberties and adding accents), through “embellishment” (anticipating, rephrasing and regrouping) and “variation” (adding clusters not originally included), which results in full-scale “improvisation” (transforming until there is little resemblance to the original artifact). He asserts that this progression implies increased demands on imagination and concentration, going far beyond simple “ornamentation” and “modification”. From this perspective, those activities that “alter”, “revise”, “create”, and “discover” are purer instances of improvisation than those that “shift”, “switch” or “add”. Weick describes how improvisation in organizations may fall anywhere on the continuum, but those that are “full-spectrum improvisations”, having made it through the complete process, are those that are apt to be more persuasive, diffuse faster, and will be more acceptable. This assertion is because full spectrum improvisations make fuller use of memory and past experience of the organization. More people are involved in its development resulting in a higher degree of ownership and understanding, thus increasing its likelihood of becoming permanent.

This abstract view of the improvisational process provides a meaningful lens for viewing improvisation in different contexts of organizational change and information systems development, setting a continuum of evolution and providing a baseline vocabulary with which to carry on the discourse on improvisation dynamics.

The generalizability of this improvisation continuum is confirmed in the context of IS research by Orlikowski's study (1996) on improvising organizational change. In this instance, she identifies differing levels of improvisation in IS implementation which range from ad hoc "situated changes" (called "embellishments" by Weick), to resulting long-term changes which she refers to as "metamorphoses" (Wieck's "full-spectrum" improvisations). This continuum will be utilized in this dissertation to assist in understanding the evolution of IS improvisations over time.

Another stream of literature that has focused on the improvisation process is innovation research. Improvisation events are often referred to as innovations, which is accurate in the sense that the act of improvisation is driven by the need to innovate (Weick 1998). Due to the close parallels between these two processes, innovation literature is helpful in further defining improvisation, as its concepts map well to the improvisation process. For example, innovation types, which are often defined as product and process innovations (Tushman 1986) are similar to the process and IT improvisation types defined in this study. Further, the innovation literature discusses organizational contexts that govern them (e.g. level of complexity and bureaucracy), (Van de Ven 1986), the conditions necessary for innovation to occur (e.g. level of uncertainty and ambiguity) (Zaltman 1971), and organizational traits that promote it (encourage new ideas, ensure the ideas are exploited, foster organizational culture conducive to innovation) (Van de Ven 1986). These concepts were essential in the development of the initial contextual variable framework in chapter 3, as they provide a high level framework for understanding of the basics of the innovation process and the variables involved.

However, research on innovation in the use of IT is especially relevant to this study. Reviews of past research such as those conducted by Nambisan et al (1999), show that most IS innovation research does not see the user as the focal point in the process, instead emphasizing such areas as the organizational core (Rockart 1988). As this dissertation emphasizes not only organizational evolution, but also the role of the user as the creator of improvisations, past research that combines the IT artifact, organizational drivers and their impact on user improvisation is ideally suited to inform this study. Therefore, the perspective offered by Nambisan et al (1999) on the impact of organizational mechanisms on user innovation in IT is essential in forming an understanding of the interplay between user and organization contexts in the improvisation process. In their study, Nambisan et al view the user as playing an active role as the primary creator of innovations. Innovation by users is described as being driven by a three variables: 1) "technology cognizance", defined as user knowledge about the IS, 2) "Ability to explore", or user's ability to procure resources within the organizational context to explore available possibilities in solving business problems with the IS, and 3) "Intention to explore", or user's willingness to explore the potential of a new IS. The connection to the organization is made through a set of organizational mechanisms that are described as being positively connected with these variables. For example, their study found that: 1) organizational mechanisms such as use of IT journals, attending IT conferences and vendor demonstrations are positively correlated with technical cognizance, 2) IT steering committees, strategic IT planning groups and IT task groups were positively correlated with intention to explore and customer support, user groups, user labs and relationships managers are positively correlated with the ability explore. These variables were used to further support the development of my contextual variable (CV) framework at the user level. It showed the need to examine similar factors for my study (e.g. *training effectiveness* and *user savvy* CVs). Further, this study shows the value of organizational drivers that impact the improvisation evolution process (e.g. *reason for implementation* and *future use plans* CVs)[6].

[6] See chapter 5, tables 5a, 5b and 5c for a full listing of contextual variables, and appendix 2 for definitions.

A final notion that I draw on in the development of my research framework is bricolage. Bricolage is defined as making do with whatever resources are available at a given point in time (Weick 1998). Improvisation increases the chances that bricolage will occur, as there is often not adequate time to obtain the optimal resource in advance (Miner 2001). This process involves inventing solutions from the current repertoire, acting extemporaneously to develop solutions in less than optimal conditions (Weick 1993). This perspective informs my research as IS use involves improvisations, known as workarounds, which are developed under less than optimal conditions, using the principles of bricolage.

Improvisation and Organizational Change

When selecting from the myriad literature on organizational change to produce the proper mix of ideas for this theory building process, I focused on the following primary themes: 1) recognizing systems development and its evolution as an ongoing process of emergent change, 2) understanding the user's role in this ongoing development process as they improvise, and 3) understanding the transformational capabilities that improvisation can have on organizations. Therefore, the organizational change literature with a focus on innovations and emergent change was reviewed. Such literature provides an understanding of the organizational processes that improvisation entails and the emergent change resulting from it. This position is supported by Tushman (1996), who emphasizes the importance of managing "evolutionary" and "revolutionary" change in the innovation process. As the improvisation process is predicated on such evolutionary or emergent change, I draw on the emergent change literature, which claims that change only takes place through situated action, and cannot be planned (Mintzberg 1985). It calls to question traditional change research streams, such as planned change (Hage 1965), which state that actors deliberately initiate and implement change in response to perceived opportunities (Orlikowski 1996), the technological imperative (Leavitt and Whisler 1958), which sees technology as the primary driver behind predictable change, and punctuated equilibrium (Meyer and Goes 1988), which posits that change follows a cycle that alternates between organizational equilibrium and episodes of rapid and significant planned change. The combination of emergent change with the notion of improvisation as a driver of organizational change, is integrated in Orlikowski's situated change perspective, which sees organizational transformation as emerging out of actors' accommodations to and experiments with everyday contingencies, breakdowns, exceptions opportunities and unintended consequences that they encounter"(Orlikowski 1996). From this view, organizational change is described as "ongoing improvisation enacted by organizational actors trying to make sense of and act coherently" (Orlikowski 1996). It emphasizes the role of improvisation in organizational change. This perspective fits well with the research themes outlined above, as it highlights the role of actors (IS users) in the organizational transformation process (ongoing IT and process design change as they design during use).

In order to complete the array of views on organizational change called for in this study, literature that describes the role of technology in the IS change process was needed. Perhaps the best characterization of the role of technology in the process of improvisation with information systems, is Desanctis and Poole's work (1994) on Adaptive Structuration Theory (AST). This structurational analysis of IS in the organization portrays technology as a set of social constraints and structures realized in practice through the appropriation of specific technical features (Orlikowski 1995). Technology shapes organizational practices and in turn is also shaped by them. This view is further supported by the "Structurational Model of Technology" (Orlikowski 1992) , which posits that information systems are potentially modifiable throughout their existence. This takes place through the interaction of designers and users as they shape the technology. This is essential to consider in seeking an understanding of IS improvisation. It helps to clarify the evolution of the system structures and organizations as users improvise. Through this lens, the interaction that takes place between users and information systems as they are created and used forms a process of improvisation. This process is one of ongoing adjustments in structure that results in the evolution of information systems and related processes (e.g. use and design). The AST perspective was essential in the development of the Improvisation Evolution Model (see figures 3a and 6b), as it exposed the evolutionary nature of improvisation in IS use. The AST model also assists in the construction of contextual variables for improvisation, as it demonstrates how constructs such as the organizational environment, system type, user knowledge, and IS use affect IS evolution.

Identifying IS Improvisation Types

Research in IS improvisation shows that there are two major categories of improvisation. First, those that result from existing shortcomings in an IS, known as workarounds, and second, those that result from a user leveraging configurable IS capabilities, known as configurable improvisations. The first type of improvisation is often the result of an unanticipated “exception” in the IS use process, which creates new requirements. Exceptions are defined in the literature as cases that information systems cannot process correctly without manual intervention (Strong 1995); or as an event for which no applicable rule or procedure exists (Saastamoinen 1995). The scope of this definition is defined as covering problems generated by 1) Erroneous or incomplete information input, 2) Requests to deviate from standard procedures and 3) Situations that the system was never designed to handle (Strong 1995). Exceptions are said to be caused by three types of errors, operation errors (user error), design errors (design flaw or missed requirement), and dynamic organization (fluctuation of contextual variables that could not be anticipated). These cases are resolved through exception handling, or the identification of an event and the selection of pertinent action in order to set the system back to coherent state (Saastamoinen 1995). This process sometimes involves the use of “workarounds”, which are defined as “intentionally using computing in ways for which it was not designed, or avoiding its use and relying on an alternative means of accomplishing work” (Gasser 1986). Types of workarounds explained by Gasser are data adjustments (tricking the system through data entry that does not reflect the spirit of the design), procedural adjustment (adjusting work routines to compensate for shortcomings in the system) and backup systems (using alternative information systems to do processing that the primary system cannot handle). The concepts of exception handling and workarounds align well with the portion of this research that studies improvisation triggered because the IS cannot meet new requirements through configuration changes. Further, the literature differentiates between process and IT workarounds, which will inform my improvisation classification scheme.

The second improvisation type involves changing the configuration of a system to meet new requirements by using tailorable technologies. Tailorable technologies are those that allow for the dynamic modification and adaptation of applications in the context of their use (Mehandjiev 2000). It involves the continued development of an application as users make persistent modifications using flexible design features. Configurable improvisations can be responses to changing design requirements when an application is unsuitable for the specific task at hand (Morch 1995).

Information Systems Evolution Literature Review

Information systems evolution is defined in the literature as a process where systems "undergo continued progressive change in some of their attributes, which leads to improvement in some sense, often to the emergence of new properties" (Lehman 2003). The impact of improvisation on the evolution of information systems is one of primary themes of this research. The importance of this phenomenon is strongly established in the software engineering research, as software maintenance cost associated with enhancements and modifications to existing systems is estimated to be as high as 75% of the total cost of the software (Lientz and Swanson 1978).

However, a review of the existing literature shows that this process is poorly understood. Articles provide insight into the unavoidable nature of ISE, describing it as being “inevitable, since changes generated by business policies and operations need to be propagated onto the support software system” (Wan Kadir 2004). There are also a number of software evolution process models (Lehman 2003) that look at the drivers of new features and enhancements. These models identify variables that drive ISE such as changing business rules (Wan Kadir 2004), environmental fluctuation and changing user preferences (Lientz and Swanson 1978). This research stream is summarized into Lehman’s theory of software evolution, which states: “long-term evolvability and evolution is likely to be heavily dependent on more global mechanisms…these include forward and feedback loops, and mechanisms that involve players such as business executives, stakeholders, organizational and individual users, governments and economies in the total evolution process”(2003). This theory begins to articulate the complexity of the dependencies in the business environment that surrounds ISE. Although this research is helpful in defining a high level process, providing some insight into types of contextual variables that influence the evolution process, and establishing the importance of ISE in software research, it is all software focused, and therefore does not cover the organizational and managerial issues that drive evolution. This is another gap that my research seeks to fill[7]. A study of the process of improvisation during ISE will move this research stream towards a deeper understanding of the specifics of the causes that add to software cost. It will also add a more practical aspect to ISE research by producing findings that promote understanding of the business issues involved in software evolution.

[7] This was not mentioned in the introduction as a research objective as it is not a primary goal of this research.

Design and Use Contexts Literature Review

Although my research focuses on improvisation in the use context, it is still important to understand how the design and use contexts are integrated in the improvisation process. The design process impacts improvisations which take place during IS use. Understanding these impacts is essential in explaining improvisation dynamics in the use of IS(Orlikowski 1992). Therefore, it is important to integrate an understanding of the “actor network” (i.e. manufacturer users, supplier users, software designers) that surrounds improvisation with the complex dependencies that exist between these actors. This section will focus on combining the understanding of time-space separation and the iterative process of design and use, to further understanding of the dynamics of improvisation. To accomplish this, I will briefly discuss and define the design and use contexts separately. I will then present a model to clarify how their interaction affects the improvisation process.

Research that explores interdependencies between IS design and use in the improvisation process has not been carried out in the past. Yet, its significance is supported by the literature. From this perspective as “composition converges with execution” (Weick 1993), we see that design continues in the process of use (referred to as “design in use”) (Suchman 2002), and the integration of these contexts is an inherent part of improvisation. Miner and Moorman’s work supports this in their definition of improvisation as: “deliberately and materially fusing the design and the execution[8] of a novel production” (Miner 2001). Further, Orlikowski claims that the evolution of technology takes place through ongoing social and physical interaction. She claims that the construction of technology that occurs during its use should be thought of as having two tightly-coupled modes: the “design mode”, and the “use mode” (Orlikowski 1992). A related theme in the literature is the need to consider the influence of the time lag between design and use in the improvisation process. This is emphasized by Moorman and Miner as they state that “the

[8] “Execution” in this case equates to the “use” context.

more proximate the design and implementation of an activity in time, the more it is improvisational" (Moorman 1998), and also by Orlikowski (combined with space disjuncture) in her assertion that "with many types of technologies, the processes of development and use are often accomplished in different timeframes and organizations...recognizing the time-space discontinuity between design and use gives us insight into how it has promoted the conceptual dualism dominating the literature"[9] (Orlikowski 1992). In both of these cases, improvisation implies: 1) that there is a time-space disjuncture, 2) that design and use are tightly coupled, 3) that users and designers can function interchangeably. From this literature, it can be inferred that the time-space variable will have an impact on the degree of improvisation that takes place. The iterative nature of design and use in the improvisation process is the final theme in the reviewed literature. From this perspective, systems development is seen as a continual process of "designing and using technologies recursively" (Orlikowski 1992).

Improvisation in the Design Context

Increasingly, researchers are seeing systems design and development more as a situated and emergent process, which is less focused on methodology (Truex 2000) and more on sense-making (Weick 1995) and improvisation (Orlikowski 1996). This finding has resulted in a new stream of research on improvisation during the design process, which looks into the dynamics that take place with designers, as they iteratively interact with users (Bansler 2003). Although this dissertation does not examine the specifics of improvisation by designers, it does look at the impact that the designer's perspective has on user improvisation.

[9] This "conceptual dualism" refers to the myopic view of technology that either designers or users have when they fail to take the other's context into consideration.

In this research, I use Orlikowski's definition of "technology design and development" (1992) to define IS Design as follows:

Dynamically fashioning and constructing information systems to realize organizational goals and opportunities in a fluctuating environment that is separated in time and space from IS use.

This definition focuses on design and development of IS that have fluctuating requirements, are impacted by contextual variables in the environment and by the separation in time and space from the use process.

Improvisation in the Use Context

Unlike the design context, research on different aspects of improvisation in the use context has received coverage in the IS research over the past 20 years. The need for a flexible computing work environment in order to assure effective IS use was documented early on by Wynn, who stated that systems should "provide users with the tools to manipulate the system according to situational and historically developed requirements of their work as they see them unfold in the process of doing work" (1979). The actual study of IS use improvisation began in 1986, as Gasser identified the parameters of workaround computing and the different types of workarounds mentioned earlier in this section (Gasser 1986). This work was augmented by the study of drivers of IS use improvisation, called exceptions (Strong 1995), a taxonomy of exceptions (Saastamoinen 1995) and studies of the exception handling process during IS use (Saastamoinen 1995; Strong 1995). My research uses this work on the types and nature of improvisation to construct the framework in the next section. I also seek to further clarify these constructs and examine different organizational, environmental and technological impacts on them.

In this research, I use Gasser's definition of "computing work" (Gasser 1986) and Orlikowski's view of "technology utilization" (Orlikowski 1992) to define IS Use as follows:

An IS user's interpretation, appropriation and manipulation of information systems tasks during the implementation and utilization of an IS to accomplish coordinated tasks in various intra-organizational and inter-organizational contexts.

This definition focuses on both the implementation and use contexts within and across organizational boundaries, which form key areas of this research. It also uses Gasser's perspective of work as a complex network of tasks that need to be coordinated carefully, and Orlikowski's view of IS use as a process of improvisation that involves not just use itself, but pre-use interpretation and post-use manipulation which feeds back into the overall use process. This fits well with the central theme of this research which sees use as a continuous process of design.

Integration of Design and Use Contexts in Improvisation Space

This section combines the above concepts of design and use, focusing on interactions between designers and users as both sets of actors improvise in their respective spaces. The goal of this section is to integrate the reviewed literature and findings from the initial case study, to construct the model below (see figure 2a), which explains how improvisation in design and use impacts the evolution of information systems. The call for integration of IS design and use in research is prevalent, as the problem of disconnects between designers and users are well documented. For example, early research by Suchman describes the process of office systems development from a designer's perspective, which often does not reflect the goals of the actual users. Therefore, key features of work are excluded (1983). This problem worsens as designers and users are separated by time and space (Orlikowski 1992), as requirements evolve over time (Swanson 1978), or becomedistorted as designers and users work in separate spaces (Suchman 1983; Orlikowski 1992) . This dynamic creates exceptions due to unmet requirements, thus driving the need for users to improvise (Saastamoinen 1995; Strong 1995) in the form of workarounds (Gasser 1986) or custom configurations if the system is “tailorable” (Morch 1995). In these cases of improvisation, the time-space disjuncture becomes minimal, and “design during use” (Suchman 2002) takes place as users can also function as designers when resolving requirements in the context of use (Weick 1993; Miner 2001). The result is an iterative process of design and use driven by changing requirements and contextual variables. These localized adaptations, combined with larger design modifications that are not always resolved locally, and the effect of contextual variables result in the evolution of the IS over time (Lehman 2003).

IS Design and Use Model

The Design and Use model below integrates concepts from the above literature streams with initial observations from my preliminary case study[10]. It describes the following primary relationships: 1) how improvisation in the use space impacts designers, 2) how improvisation in the design space impacts users, 3) how contextual variables and time-space disjuncture impact the evolution of requirements and systems. It combines key elements of the improvisation process in the IS context that were defined above, including IS design, IS use, ISE, and time/space disjuncture. The model also incorporates the following elements from my preliminary study: 1) The inter-organizational systems aspect of the network added by separating users into two groups, manufacturer and supplier, and showing the interdependencies that exist between them, 2) The addition of the functional liaison role. This actor, who is part of the manufacturing organization, is the intermediary between the users, management and the designers. He serves as the “gatekeeper” for screening requirements. His task is to design workarounds and resolve issues locally or communicate the new requirements to the designers at the software development organization (which in this case is a separate company), so that they can modify the IS. 3) The overall impact of contextual variables on the design and use process. Therefore, I assert that the

[10] See chapter 4 on methods for specific details on this preliminary study.

design and use processes are driven by a complex network of variables as described in the contextual variable framework (see chapter 3, table 3a).

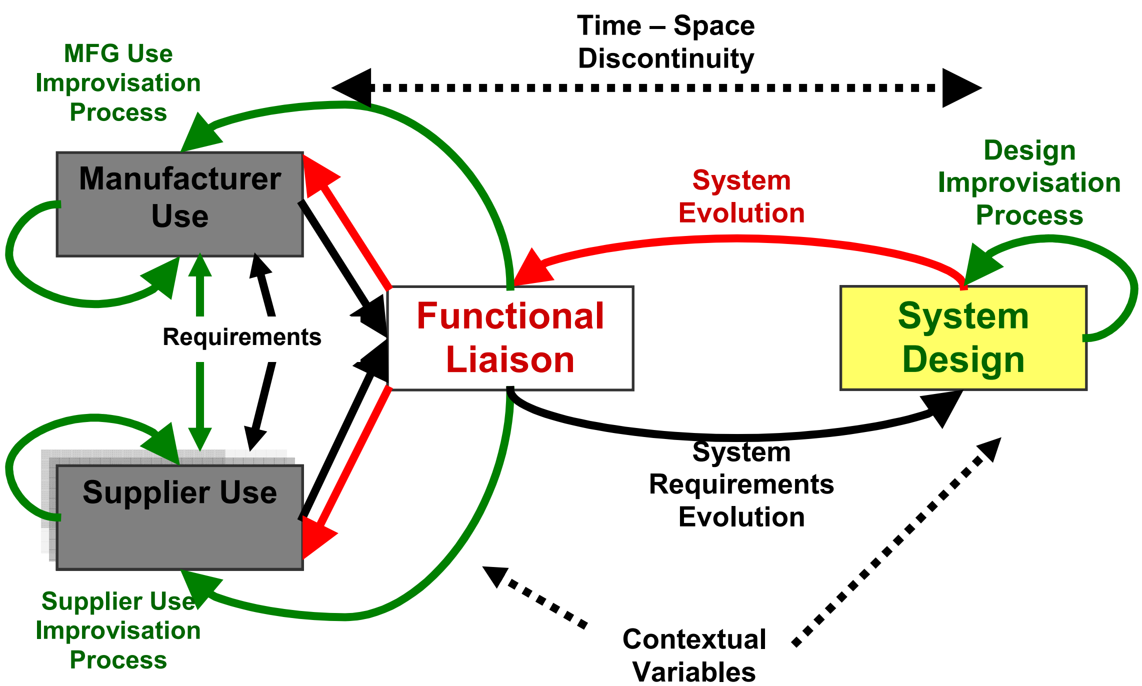

Figure 2a – IS Design and Use Model

The details of the relationships in this model are explained as follows[11]:

Localized Improvisation (Green Path) - This path shows how requirements drive localized improvisations by users (or between user organizations) and how designers improvise locally to meet requirements. These improvisations are fed back into organizational processes in the case of users, and back into the design of the IS in the case of designers. In this path, there is no interaction between designers and users. To reflect the inter-organizational nature of this research, users in this model are part of the manufacturer's organization, or are one of their suppliers. My research showed that some localized improvisations may evolve over time into requirements that cannot be resolved locally. In this case, they are routed through the black path.

[11] The paths of this model are indicated using colors. Therefore, black and white printouts render these descriptors useless. I apologize for this and promise to fix this problem in the next revision of this model.

Functional Liaison Intervention (Black Path) **-** When user requirements cannot be resolved locally, they are routed to the functional liaison who acts as the intermediary between designers and users. His task is to design workarounds and resolve these issues locally or communicate the new requirements to the designers at the software company, so that they can modify the IS.

System Evolution (Red Path) – After software is modified to meet requirements, the new version is routed back to the functional liaison. She/He then screens and implements it if it meets requirements. However, this is the point in the model where separation in space and time may have impacted the modified IS. Considering the space factor, my study has shown that designers (separated by space from users) often improvise in meeting requirements due to necessities of the situation or exercising "creative license" (McGann/BBC FN #1, 2003 #1)[12]. In this case, their improvisation may impact users in various ways. For example, from the perspective of time disjuncture, if the amount of time elapsed between developing and meeting new requirements is too long, requirements may have already changed. One response to this can be the development of a new solution (workaround) by the users, to meet the requirement out of necessity, while waiting for the software modification. If the changing requirements are not communicated to the designers, the delivered modification may not meet them. As a result, the design process must be repeated over time, and the users continue to use the workaround in the interim.

The explanations and observations mentioned above are a preliminary view of this process. Although this study does not cover elements of the model such as improvisation in the design context, my preliminary findings confirm that the inputs from the design process must be considered. I found this to be true because the IS design process has a significant effect on the improvisation dynamics (e.g. new software features and releases impact improvisation types and

[12] **Field note references** are denoted as follows: (Author name/Research Site Field note data collection round, year).

frequency). That is why this study includes detailed data collection from all perspectives including the software designers. In the remainder of this study, I will use this model as a starting point to deepen understanding of the impacts and dependencies in the improvisation process.

Inter-organizational Systems Literature Review

This section outlines the IOS research context, discussing the unique environment created for improvisation when systems cross organizational boundaries. It looks at the system differences in the IOS context, examines the IOS improvisation process and the difference in improvisation that takes place in IOS. I then present a model designed to guide analysis of IOS denoted as the Interaction Zone Model.

IOS Background

Primary themes explored in the IOS literature relate to strategy, transaction cost, and organizational impacts. The concept of IOS was introduced in the 1960s (Kaufman 1966), but gained considerable momentum in the 1980s, as successful implementations of airline reservation systems and hospital supply systems demonstrated clear strategic benefits (Cleamons 1988). In the early literature, a key driver for IOS development was that they offered a competitive advantage by harnessing the efficiency of electronic communication for all participants (Meier 1995). In the 1970s, firms traditionally relied on vertical integration in order to maintain control over their critical resources (Pfeffer 1978). Accordingly, the primary tone of research in the 80s and early 90s was overtly optimistic: systems that cross organizational boundaries have positive impact on both owners and non-owners, providing economic benefits to all parties involved, and bringing the organizations closer together (Johnston 1988). From the mid 90s, failed implementations and organizational and strategic challenges of introducing IOS have spawned a more realistic view of IOS impacts as firms have seen the organizational and technical complexity of these systems (Bensaou 1997). The increased complexity is due in large part to the necessity to manage new interdependencies and to carefully coordinate activities to jointly optimize performance of the firms without vertical integration (Clark 2000). The coordination of autonomous entities is more challenging and requires joint implementation of policy and process changes between firms (Lee 1996), as they struggle to optimize the relationships between interdependence, performance and coordination (Clark 2000).

IOS Definition

Derived from the above literature on the strategic motivation behind IOS (Bakos 1987), economic drivers for IOS (Williamson 1981) and resulting organizational impacts of IOS (Johnston 1988; Clark 2000), the following definition of IOS provides the context for studying improvisation in the IOS research area:

Systems crossing organizational boundaries designed to reduce transaction cost, while facilitating efficiency, accuracy, and competitive advantage through interactive sharing of supply, demand, quality, design and other collaborative information.

The literature shows that the dynamics and complexity inherent in modern IOS environments make IOS a unique research context. This is especially true in the case of studying improvisation in the use of IOS. However, research on improvisation in this context has not taken place. Therefore, this dissertation expands improvisation research into IOS space, by examining differences in the IOS improvisation process from IS improvisation that takes place within organizational boundaries. My initial data analysis shows that IOS Improvisation offers a unique opportunity to understand the phenomenon in the following three primary areas: 1) The IOS Environment: The impact on improvisation dynamics as scope increases, due to more organizations, technologies and processes being involved, 2) IOS Types, Features and

Configurations: The impact on improvisation dynamics in the use of unique system types (such as eCollaboration and EDI), their features (e.g. ability to promote interactive information exchange and share supply and demand information) and the way that they are configured (e.g. security controls and data transmission methods), 3). Lack of Hierarchical Control**:** lack of control over requirements and the process of improvisation (due to the difficulty of controlling multiple organizations), and the impact that this has on the improvisational process. This research seeks to examine how these three IOS characteristics impact the types, frequency and evolution of improvisation.

The IOS Environment for Improvisation

When improvisation is studied in the context of IOS, the complexity and the potential scope of improvisation increase greatly. Previous IOS research confirms this by showing that factors such as size and scope of the inter-organizational network (Bakos 1987; Williams 1997), the nature of the relationship between these organizations (Bensaou 1997; Helper 2002), governance structures[13] (Cleamons 1993), cultural issues (Kumar 1996) and the specifics of the technology involved (Iaconov 1995; Bensaou 1997) suggest key determinants in adoption functionality and impact of IOS. These factors form a set of contextual variables that are unique to this setting.

IOS Types, Features and Configurations

There are various types of IOS that have been developed for use by customers, dealers, suppliers and competitors to perform functions such as boundary transactions, retrieval and analysis of stored information (Johnston 1988). Reasons for varying types of IOS are pooling of resources (e.g. shared databases/applications and electronic markets), value/supply chain transactions (e.g.

[13] For purposes of this research, I draw on Cleamons and Row's definition of "Governance Structures", which refers to: 1) the level/division of ownership of transactions components between buyer and supplier, 2) the nature of contracts in place and 3) the level of coordination that takes place between actors in the IOS network.

EDI and eCollaboration), and networking (e.g. electronic sharing of design data and groupware applications) (Kumar 1996). Unlike organization-specific IS, IOS integrate disparate systems (serving as a link between IS), which promote interaction and cooperation between organizations and allow business transaction (Bakos 1987). This is accomplished through a variety of IOS types (e.g. EDI and eCollaboration), which involves various technical features and functional configurations.

The consideration of different IOS types, features and configurations are important in understanding the nature and scope of IOS improvisation. Although this dissertation will only study one system type (eCollaboration), it will look at the various features that are used in different IOS settings and project phases (e.g. a system feature that facilitates interaction between organizations will allow IOS users to collaborate in the improvisation process. This facilitates improvisations that are IOS in nature, involving multiple organizations and systems). It is my intent to use these observations to make generalizations about improvisation across IOS types, features and configurations.

The Importance of Partnerships to IOS Improvisation

The ability to understand the behaviors of firms and actors as they improvise in their use of IOS is a key to this research. Building on the observations in this section, I summarize the following significant differences that I see in the IOS context, which shape improvisation: 1) System use and ownership, 2) Creativity and innovation in the improvisation process, 3) Contributions to system evolution through feedback to the functional liaison, 4) Development of technical skills needed to effectively use the system.

I will use the concept of inter-organizational cooperation (i.e. “the degree to which focal activities to the relationship are carried out jointly”) (Bensaou 1997) to explain these behaviors. In his study of inter-organizational behaviors between suppliers and manufacturers in US and Japanese supply chains, Bensaou observed that cooperation was determined by a construct called "Partnership Uncertainty" (i.e. "uncertainty a focal firm perceives about a relationship with a business partner"). The sources of this uncertainty are theorized to be the governance structure of the relationship (i.e. level of switching costs due to asset specificity and contract length), and the climate of the relationship (mutual trust, goal compatibility, and perception of fairness).

The "governance structure" source fits well with Transaction Cost Theory (TCT) (Coase 1937; Willamson 1975), as it sees uncertainty as a key driver of inter-organizational behavior and governance structures as one mechanism to control uncertainty as they seek to minimize transaction cost. Based on TCT, the study suggests that in the automotive industry, asset specificity in the governance structure equates to investments that are highly specific to the relationship, which may enable the supplier to "hold the buyer hostage", making it costly for them to switch to other suppliers. In this case, higher levels of cooperation are expected, as opportunistic behavior is minimized. Also related to TCT, the study suggests that as contract lengths increase and expectations of relationship continuity increase, uncertainty about intentions of the other party decreases. As a result, the claim is made that partners will then be more likely to deepen relationships, sharing such items as strategic plans and critical product information.

The "relationship climate" source of uncertainty in this study pertains to the "extent which inter-firm transactions are based on mutual trust, whereby the parties share a unit bonding or belongingness" (Reve 1976). This trust is said to further "compatibility in goals" and "perception of fairness" while reducing "uncertainty about partner's intentions for opportunistic behavior and therefore inviting cooperation" (Bensaou 1997).

It is my contention that the above perspective on the nature of partnerships and cooperation within them can be effectively used to explain the behavior of improvisers in the IOS context. I therefore argue that significant improvisation between organizations must be preceded by a high level of cooperation and a relationships climate that based on trust and a system that seem to be mutually beneficial to all in the IOS network. The factors mentioned can be used as potential predictors of an environment that may or may not be conducive to improvisation. Specific to this study, they provide an important perspective, which led to the further development of IOS relationship contextual variables.

Definition of IOS Improvisation

Based on the above review and the scope of this research, I offer the following definition of improvisation applied in the context of IOS:

The creative practice of adaptation in the use of IOS, enabled by inter-organizational cooperation, as actors react to technical opportunities, unanticipated problems, emerging inter-organizational requirements, and external environment fluctuations, which result in joint adjustments of systems and processes.

This definition combines the concepts of IOS and improvisation to describe a unique interactive environment which requires elevated levels of cooperation. The goal in this context is to effectively adjust mutual processes while resolving requirements. This research focuses on the dynamics that occur as organizations in the supply chain attempt to simultaneously adjust systems and processes.[14]

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[14] Note: The characteristics of improvisation driven by firm boundary characteristics do not necessarily apply solely to the IOS context. They could also apply to boundaries within firms (between different strategic business units (SBUs)). This distinction is made as a frame of reference only. Analysis from the SBU perspective is not within the scope of this dissertation, but will be pursued in future research.

Studying Improvisation in the IOS Environment

In order to guide the exploration and focus of improvisation dynamics between organizations implementing an IOS, I will apply the following model, called the "IOS Interaction Zone Model" (see Figure 2b) to define the nature and scope of IOS interactions. The model is adopted from Ives' Customer Service Lifecycle (1999) and Lee's and Whang's Supply Chain Integration Model (2001). It will serve as a scoping tool for my IOS improvisation studies, as it maps pertinent research areas in a typical supply chain, and the role of different IOSs and supporting systems in this chain. It is designed to aggregate multiple "touch-points" that exist among a company and its suppliers/customers for more careful scrutiny. These points represent key contact areas, referred to as IOS "Interaction Zones", for the flow of information, business transactions, and materials. Therefore, it serves as a tool to identify from a high-level, the zones of interaction between companies, and then explicates the details of the systems and interactions in each zone. This holistic understanding of interactions across systems is helpful in theorizing on the organizational dynamics of IOS use and evolution. This understanding provides an expanded exploration into the details of IOS and their inherent organizational dynamics. Research focused on interaction zones of various supply chain systems provides insights that can also be generalized across other IOSs. This model also elaborates the complexity of the IOS research domain by illustrating the web of interactions needed in B2B supply chain processes.

IOS Interaction Zone Model*

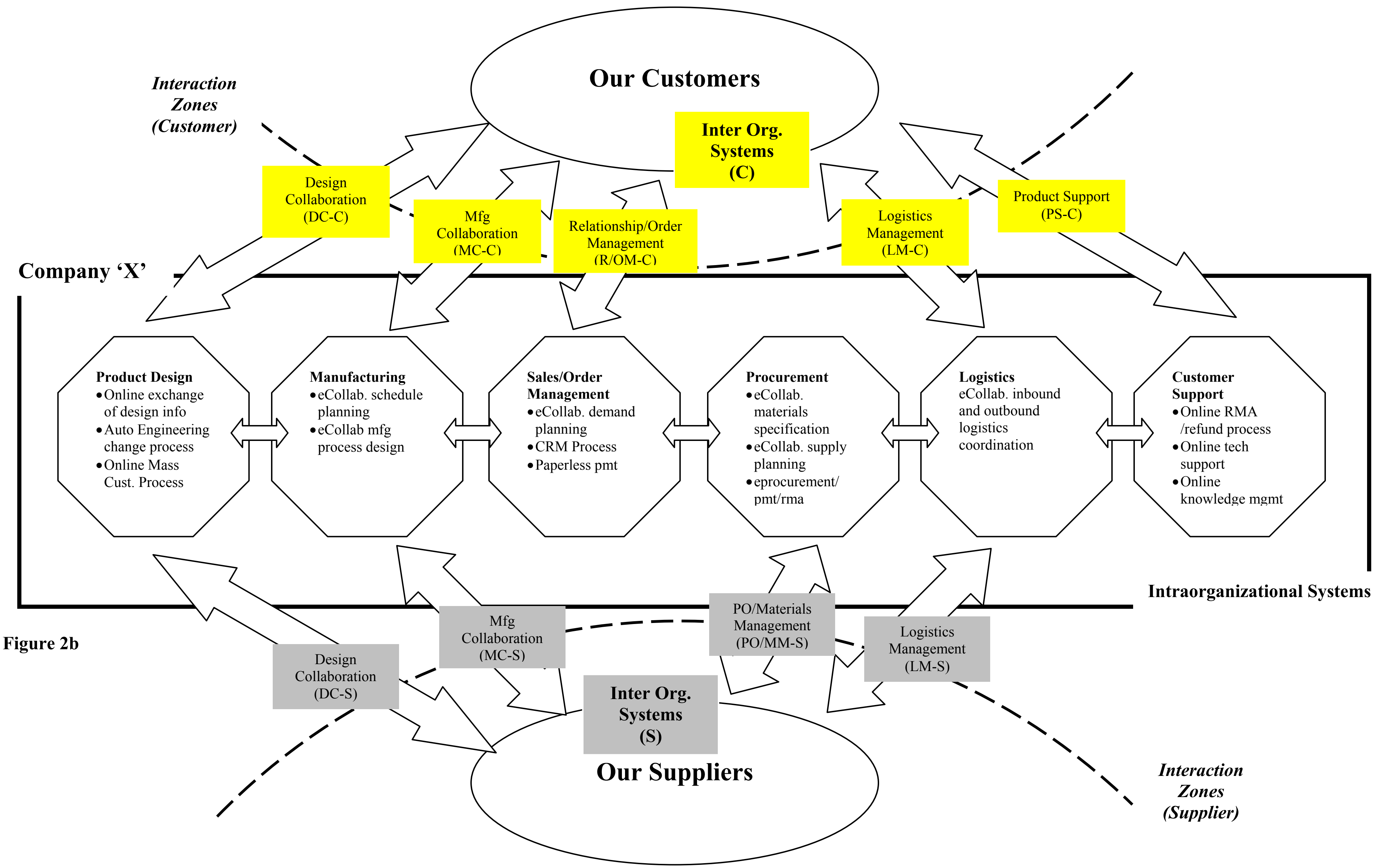


Figure 2b

*Adopted from Ives' CSLC (1999), and Lee and Whang's eBusiness Supply Chain

Model Overview

The Interaction Zone Model (IZM) depicts part of a supply chain consisting of one company, one supplier, and one customer. The model encompasses the intra-organizational system environment of "Company X" and its surrounding inter-organizational systems. At the intersection of these two environments, lie interaction zones.

For purposes of this dissertation, an "**Interaction"** is defined as:

The exchange of information, business transactions or materials in the context of the IOS environment.

This term serves as a comprehensive characterization of all inter-organizational contacts initiated by actors in a supply chain. Examples of interactions would be a messaging conversation on a material quality issue, an EDI demand transaction, or a shipment of materials from a supplier to a buyer.

An "**Interaction Zone"** is:

A point in the supply chain where the exchange of information, business transactions, and materials takes place between businesses in the IOS environment.

Examples of interaction zones would be the design collaboration zone between the manufacturer and supplier (DC-S) where design information is exchanged using an IOS or the purchasing and materials management collaboration zone (PO/MM-S) where suppliers and buyers coordinate the procurement and flow of materials using IOS.

The model divides the supply chain into interaction zones on the customer side and the supplier side. Each side has its own areas of collaboration and transaction, which are associated with the processes and systems of the different functional areas of the organizations involved. This overall map serves as a guide to structure studies of various sectors of the supply chain, illustrating the actors, systems and organizational areas appropriate for IOS research.

For example, in this study, this model was used as a part of the research design process to identify target research areas[15]. The first step was to identify the zones, based on research interests, where the study was to be focused. After that, I was able to design the interview scripts and other data gathering activities. Finally, I used the IZM to map the types of interactions in each zone of interest to a set of actors that were to be interviewed and observed. Full details on the application of the IZM in this study are discussed in chapter 4.

This section outlined the unique characteristics of the IOS environment in the study of improvisation. Through a literature review and initial data collection I have found that IOS entail an additional set of contextual variables that must be considered (e.g. relationship and systems integration factors). It is also apparent that the lack of control that a manufacturer has over its IOS users combined with the increased scope when integrating a large network of systems can cause the IOS improvisation process to become increasingly difficult to coordinate. These challenges are due to lack of standardization of processes and IT configurations (e.g. numerous suppliers making different changes to system configurations can result in disparate numbering schemes and material flow processes such as shipping that need to be standardized). These characteristics combine to set the stage for an interesting addition to improvisation research.

[15] See chapter 4 for details on the research design process for this study

Chapter 2 Summary

My review of the literature on improvisation captured the complexity of the improvisation process and its antecedents. It was necessary for me to expose a vast array of related research that highlights the various facets of improvisation and the large number of variables that drive it. Through this review, I was able to develop a model, which integrates the design and use contexts and reveals critical relationships between constructs and contexts in the actor network of IS improvisation. The review also showed the unique aspects of the IOS environment that must be considered when studying IOS improvisation. Finally, it assisted in defining preliminary constructs (e.g. configured and workaround improvisation types, contextual variables that influence it, and the continuum of improvisation evolution) that will guide the formulation of the improvisation research framework.

III. Framework for Improvisation Dynamics

The objective of this chapter is to develop a framework for improvisation dynamics research, which will guide the rest of this study. I will outline the elements of the framework, and define its key concepts and their relationships. This framework was created through the synthesis of the literature from chapter 2 with empirical data from the first round of research. The result was a set of improvisation triggers, contextual variables, classification schemes and a model of improvisation evolution, which were designed to aid in subsequent rounds of data collection and analysis. Through this framework, the identification of relevant improvisation causes (triggers) and assessment of conditions that enable or inhibit it (contextual variables) was possible. The framework also assisted me in the identification and analysis of improvisation types and resulting organizational outcomes (evolutionary stages). In the rest of this chapter I will define each element of the improvisation framework. I will then explain how they relate to each other in the formation of a process model, which furthers understanding of the improvisation process.

IS Improvisation Triggers

The first step in developing the improvisation framework was to identify what triggers improvisation. To accomplish this, I drew on IS Design and Use literature (Suchman 1983; Strong 1995) to create the following definition of improvisation triggers:

An event encountered in IS use where information cannot be properly processed through existing IT functionality or process design, thus triggering improvisation.

This is a variation of Strong's definition of exceptions which is: "situations that cannot be correctly processed by computer systems without manual intervention" (Strong 1995). What she refers to as "manual intervention", I recognize as improvisation.

Through preliminary data analysis at BBC, I identified the following three trigger types:

Missed Requirements – those that result from an error in the design process, where the IT design team misses an essential system requirement. Therefore, needed functionality is missing from the system.

Examples Encountered: There was a need to capture and display materials using both the manufacturer and the supplier part number. The system was only designed to display manufacturer part number. This was a fundamental requirement, and it was later acknowledged by the design team that they missed this in the design process. It resulted in an improvisation which involved using a comments field for supplier number, and ultimately the software was modified to display both numbers.

Evolving Requirements – new requirements that were not needed in a previous software release, but surface after a period of time due to changing business conditions.

Examples Encountered: A new requirement evolved as users became more aware of potential uses for the portal. They realized that it could be used to track supplier performance and display results dynamically to the suppliers. This resulted in a number of improvisations and ultimately a modification which created a screen and report called the "supplier scorecard".

Unmet Requirements – requirements that were properly designed into the system, but due to a software error (e.g. software bug), they are not met.

Examples Encountered: User profiles were being deleted by the system administrator, but due to a software malfunction, deleted users could still log in. It was discovered that there was a problem with the software not updating a "user status" column in the database. An improvisation was created, in which the administrator used SQL programs to update these fields when a user was deleted. Ultimately the software was modified to properly update the database.

This list of improvisation triggers is an integral part of this study, as they guided me to organizational areas and personnel that cause triggers and/or are affected by them. As a result, they ultimately exposed the improvisers themselves.

IS Improvisation Contextual Variables

The next step in the framework construction process was to establish an understanding of the variables that impact improvisation dynamics (see table 3a). I accomplished this by analyzing first-round data from a field study, where I looked for the root causes of improvisation. I then combined these findings with knowledge from the literature review to infer a list of improvisation enablers and inhibitors, which I call contextual variables (CVs). As the list is extensive, each variable and its description are detailed in appendix 2[16].

Based on the above research process, this list of variables was categorized into three hierarchical levels. These levels were created to facilitate parsimonious analysis, as discussion of each contextual variable is not always practical or useful. The levels are defined as follows:

[16] The preliminary CV list presented in this chapter was used to guide the following rounds of data collection and analysis. However, this framework was continually refined in the process. Therefore, the list in appendix 2 was expanded significantly reorganized to better reflect the findings of this study. See chapter 5 for the refined CV framework.

1) Contextual Variable Area (lowest level of detail) – These are the categories of the individual variables. This level allows for summary level CV analysis of a group of variables and/or factors.
2) Contextual Variable Factors (second highest level of detail) – This is a sub-category of the Contextual Variable Area. This level allows for more parsimonious analysis of variables that logically group together.
3) Contextual Variables (highest level of detail) – These are the specific contextual variables that enable inhibit improvisation. Analysis using these CVs provides the most detailed insight into the nature of a given improvisational environment.

In this study, I deploy these CVs to qualitatively analyze the improvisational environments at each site. Through this analysis, I am able to assess the drivers of improvisation at multiple levels of detail, and in multiple contexts. Because effective case studies require a high level of contextual data (Yin 1984; Eisenhardt 1989), improvisation CVs are well suited for this study. The CV Framework facilitates an understanding of the overall improvisational environments, and offers insights into the detailed drivers behind improvisation. This helps establish causal links between certain CVs and improvisation types (e.g. high levels of technical skills enable IT workarounds), frequencies (e.g. more user enthusiasm will cause more frequent improvisation) and organizational outcomes (e.g. high frequency of IT workarounds will increase the number of IT modifications). Analyzing these enablers and inhibitors will provide an initial understanding of the complex nature of the IS improvisational environment and will further clarify understanding of variations in improvisations that occur between organizations. Explaining these similarities and differences will promote generalizations that explain how and why improvisation occurs, thus furthering theory building.

Preliminary Contextual Variable Framework

Contextual Variable Area	Contextual Variable Factors	Contextual Variables Items	Parameters	Reference
Organizational Environment	1. General Organizational Factor 2. Improvisation-Specific Org Factor	a) Org Size (1) b) Complexity (1) c) Change Culture (1) d) Internal Job Movement (1) e) Innovativeness (2) f) Improvisational Awareness (2)	a) Large/Small b) Low/High Complexity c) Adept/Averse d) Often/Not Often e) Low/High Innovativeness Level f) Low/High Awareness	• Tushman 1986;1996 • Weick 1999 • Hage 1999
Inter-organizational Environment	1. Relationship Factors 2. Supplier Factor 3. Systems Factor	a) Exchange Mode (1) b) Partnership Perception (1) c) Level of Trust (1) d) Cultural Differences (1) e) Supplier Size (2) f) Location (2) g) Part Criticality (2) h) Legacy IS Integration w/IOS (3) i) Previous Portal Experience (3)	a) Exit/Voice b) Low/High c) Low/High Trust d) Low/High Differences e) Large/Small f) Local/Regional/International g) Critical/Non-Critical h) Low/High i) Yes/No	• Helper 2002 • Singh 1998 • Bensaou 1997 • Cleamons 1993 • Kumar 1996
General System	1. System Type Factor	a) Usability (1) b) Configurability (1) c) Formality (1) d) Interactivity (1)	a) Low/High b) Low/High c) Low/High d) Low/High	• Orlikowski 1996 • Gasser 1986 • Strong 1995 • Morch 1995 • Weick 1998 • Mirvis 1998
System Environment	1. New System Factor 2. Alternative System Factor	a) Reason for Implementation (1) b) System Use Mandatory? (1) c) Fit (1) d) Modification Policy (1) e) Future Use Plans (1) f) Release Currency (1) g) Level of Use (1) h) Legacy Use/Parallel Systems (2) i) Legacy Internal Integration (2)	a) Users Accept/Do Not Accept b) Yes/No c) Good/Bad d) Pro-Mod/No-Mod e) Low Use/High Use f) Current/Not Current g) Low/High h) Low/High i) Low/High	• Suchman 1986
User Type	1. User Savvy 2. User Engagement	a) Experience Level (New) (1) b) Experience Level (Legacy) (1) c) Tech Skills (1) d) IS Integration Knowledge (1) e) System Enthusiasm (2) f) Level of Empowerment (2) g) Level of Use (2)	a) Low/High b) Low/High c) Low/High d) Low/High e) Low/High f) Low/High g) Low/High	e) Gasser 1986 f) Strong 1995 g) Orlikowski 1992
Implementation Effectiveness	1. Support Factor 2. Use Factor 3. Post Conversion Factor	a) Effectiveness of Training (1) b) Support Effectiveness (1)	a) Low/High b) Low/High c) Low/High d) Actual=Designed	h) Gasser 1986 i) Strong 1995

Contextual Variable Area	Contextual Variable Factors	Contextual Variables Items	Parameters	Reference
		c) User Buy In (2) d) Actual vs. Designed Use (2) e) Missed Requirements (3) f) Number of Issues (3) g) Types of Issues (3)	e) Low/High f) Low/High g) Minor Problems/Major Problems	

Table 3a – Preliminary Contextual Variable Framework

Improvisation Types

The third step in building the improvisation research framework was to identify different types of improvisation. Based on the literature, two dichotomies were identified for each improvisation: **Dichotomy 1)** "Configured Improvisations" that take place because exceptions can be met with designed system "tailorability" vs. "workarounds" which are necessary when the system cannot satisfy requirements with designed functionality, and **Dichotomy 2)** Improvisations consisting of an adjustment of a process vs. those that are an adjustment of the IT. With those characteristics as a basis, I propose the following classification scheme for improvisations in table 3b below:

Improvisation Type	Process	IT
Configured	N/A	Configured IT Improvisation
Workaround	Process Workaround	IT Workaround

Table 3b – Improvisation Types

The above table shows how the intersection of the two dichotomies form three distinct improvisation types, which are defined as follows:

Configured IT Improvisation – a dynamic modification of IT that is facilitated by existing system design functionality. This promotes agile response to IT requirements and creatively expands system use.

This definition use the concepts of dynamic modification (Mehandjiev 2000), agile response to exceptions (Strong 1995), and the creative expansion of system use (Morch 1995). In this classification system, all configurable improvisations are IT related, as opposed to process. This definition draws on tailorability research, which defines configurability as a trait of IT.

Examples Encountered: 1) Selecting from options in a system configuration menu of a supply chain system, which allow the user to control the unit of measurement for materials (pounds, ounces, grams, etc), 2) Using filtering options to configure what is displayed on reports (e.g. showing only certain parts or vendors), 3) Choosing XML from a number of data download format options to automatically integrate with an EDI system.

IT Workaround – an adjustment in the use of an IT, which involves intentionally using it in ways it was not designed, to meet business requirements.

Examples Encountered: 1) Using a comments field to store the vendor's version of a part number, 2) Downloading data into an Excel spreadsheet to perform calculations and analysis that the primary system could not.

Process Workaround – the creation of temporary organizational processes in response to an IT requirement.

Examples Encountered: 1) Planners mailing schedules to suppliers because they were unable to access them due to system problems, 2) Planners calling suppliers to warn them that an order had been added with a due date that was less than the normal lead time (initially planners would just "drop them in", but then suppliers began to complain).

Both the process and IT workaround definitions draw on Gasser's concept of "working around" by intentional deviation from design to compensate for shortcomings of systems. He suggests that this can be accomplished either through the creation of new work processes or adjustment of IT use (Gasser 1986).

These definitions are essential in explaining the improvisation phenomenon and dynamics, as they serve as the basis for every stage of this study. Having clarity on exactly what constitutes an improvisation event promotes more rigorous study design. Armed with this understanding, I am able to design instruments and inquiry processes that expose events with these characteristics. It also promotes more effective data collection, because I know when I observe improvisations and where to look for them. Finally, knowledge of improvisation types promotes better analysis as I can distinguish various traits and patterns inherent within them.

Evolutionary Stages

Having defined improvisation types, I now move to defining concepts relating to improvisation evolution. This section will discuss how improvisations evolve from temporary solutions to permanent organizational change. An understanding of this evolution is the most essential component of improvisation research, as this process is where organizations are impacted profoundly by improvisation. My initial understanding of this process stemmed from Weick's Improvisation Continuum (1998), and Orlikowski's Metamorphosis Model (1996). Both of these conceptual models describe individual improvisation outcomes, but also offer a basis for explaining improvisation evolution. Using the improvisation continuum concepts from the literature, I created a process model of improvisation evolution that consists of the following stages: ad hoc adjustment, embellishment, modification and metamorphosis. This process model shows how a temporary adjustment of IT or process can ultimately evolve into a significant organizational change known as a metamorphosis (Orlikowski 1996). Having identified these stages, I used observations from the preliminary study to develop the following definitions for them:

Ad Hoc Adjustment (IT or Process) – This is the initial stage in the evolution process. In this stage, a user creates a solution for a newly identified requirement by producing an IT or process workaround, or a configured improvisation. The improvisation remains localized, and results in no formal modifications of IT, or organizational processes. Most of these improvisations do not cause such modifications due to the sporadic nature of the unmet need that drove it.

Examples Encountered: 1) Use of ad hoc query and reporting tools to address sporadic reporting requirements, 2) A custom query was developed to uncover purchase order lines in the portal that didn't match those in the legacy system. This is used infrequently, as it was developed to meet an unusual requirement.

Process Embellishment – This stage results from an ad hoc process improvisation, which has been adopted to change organizational procedures. The magnitude of the organizational impact of an individual embellishment is not highly significant.

Examples Encountered: 1) An Accounts Payable clerk improvised a process for proactively viewing message traffic between planners and suppliers to identify when there would be problems in the future. This process was later formalized and is now used by all A/P clerks. 2) Material handlers needed to use materials before they were received in the system. One user improvised a process of leaving a note on the receiving clerk's desk with all pertinent information about material if it was taken before entered. As a result, a formal process was created where a log was filled out for later entry when materials had been taken.

IT Modification – This stage results from an ad hoc IT improvisation, which has been permanently designed into IT functionality.

Examples Encountered: 1) One key supplier user needed in-transit information for her overseas warehouses, so she improvised a query and spreadsheet system to handle this requirement.

Management became aware of the report and decided to modify the inventory “pull report” so that it could calculate and display in-transit information on all shipments, 2) Management wanted to know which suppliers were using the system. In response, the functional liaison developed a query to display a list of users and times of use. The decision was made to modify the software to include a standard report of user traffic.

Metamorphosis – This is the final stage of evolution, which results from one or more significant modifications of the IT and one or more process embellishments. The overall impact of this stage is highly significant as organizational procedures, IT and policies are changed.

Examples Encountered: 1) A key supply chain strategy was to focus on having vendors manage the inventory control process, requiring them to automatically replenish supply at certain inventory trigger points. A number of inconsistent processes and IT reports were improvised at various plants to accomplish this. The decision was made to leverage the power of the portal system to make this a more efficient and consistent process. As a result, an entirely new software module and set of formal processes were created and implemented. 2) Raw material inventory was out of control, as shipments were arriving and never accounted for on the system. Therefore, inventory position was never known, creating significant problems for management, materials control, receiving and A/P. A process and IT reporting system was improvised by a group of users to track these issues. The impact of this problem and early success of these improvisations led to the creation of an entirely new software module and a set formal processes at the user and management level to assure accuracy of raw material inventory.

The development of these stages of evolution is an important step towards integrating all of the above concepts into a model, which explains the evolution process. They show that user improvisations are often events that can initiate organizational change, but to do so, they must go through an evolution process.

Improvisation Evolution Process Model

The purpose of this section is to develop a preliminary version of the "Improvisation Evolution Model" (see Figure 3a), which integrates all of the above concepts to begin to describe the evolution process of IS improvisation. It depicts the interplay between the IS use and IS design contexts, as well as planned and emergent change. It is intended to show the evolution of improvisation as planned change sets the stage for emergent change, and emergent change evolves into permanent change as a result of the improvisation process. It also shows how the boundaries between the design and use contexts must be crossed in order for improvisation to result in permanent organizational change. Finally, it shows the evolutionary nature of improvisations as they move from ad hoc adjustments to embellishments and/or modifications and ultimately to a metamorphosis.

Preliminary Improvisation Evolution Model

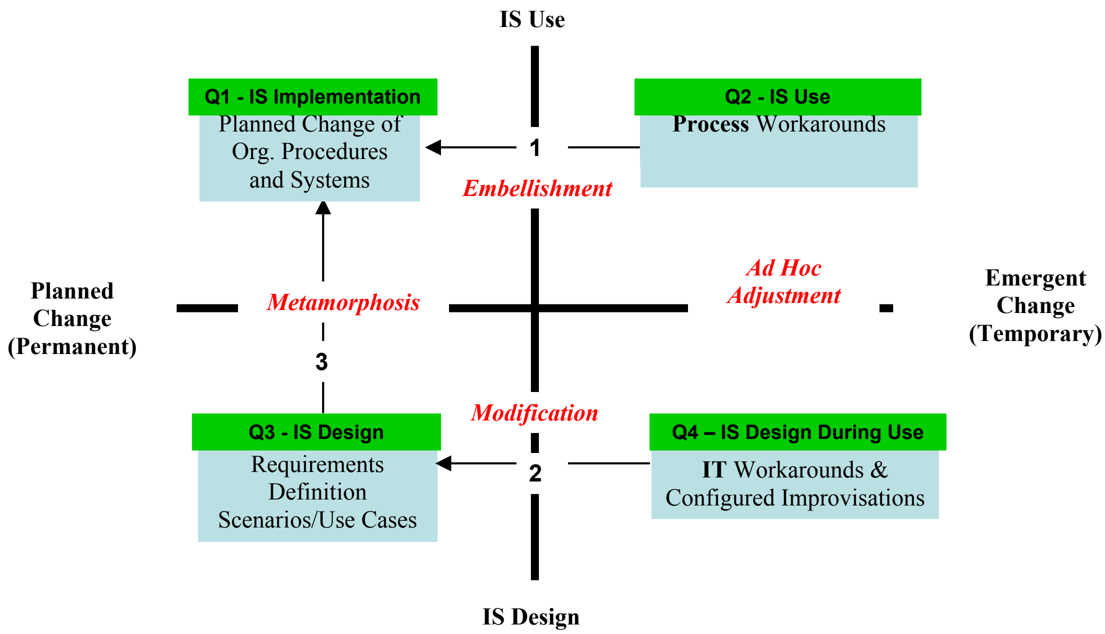


Figure 3a – Preliminary Improvisation Evolution Model

I will now use this model to analyze the evolution of improvisations using the concept of evolutionary paths. I define a path as a sequential movement in the improvisation change space that takes place from the initial improvisation event to its final evolutionary stage. These paths are shown by the arrows and numbers above in figure 3a. As the figure shows, the evolutionary paths trace the movement across the different dimensions of change and across different IS contexts as improvisations progress from temporary to permanent change. They further show that the beginning point of all improvisations is ad hoc adjustment, and the ultimate destination in the evolution process is metamorphosis. Any improvisation's evolution can cease, however, at any evolutionary stage. The evolutionary paths are described as follows:

Path 1 – Ad Hoc Process Adjustment-----Process Embellishment - This path shows a localized process adjustment that has been institutionalized into organizational procedures.

Path 2 – Ad Hoc IT Adjustment------IT Modification – This path shows a localized IT adjustment that has driven a permanent modification of the software.

Path 3 – IT Modification-------Metamorphosis – this path shows a significant IT modification that has been associated with significant organizational change. The path results in major restructuring of organizational procedures.

This preliminary model represents an initial step towards formulating a theory of improvisation dynamics and it serves as a starting point for the study of evolution of system use and software. The goal in this process is to refine the theory to explain the evolution of actual improvisations observed (i.e. how and why they took place), thus creating a deeper theoretical model. My challenge in the study that follows is to capture the complexity of this process as I add more evolutionary paths and change existing ones, while I strengthen understanding of the triggers and drivers of the improvisation evolutionary process.

Improvisation Framework Summary

To summarize, I have described the improvisation process from initial trigger to final stage of evolution. This can be viewed as a synthetic strategy for describing processes (Langley 1999). The approach involves constructing a model that combines causal and sequential relationships to capture all critical components and nuances of a process.

The first step s is the initiation of improvisation that is caused by one or more triggers[17]. Such improvisation triggers surface as new or previously unrecognized requirements. These

[17] Although it is assumed that improvisation triggers are driven by a separate set of contextual variables, they were not considered in this study. This is a possible area for future research.

requirements are addressed by an IS user, who must decide the appropriate course of action to resolve them. The options are to improvise using a workaround, or configured improvisation, to refer this to the functional liaison, or not to act at all. This decision is driven by a set of contextual variables that impact the user's response to these improvisation triggers. Variations in the organizational environment, type of system, user savvy and engagement, and effectiveness of user support can all impact the type and frequency of improvisation that follows. Assuming the user chooses to improvise, the improvisation will either remain a temporary adjustment that is localized, or take one of the three evolutionary paths, resulting in a permanent organizational change.

Chapter 3 Summary

In this chapter, I have refined the key concepts from the literature review in chapter 2 by combining them with the first round of field data to construct a framework for improvisation processes. This framework was used to guide data collection and analysis in subsequent rounds. It acted as a starting point for my exploration into improvisation, and provided a means to design and execute subsequent rounds of this study. The framework also exposed the complex nature of improvisation in the context of design and use. At this early stage of theory building, with so little known about the specifics of improvisation, it is expected that the framework will evolve considerably throughout this study.

IV. Methodology

The goal of this chapter is to discuss the details of the iterative process that was used to progressively design this study, collect data and analyze results. I will give an overview of the literature that was combined with the improvisation framework to design the study and then describe how the study evolved in accordance with the theory building process. The chapter begins with a description of the literature that guided the study design and led to the selection of the theory building methodology. Next, I give an overview of the cases that were selected and discuss my experience at each site. I then provide details on the iterative data collection and analysis approach that promoted the continual refinement of the improvisation dynamics theory. I conclude this chapter with an outline of the reliability and validity issues that were encountered.

In selecting the appropriate methodology for this study, the overall goals outlined in the research questions section dictated the research design. The questions focused my study on the following tasks: 1) Identifying improvisation types, 2) Identifying contextual variables that impact improvisation, 3) Analyzing the improvisation process and the impact of contextual variables on it, 4) Theorizing on improvisation dynamics. The approach chosen to accomplish these goals combines theory building (Glaser and Strauss 1967; Strauss 1987), case study (Yin 1984) and process research (Langley 1999) methods. One of my primary reasons for choosing this topic was the fact that there is little prior research in this area in the IS field. This provides an opportunity to break new theoretical ground. Therefore, a theory-building method was a logical selection. The use of case studies was chosen, because the study involved the examination of a "complex social phenomenon" and there was a need to "retain holistic and meaningful characteristics of real-life events" and "retain contextual conditions" (Yin 1984). The case study approach also allowed for the collection and use of multiple data sources to increase validity of findings through triangulation (Yin 1984). This study closely modeled Eisenhardt's "Theory

Building Through Case Study" approach (1989). Process research methods were used because I was theorizing on the improvisation process. Specifically, I was looking for an explanation of how and why improvisation events evolved over the course of the study. This fits well with Van de Ven's explanation of the goal of process research, which is "understanding how things evolve over time and why they evolve in this way"(Van de Ven 1990).

Study Design

The first step in the process was to define broad research questions to guide the study. My decision was to first ask "what?" or exploratory questions, in order to identify improvisation events and their types (e.g. What are the types of improvisations and contextual variables?). I then moved on to "how?" and "why?" or explanatory questions (Yin 1984), in order to explain the dynamics of improvisations as they evolve (e.g. How do contextual variables impact improvisation dynamics?). In the second step, a priori specification of constructs and a preliminary model took place (Eisenhardt 1989). The unit of analysis was established as unique "improvisation events", which are discrete periods/points in time where IS users improvise. Improvisations were studied at multiple levels, within the manufacturing organizations and across boundaries to the supplier organizations to understand the impact of IOS on the process. Other constructs introduced at the outset were: improvisation types, contextual variables and evolutionary paths that improvisations may follow, as defined in the Improvisation Evolution Model (see figure 3a). The combination of the improvisation constructs and the evolution model acted as a preliminary lens, which guided study design, selection of cases and data collection. During the research process, I observed that the process model required an extended timeframe in order for studied organizations to complete enough improvisation cycles to support the development of rich process theory. Therefore, a two-year timeframe was selected. The choice of a longitudinal approach also strengthened external validity and reliability of the study. This is true because findings became more generalizable over other domains and my ability to replicate results increased with the depth of the data set (Yin 1984). Furthermore, by collecting first-hand observations through interviews, participant observation and ethnographic techniques over the course of over two years, the research design extended the time/scope of previous improvisation studies such as Bansler (2003), who studied a single implementation over six months, and Orlikowski's work (1996), which covered two-years, but was limited to pre- and post-implementation interviews with one organization. This approach allowed me to refine the study constructs and process models multiple times, based on the continuous interpretation of emerging data over an extended period of time.

Case Selection and Site Descriptions

Case selection was guided by the principle of theoretical sampling (Glaser and Strauss 1967; Yin 1984). This approach involves selecting cases for theoretical (to support theory) instead of statistical (e.g. random sampling) reasons. It is appropriate when there is a need to choose cases that will extend emergent theory, fill theoretical categories and provide examples of polar types (Pettigrew 1988). I used the Design and Use model stages (see figure 2a) to determine the correct theoretical sample. This model helped me focus on the interaction between the three primary groups of actors: software designers, manufacturing users and supplier users. Therefore, it was determined that these groups needed to be represented in each case. Within cases, the Interaction Zone Model was used to locate target interaction areas of IOS for the study. A corresponding list of actors in each area, and description of their roles was then created. This list of interviewees derived from the model (see table 4a) was given to key contacts at all three organizations for participant selection. In order to strengthen the generalizability of the theory, to assure comprehensive and diverse data and to provide empirical grounding, multiple case studies were conducted (Eisenhardt 1989; Orlikowski 1993). Due to time constraints, the study was limited to two cases. In order to increase internal validity (Yin 1984), two cases were chosen with similarities in domains critical to the research (Eisenhardt 1989). These similarities were: 1)

Company size (roughly 500 million in annual revenues), 2) Same industry/industry position (Tier 1 Automotive Suppliers) 3) Implementation of the same system (“XXX”) with the same software development/consulting firm (“Express”), 4) Similar project team size and structure. The cases were also chosen because I was explicitly seeking variation in improvisation contextual variable characteristics such as: 1) Organizational Culture (American vs. Japanese), 2) Inter-organizational Relationships (Exit vs. Voice Mode, Dictator vs. Partner), 3) Technical Expertise of Users and 4) Purpose of Implementation. Because one of my goals was to explain the impacts of contextual variables on improvisation dynamics, generating this variation by sampling was necessary. In executing this research design, I examined two implementations of XXX, an eCollaboration system designed by Express Systems. The system was being implemented at Big Truck Brake Company (BBC) and Automotive Interior Manufacturers (AIM). A description of each company and the chain of events that led up to the implementation of XXX follows.

Express Systems

In order to gain the designer’s perspective, the interaction of Express Systems with both BBC and AIM was studied. Express Systems is a small software development/consulting firm located in northwest Ohio, which specializes in developing Internet-based eCollaboration solutions. In their fourth year of business, they have expanded from a two-man operation by adding a sizeable design and development team, and a marketing and sales team, with offices in regions throughout the US. Their focus is currently on Midwest manufacturing clients, but they are working to expand their install base into different industries and areas of the country. The solution in this study, “XXX”, is an extranet-based package, which leverages the Internet and portal technology as a medium of exchange and collaboration with suppliers. In the words of the Express owner, XXX is a “B2B lean supply solution that energizes the supply chain through web technologies” (Lamantia 2003). This system qualifies as novel technology, as the idea of eCollaboration is new to the IS field and the system itself was previously untested. In the scope of this study, Express successfully completed their first two implementations of this system, and was in the process of completing a third.

This study was initiated through contact with the Express owner, Joe, through our mutual involvement in the eBusiness Advisory Board at Case Western Reserve University. After a series of meetings, he agreed to assist in the facilitation of this study by acting as the intermediary between BBC and AIM project management and me. Joe took great pride in his product, and was particularly interested in seeing how his innovative approach to supply chain management would fare. He saw this study as an opportunity to get feedback from various perspectives on the system, as well increase exposure of his company through publication. He therefore took a highly active role in the study, introducing the research idea to the two clients, making initial introductions and participating in a kickoff meeting, where formal handoff of the interaction with them was handed off to me. In the actual study of the Express design process, he was readily available for formal and informal interviews, some of which lasted more than three hours. We selected the appropriate staff members for the study together after I explained the Interaction Zone and Design and Use Models. However, he allowed me to contact them to schedule and conduct interviews. He also gave me full access to documentation, records and test versions of the software. Of particular value to this theory building process was his constant feedback on the models that were being developed. The benefit of his expertise was a key to their continual refinement. The zeal with which Joe provided assistance and advice was definitely a key factor in the success of this study.
The organizational culture at Express seemed to be one of openness and honesty. People felt passionate about the success of the XXX product, and this energy showed in the interviews. Morale was high. Interviewees were open, candid and seemed to trust that this study was beneficial for them. In my opinion, the nature of this environment contributed to the high quality of the data, as they provided honest, detailed accounts of the implementation processes and

allowed access to a wide variety of secondary data (e.g. design documentation, company background information, and access to the XXX test environment).

Big Truck Brake Company (BBC)

Big Truck Brake Company is a manufacturer of OEM and aftermarket brake assemblies and replacement parts for large commercial trucks, operating as a Tier 1 supplier to the trucking industry. They service a customer base of approximately 98 companies, with 80% of their sales coming from five large customers, some of whom are Big Three Automotive Manufacturers. BBC has endured multiple acquisitions and mergers throughout the last 20 years, and as a result has become an organization that is adept at embracing change. The organizational and information systems environment has undergone multiple revisions and thus has achieved a high level of integration in concentrated areas. However, as a whole, their system architecture consists of a network of disparate systems integrated by many interfaces. Their general strategy in IT has been movement towards modernization of these systems and cutting costs. Therefore, the inherent opportunities of an eCollaboration solution like XXX for BBC to eliminate EDI cost, while increasing efficiency were readily apparent. The value proposition of this cost savings was an easy sell to management and supply base alike, which resulted in an expedient approval process and initiation of the XXX project. This was the first XXX implementation for Express. Therefore, BBC was to serve as an initial proving ground for the concept and the implementation was a continuation of the design process for the software. Although XXX had been tested thoroughly before this implementation, its functionality was intentionally limited in lieu of feedback from the users in the BBC implementation.

The BBC case study was initiated by the Express owner, as outline above. After the kickoff meeting, I worked directly with the XXX implementation project manager and the functional liaison to conduct the study. After meeting with the project manager to review the Interaction

Zone Model, we mutually determined which personnel would align with the list of interviewees/roles. She then delegated the responsibility of arranging all interviews to the functional liaison. In the initial round of data collection, the project manager sat in on the first couple of interviews to assure that she was comfortable with the process. After that, her involvement in the study was minimal, and I was given full autonomy to conduct interviews as I saw fit. For the last two rounds of interviews, I was allowed to contact participants directly. I handled all scheduling and interviewing and other interaction without supervision from BBC management. I was also given access to most information that I requested, including training materials, performance measures, and other archival information. Overall, my primary management contacts at BBC were helpful and eager to assist. An example of this was when the project manager reserved a company van and drove me to an Indiana plant for a day interviews with planners.

When interviewing BBC personnel, some cultural issues surfaced, which presented some challenges. Although management personnel seemed comfortable with the interview process, the primary users at the plant level did not. Managers seemed candid, honest and at ease with the process. However, although the planners were always cordial, they seemed apprehensive. I sensed that they were a bit suspicious of me in the initial round. Therefore, it was a challenge to get them to respond in detail to questions such as “what don’t you like about the portal?”, and when asked how the implementation was going, answers were almost always “It’s going well…yeah just fine”. After the initial round, however, this dynamic changed. Planners responded more candidly, as I came away from the final rounds with a sizeable list of data points (e.g. problems with the portal, the implementation and the organization) exposed through interviews. My sense was that through efforts in the initial round (e.g. I bought them college sweatshirts and did some pro-bono consulting for them) I developed a stronger rapport with the interviewees. As a result, they were more open, increasing the quality of the data significantly.

Interviewing suppliers was quite different. They were quite candid and open from beginning; all eager to help and very supportive of the process. I had no problem getting them to be frank with me about the issues associated with working with BBC and the portal implementation. Supplier data from the BBC case was among the best sources of improvisation data, due to their high level of candor and general business/technical savvy.

Automotive Interior Manufacturer (AIM)

AIM is a middle-market (approximately $500 million in sales), Japanese-owned company, with only one customer: Honda. They manufacture seats and other plastic injection-molded parts for several Honda models. As is typical of Japanese suppliers, Honda dictates a great deal of what takes place in their supply chain. The latest of these mandates is an initiative called Value Chain 2 (VC 2), which calls for suppliers to respond to drastically shortened lead-times, schedule changes and also to cut costs significantly. AIM had serious supply chain issues which were causing them to have difficulty meeting this mandate. These issues were primarily in the areas of lost material and receiving discrepancies. This situation made the XXX implementation a high priority for them, as the system was being modified to incorporate a process which could potentially solve their inventory problems by giving them visibility of in-transit inventory and greatly refining the receiving process. This implementation was the second for Express, but the software had been enhanced significantly as a result of the evolution that took place at BBC. .

The AIM case study had a number of key strengths. First, the study was kicked off with a meeting that was attended by all participants. This meeting gave me the opportunity to break the ice, and establish initial rapport and credibility. I gave a short presentation about the study and my goals as a PhD student and future professor. I found that this helped promote trust, as they saw that I was there for a respectable cause. Second, AIM was working with a much more “mature version” of XXX, which was more robust than BBC's. This gave me the opportunity to study improvisation with more functionality than the other case, which drove some interesting results (e.g. more actors were involved in the improvisation process, because there were more functional areas, like receiving, integrated into the system). Third, my primary contact was a senior associate, Clif, who had been with the company almost since its inception. He had tremendous knowledge of the organizational history, especially in the realm of IT, and he had been involved in the design of most of the current organizational processes. Since he was in charge of the XXX project and also had handled most of the initial training and day-to-day support, he was able to provide me with an integrated perspective on the project. In our interviews, he expanded in detail on processes, IT, strategy and organizational culture. He was able to clearly articulate what he saw to be the impact of these conditions on improvisation. Clif was definitely the best source of data in this study. Also, he was liberal with his time, granting me several interviews in each round of data collection. Fourth, AIM was quite generous with their resources, providing me with an office each day that I was onsite for data collection (and also taking me out to lunch), arranging all interviews, reserving a conference room for them and even allowing me to use their phones for long-distance interviews with suppliers. I felt welcomed and comfortable there, as the environment was very relaxed. Finally, the interviewees were more open and trusting from the beginning. It seemed as though they were quite secure, which allowed them to be more candid. I saw this as having a positive impact on the quality of my data.

On the other hand, interviews with suppliers were quite difficult. They were less eager to help than BBC suppliers, and seemed to have an overall negative attitude about the XXX system, which made the interview process difficult (e.g. it took great effort to get them to commit to interview times and their answers were often short) Although I did feel that they were being honest, I think that the negativity surrounding the implementation prevented them from embracing the research process.

Data Collection Approach

Data was collected from multiple sources including formal and informal interviews, passive observation of meetings and training, participant observation (such as performing live A/P, Receiving and Buying transactions) where I actually interacted with the system, documentation (such as training materials, memos, articles and e-mails) and physical artifacts (such as issues database, reports and access to the XXX system). The intent of using multiple sources of evidence was triangulation of data to increase credibility and to corroborate empirical findings. The overall goal was to establish a clear "chain of evidence" between research questions and conclusions (Yin 1984). Further, the longitudinal nature of this study, which took place over the course of two years, provided an opportunity to collect a broader range of data, under evolving conditions, helping to establish a more elaborate chain of evidence and richer theoretical framework (Yin 1984; Eisenhardt 1989).

In order to gain the variety of perspectives specified by the Interaction Zone Model and the design and use aspects, interviews were conducted with three groups of actors: Manufacturer Management and Users, Supplier Users and Express Management/ Designers (see Table 4a).

The interviewees selected were as follows:

Firm/Position	Number	Description	XXX Implementation Role
VP of Manufacturing	1	Development of overall strategy and policy	Final decision maker
Director of Supply Base	1	Development of long-term supply base strategy, global sourcing	Develops specific supply chain strategy that the system needs to support
Supply Chain Project Manager	1	Requirements definition, design and testing of new supply chain solutions	Overall project manager
Functional Liaison	2	Implementation, training and support of supply chain projects	Training and day-to-day support, creation of workarounds, design of modifications
IT Business Analyst	1	Analysis and design of legacy system projects	Support of IT infrastructure, integration with legacy system
Materials Planning Supervisor	1	Supervision of purchasing and production materials planning	Supervision of users to assure system supports materials process
Buyer	1	Oversight of purchasing function at the plant level	Monitoring of supplier performance using XXX
Purchasing Planners	5	Interaction with suppliers dealing with demand and exceptions	Primary users of system for planning and purchasing
Materials Handler	1	Design and implementation of plant level material movement solutions	Design of process to support the XXX
Suppliers	5	Various suppliers to BBC	Primary users of system for sales and shipping to manufacturer
Express – President and Founder	1	Founder and principal of Express	Overall Express and XXX visionary
Express – Product Manager	1	New business development manager	Sales and support of XXX
Express – Lead Developer	1	In charge of design and development of each release of XXX	Design and development of modifications
Express – Head Technical Architect	1	Oversees all development activities	Product evolution management

Table 4a – List of Interviewees

Interaction Zone concepts were used to guide data collection by showing zones of focus, which were supplier side Design Collaboration, Manufacturing Collaboration, PO/Material Management and Logistics Management. Within these zones, I selected interview participants and composed separate scripts to serve as guidelines for discussions within each group. Questions were developed which pertained to the types and contexts of interactions that occurred in each interaction zone, types of XXX use that took place and resulting improvisations. Data Collection Round 1 questions were open ended and informed by existing research on improvisation, systems design, system use and inter-organizational systems. Round 2 and 3 questions were based primarily on the evolving theoretical framework and previously refined concepts/questions. Interviews were 1-2 hours in length, and were conducted onsite for BBC, AIM and Express participants. Supplier users were interviewed over the phone due to geographical and time constraints. All interviews were recorded, transcribed, and submitted to selected participants for verification. The interviews were intentionally scheduled to allow for overlap of data collection and analysis within each phase (Glaser and Strauss 1967). This was accomplished by interviewing parts of the group of primary users at different times over the course of a 2-3 week period. This approach facilitated better interviews for each successive group, as I had time to analyze and reflect between interviews, thus formulating better questions. Follow-up interviews and ad hoc question and answer sessions were conducted with the Express owner, BBC functional liaison and AIM Senior Manager after each round to clarify and add detail. This follow up was a key part of the theory building process in each round, as it solidified core concepts.

Initial questions in each interview focused primarily on contextual variables related to the organization, relationships with suppliers, perceptions of the system and its implementation. Respondents did not have significant problems answering these. However, posing questions regarding improvisation was more difficult and evoking related responses was challenging. I found that in most cases (with the exception of the functional liaisons), effectively explaining improvisation to users was difficult. It often created more confusion than clarity. Instead, I developed an inquiry to expose improvisations indirectly. I used questions like: “How do you handle a situation where the system won’t do, what you need it to do?”, “What creative things have you found that the portal can do since the last time we spoke?" and "What kind of tools does the system provide to offer you flexibility in doing your job?" The interview protocols were updated after each interview, and by the final phase, I had become quite proficient at conducting this line of inquiry. Examples of interview protocols used are in Appendix 6

Using Glaser and Strauss's (Glaser and Strauss 1967) approach to descriptive qualitative research, field notes were taken throughout to document initial impressions, central/recurring themes, and to classify potential categories of responses. With system users, most interviews took place at their workstations. This allowed me to observe their system use and permitted them to demonstrate functionality and improvisations to clarify their points. After each interview, a summary was written up to elaborate main findings. This step served as the initial step of data analysis while ideas were still fresh, keeping a "running stream of consciousness commentary about what is going on in the research" (Van Maanen 1988).

After each round of interviews, transcript review and incremental analysis, new improvisations were identified and the theoretical framework was refined. Through this process, the contextual variables, definitions of improvisation types and evolutionary paths began to more closely match the data, while the framework became richer. The next step in the analysis was the revision of the Improvisation Evolution Model. As the study progressed, the model emerged to capture the progressing theory of improvisation dynamics, as it linked the emerging key concepts of the framework. The final step was to revise interview scripts for the upcoming round. By the final round of each case, questions asked had moved from broad and exploratory (seeking to identify what improvisation was), to refined and explanatory (targeted specifically how and why improvisations took place).

Upon completion of interviews, a day of participant observation was held at AIM (BBC chose not to participate in this process). The purpose of this data collection phase was to directly observe XXX and legacy system use and associated improvisations. During this day, I worked with primary users in receiving, accounts payable, materials planning and IT support. I watched as they performed their tasks, demonstrated improvisations,, and even coached me through the use of the system. Throughout the process, notes were taken, screen shots and reports were printed out and a number of improvisations (that had not been reported during interviews) were explored. At the end of the day, I revised field notes and drafted a summary report. I also revised the improvisation framework.

Timeframe of Data Collection

For analysis purposes, the AIM and BBC implementations were divided into four phases. These are outlined in Table 4b below. These phases coincided with project phases being followed by AIM and BBC. These milestones were set by project management in six-month increments.

Project Phase	Time Since "Go Live" Date
Phase I	< 6 Months
Phase II	6-12 Months
Phase III	12-18 Months
Phase IV	18-24 Months

Table 4b – Implementation Phases

Data for this study were collected in three rounds as noted in the following table 4c. These rounds encompassed subsequent project phases at each site. Data collection took place at both sites during rounds two and three. The table shows that at BBC, data collection took place for Phases I and II at the same time. This was because that case study began after Phase I was complete.

Therefore, Phase I data was retrospective. Also, due to time constraints, data was collected at AIM for Phases I and II only.

Data Collection Round	Timeframe	Company	Project Phase
1 - Preliminary Round	March 2003	BBC Only	Phase I & II
2 - Initial Round	October – November 2003	BBC	Phase III
		AIM	Phase I
3 - Final Round	April - May 2004	BBC	Phase IV
		AIM	Phase II

Table 4c – Data Collection Rounds

Analysis Approach

The data analysis for this project was an iterative theory-building process of analysis and verification across data collection rounds using the "Constant Comparative Method" (Glaser and Strauss 1967) as a guideline. Data analysis/data collection and analysis results were constantly compared with new data to allow for adjustment of the evolving theory and the data collection approach. This approach allowed for the continual refinement of the improvisation framework and process theory, facilitated the adjustment of interview protocols and prompted me to add new data sources when needed (e.g. re-interviewing users as new questions evolved, interviewing additional users and adding a day of participant observation). The goal of data analysis was to identify individual improvisations, categorize them and create a process theory explaining their dynamics. To accomplish this, I used Langley's "Strategies for Theorizing from Process Data" (Langley 1999) as a guide. In doing so, I applied a number of her strategies for sense-making (Weick 1979) such as grounded theory, narrative, visual mapping, quantification and a synthetic strategy in a "combined approach" to generating process theory (Langley 1999). These strategies were divided among the various data analysis phases, which were a preliminary phase, which spanned data collection rounds 1 and 2, and a final phase which took place after data collection round 3.

Preliminary Analysis Phase

The first step in the preliminary analyses was to construct a framework for improvisation consisting of definitions, classification schemes, a listing of evolutionary paths and an evolution model. The framework was initially literature based, but developed significantly over the course of the project as it was adjusted to better fit the data. The process theorizing strategies applied in this phase were grounded theory, which used open and axial coding, and narratives. After my first round of data collection, open coding (Strauss 1998) was used to refine the framework. This process consisted of analyzing data to place conceptual labels on them. It was used to establish initial categories of improvisation types, evolutionary paths and contextual variables that were present in the improvisation process. Analysis consisted of in-depth review of transcripts and field notes, with the intent of documenting impressions, assertions and themes with regards to the improvisational environment at BBC. As concepts emerged that needed further elaboration or clarification, other data sources such as documentation and re-interviewing were used to solidify them. After open coding, I used the narrative approach (Pentland 1999) to write thick description of the improvisation process, using the concepts created during open coding as a basis. Through this, I discovered a number of inconsistencies and missing variables. I used these revelations to further develop the improvisation evolution process model, which assisted in subsequent rounds of data collection. After the second round of data collection, axial coding (Strauss 1998) was applied to the contextual variable framework. This process links similar concepts together into more refined categories. In my case, this helped me take an extensive list of contextual variables and create sub-categories of contextual variable “Areas”, “Factors” and “Items”. This resulted in a more manageable level of analysis for contextual variables (using the “area” and “factor” levels to summarize, instead of focusing on the “item” level). Once the framework had been through several iterations of refinement across rounds 1 and 2, selective coding (Strauss 1998) was performed. In this step, a core phenomenon is selected (in this case, improvisation dynamics, which was defined as frequency, type and evolution of improvisation), and the beginning of a story line is developed to describe it. This involved the definition of improvisation dynamics, and application of the framework to codify data collected across all phases, which would promote the development of the theory on improvisation dynamics. At this point, I applied visual mapping strategy (Miles 1994; Langley 1999) to construct an initial process model which integrated all of the constructs and concepts, showing key relationships and sequences. This was the first iteration of the improvisation evolution model.

One of the key deliverables that evolved from the selective coding of field notes and transcripts was the Master Improvisation List (see Appendix 4). As an improvisation event was identified during an interview, it was highlighted in field notes. Immediately following the interview, the improvisation was codified according to name, type, detailed description, what drove it and its evolutionary path. The transcripts were then reviewed to add more detail to each improvisation description. In many cases, other users and the functional liaison were consulted to obtain different perspectives on each improvisation. Documentation of these events served as the most tangible data collected. It guided most of the analysis and was an effective means to illustrate the application of the improvisation framework.

Final Analysis Phase - Within-Case Analysis

Once CV and improvisation data from rounds 1, 2 and 3 had been selectively coded, the first step in the final analysis phase was within-case analysis for BBC and AIM. These analyses involved the creation of detailed, descriptive summaries of research results for each site (Eisenhardt 1989) separately. For each case, I chose an exemplar improvisation that had moved through the entire Improvisation Evolution Model, to serve as an illustrative example. Extending the narrative strategy suggested by Langley (1999), I used ethnographic techniques (Van Maanen 1988), to write a detailed explanation of the events surrounding each improvisation as it evolved from ad hoc adjustment to metamorphosis, resulting in significant organizational change. This exercise helped solidify the evolution model and was also designed to elevate the reader's understanding of key improvisation concepts. I next used the contextual variable framework to assess BBC and AIM improvisational environments, gaining insight into the enablers and inhibitors of each case. Contextual variable assessments were supported through the use of illustrative quotes, field note references and vignettes. In this process, certain variables emerged as having more of an impact than others. These were deemed "critical variables". For each critical variable, I used all available case study data to assess whether it enabled or inhibited improvisation. Variables that were assessed as enablers received a rating of "+" and those assessed as inhibitors received a rating of "-". Those variables deemed "non-critical" were not assessed. These contextual variable assessments increased understanding of the critical drivers of improvisation for each company.

The next step in preparing the write-ups was to summarize the master improvisation list across all phases. For each case, I used the quantification strategy, which involves quantification of process events and their outcomes, to produce counts of improvisation types and evolutionary paths (Langley 1999). These were all compiled and graphed by phase. Also, improvisation counts by user across phases were graphed. These graphs provided the first visual illustration of the actual improvisation dynamics that took place. In them, I could see the frequency, type and evolution of improvisation, how it changed over time, and which actors drove it in each phase. This allowed me to begin to view patterns of improvisation dynamics that took place over the course of this study. For each project phase, I then used the contextual variable assessments to interpret and develop possible explanations for these patterns.

Final Analysis Phase - Cross-Case

The final analysis step was to examine the contextual variable assessments and the improvisation dynamics across the two cases to create a set of key findings. These findings then promoted the creation of my improvisation process theory and formulation of a set of propositions for future research. In exploring findings, the two goals were: 1) to explain similarities and differences between the cases and 2) to look for cross-case patterns (Eisenhardt 1989). First, I made of list of similarities and differences in contextual variable assessments and improvisation dynamics. The search for differences (e.g. different software versions, cultural disparity, core reason for implementation and technical ability of users) and similarities (e.g. implementation effectiveness, inter-organizational relationships) in contextual variables provided a deeper understanding of the application of the contextual variable framework. This process also refined the framework, as some variables were eliminated (e.g. "Previous Portal Experience" in the "Inter-organizational Environment" CV area) and some were added (e.g. "Reason for Implementation"). It also showed the importance of contextualizing the assessment with the data to support the findings. The juxtaposition of improvisation dynamics across the cases led to deeper refinement of the evolution model. This theorizing process exposed consistencies (e.g. all improvisations begin in the Ad Hoc Adjustment stage) and inconsistencies (e.g. improvisations that result in metamorphoses follow different evolutionary paths, depending on the urgency of the requirements driving them) in the data, which led to refinement of the theory. Second, I conducted pattern matching across cases to further expose salient relationships in improvisation dynamics[18]. In this process, I looked specifically at how improvisation dynamics changed over time in terms of frequency, (e.g. decreased for both BBC and AIM), improvisation types (e.g. shift towards more process workarounds in later phases for both BBC and AIM) and improvisation evolution (e.g. increase in process embellishments as the final stage in both cases).

Finally, the resulting analyses were used to employ the synthetic strategy. This involves constructing combination variant/process models, in which all critical components and nuances of a process are captured by the relationships to variables which influence it (Langley 1999). The synthetic model that I created was the Improvisation Dynamics Model. The creation of this model

[18] The criteria for choosing salient relationships are explained in chapter 6.

suggested a number of key revelations, which are explained in the following chapters. The next step in the synthetic strategy process was to use the improvisation dynamics model to further refine the improvisation evolution model, to assure that the concepts aligned. Finally, all key causal relationships were organized into a set of causal models for user and organizational CVs in the improvisation processes. The combination of these models organized all key study concepts. They served as the basis for the formulation of the emerging theory and were used to theorize how and why the dynamics of improvisation take place. From these theoretical conclusions, propositions for future research were created.

Reliability and Validity

During various phases of this study, validity and reliability were taken into consideration to assure these tests of data dependability, credibility and confirmability were maximized. Four quality tests were used to guide proper research design, data collection and analysis. Also, related quality tactics as established by Yin (1984) were employed throughout the study. The tests and resulting tactics are described as follows:

1. **Construct Validity**: "establishing correct operational measures for concepts being studied". (Yin 1984). Due to the subjective nature of case studies, there are commonly concerns that the constructs are not established with sufficient rigor (Yin 1984). This was particularly true in this study, as there were a number of new variables and constructs that were developed. I addressed this concern by first deriving initial concepts from the literature in chapter 2. This provided a viable foundation for my theoretical framework. I then expanded these concepts with empirical data from multiple sources to provide measures of improvisation events, the improvisation dynamics process and contextual variables. The purpose was to develop "converging lines of inquiry" (Yin 1984) with regards to improvisation. I also used these data sources to establish a "chain of evidence" by referring to interviews, field notes and other documentation throughout the analysis. The final tactic used to maximize construct validity was the review of key documents by informants (primarily functional liaisons and project managers from BBC and AIM, and the Express Owner and Product Manager). Upon completion of each phase of analysis, these key project personnel reviewed improvisation concepts, constructs and models and gave feedback to help improve them.
2. **Internal Validity**: "establishing a causal relationship whereby certain conditions are shown to lead to other conditions" (Yin 1984). The use of CVs in this study made internal validity a concern. This is because I was seeking to show a complex network of causality between CVs and varying events in the dynamics model. In order to assure that these relationships were

valid, I first assured that cases selected were similar enough to promote valid comparisons. I also used a combination of process theorizing strategies (Van de Ven 1990; Langley 1999; Pentland 1999) to assure rigor in constructing process models with viable causal relationships, which were used to analyze causality. Finally, I used the depth of the longitudinal evidence from both cases to assure that rival explanations and possibilities were considered (Yin 1984).

3. **External Validity**: "establishing the domain to which a study's findings can be generalized". (Yin 1984). Another common concern with case study research is how generalizable the findings are, especially in single case studies (Yin 1984). In the design of this study, a longitudinal approach was chosen to add depth to the data, thus making inferences more generalizable. Also, a second research site was added after data collection round 1, to further address this issue. I attempted to replicate Phase I and II aspects of the BBC study by selecting a similar site (AIM), applying the same research framework and testing the evolving theory on improvisation. Replications were successful in the identification and categorization of improvisations, as well as tracking them through the dynamics model across multiple user groups (e.g. suppliers, planners, A/P clerks, shipping and receiving clerks, functional liaisons, management and inventory control), which was further evidence of external validity. The basic consistency or "replication logic" (Yin 1984) of these concepts addresses the issue of external validity on a fundamental level. This is acceptable for this early stage of theory building (Eisenhardt 1989). However, more research is needed to deepen the replicability of these findings. In that process, it is expected that these will generalize to a number of improvisational contexts including: IS implementations, IOS implementations (at key interaction points specified by the interaction zone mode), implementations of novel technology, and improvisation by users in various functional areas.
4. **Reliability**: "demonstrating that the operations of a study, such as data collection and analysis, can be repeated with the same results". (Yin 1984). One of the primary tools to

assure reliability is the use of a case study database containing all data, which has been codified for easy referencing (Yin 1984). My approach to building this database was to record and transcribe all interviews, paginate all field notes, and file all documentation by case, phase and participant. The depth of this database was increased through the longitudinal nature of the study. I also summarized each phase through narratives in order to outline concepts identified and findings to date. Another measure that was taken to assure reliability was development of a case study protocol. This set of documents contains an outline of the key procedures used, and interview protocols in each phase. These steps help assure that external personnel can better trace the procedures and evolving findings of this study, which enhances the ability to replicate it.

Chapter 4 Summary

In this chapter, I have outlined the iterative approach to research design, data collection and analysis that was utilized to complete the study. It is now apparent that in such a process, the design of the study is never complete. The framework, constructs, approach to inquiry, sources of data and resulting theory must constantly evolve. This is necessary to assure that the proper data is collected and incorporated into an evolving process model.

V. Analysis of the Improvisation Process

The goal of this chapter is to summarize the case study data and to analyze the improvisation dynamics that occurred. My approach is to use models, narratives, data displays, and representative quotes to provide a high level of detail on different aspects of observed improvisations. I then offer explanations of why improvisations occurred as they did. The chapter divides the analysis into two cycles, one for each case. For each cycle, I present an example of an improvisation event and trace its evolution. The examples were selected because they best exemplify all improvisation dynamics concepts, and evolutionary paths in the Improvisation Evolution Model. Next, I expose why improvisations took place by applying the Improvisation CV Framework. I use the framework to assess improvisational environments of BBC and AIM at the user and organizational levels. Finally, I explore improvisation dynamics for each site by graphically displaying and analyzing the triggers, frequency and types of improvisations and resulting evolutionary paths. I then use the contextual variable assessments to interpret why these dynamics unfold.[19]

The analysis follows the Improvisation Evolution Model (Figure 5a). In order to create this process model, I used the synthetic process development strategy (Langley 1999) and sought to integrate all causal and sequential process concepts that were discovered during the study. The model emerged from the data during the following process model analysis. The analysis resolved a number of inconsistencies and gaps in the initial improvisation process description presented in chapter 3. The model contains new concepts, which explain how and why improvisations occurred in studied sites. The first new concept in the model is the division of improvisation dynamics into two primary processes, 1) the improvisation process, which is the actual creation of improvisations and 2) the improvisation evolution process, which involves the organizational

[19] Due to data and scope limitations, evolution triggers were not included in this analysis, but are seen as a key area for future research.

evolution of improvisation outcomes as they move on a path between different evolutionary stages (i.e. ad hoc improvisation, process embellishment, IT modification and metamorphosis). The second new concept anchors these processes in two primary contexts: the user context and the organization context. Improvisations actually occur in the user context, while in the organizational context they evolve into permanent organizational change. The third new concept relates to contextual variables. In the initial framework, they were combined into a single set. This was problematic however, when I analyzed variables such as “Level of Use”, “Innovativeness” and “Improvisational Competence”; I found that they could be applied at both the user and the organizational level. Therefore, to better align the variables with the proper contexts, the CVs were divided into user and organization levels. As a result, the variables were broken down into three groups that pertain to these contexts: 1) manufacturer-user, and 2) supplier-user variables within the user context, which affect improvisations in terms of type and frequency of improvisation and 3) organizational variables within the organization context, which influence the evolution of improvisations into organizational change. The fourth new concept is improvisation triggers. These are events that initiate the improvisation process. Triggers are classified as missed requirements (i.e. caused by a mistake in the design process), evolving requirements (i.e. caused by evolving business processes and environments) and unmet requirements (i.e. caused by software errors or unexpected system flaws). The final new concept is a group of events called evolution triggers. These are events, which cause improvisations to move between consecutive evolutionary stages in the improvisation evolution model. For example, management allocating IT funds can trigger an ad hoc adjustment to evolve into an IT modification. Evolution triggers are actions taken primarily by management to institutionalize improvisations into permanent organizational routines or IT solutions. For example, recognition by the AIM materials manager of the value of an improvised process to log material that is used before received on the system. This caused management to revise formal procedures to include this process.

Improvisation Dynamics Model

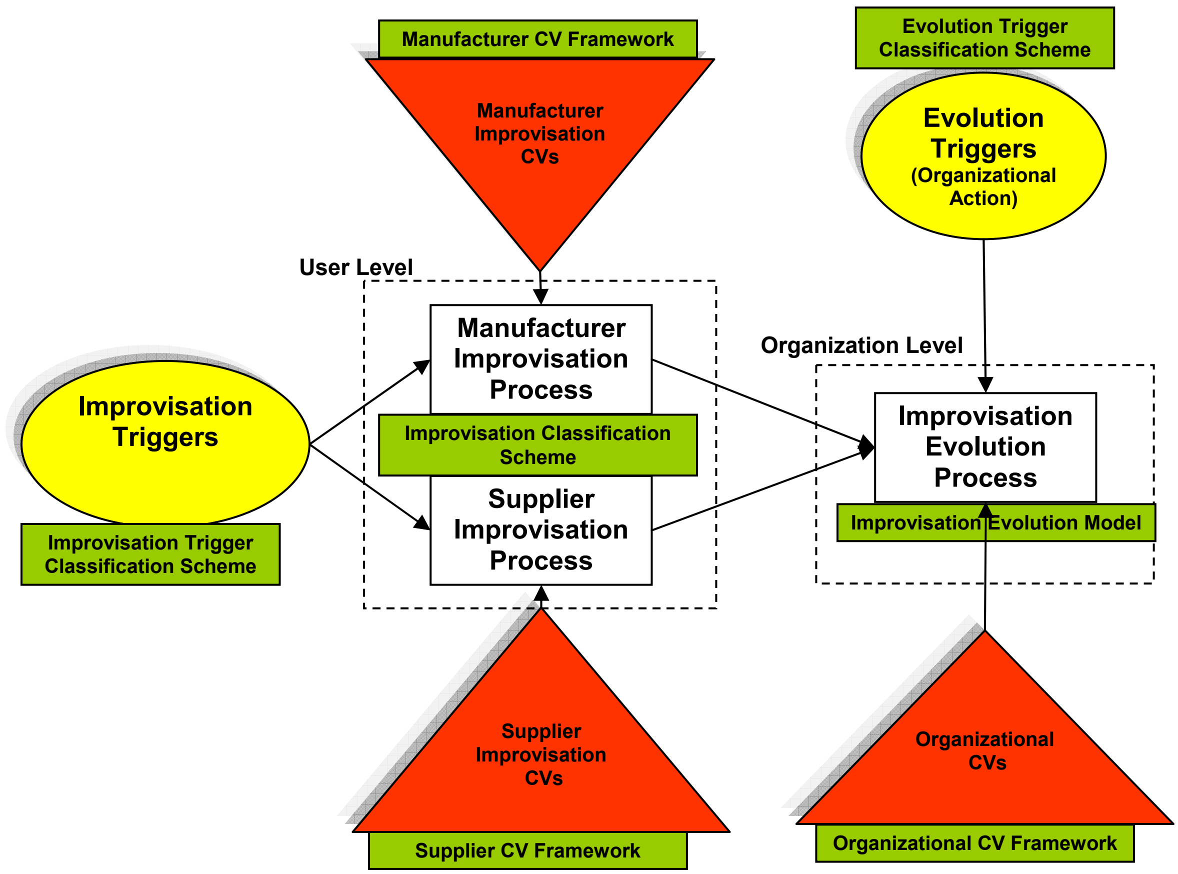


Figure 5a – Improvisation Dynamics Model

I will now describe the details of the improvisation dynamics process that are represented in the above model[20], moving from left to right. The first step in the improvisation process is the initiation of improvisations by one or more improvisation triggers, which are described in detail later in this chapter. These triggers initiate improvisation by a manufacturer-user, and/or a supplier-user. A separate set of contextual variables (see tables 5a and 5b below) influence the type and frequency of improvisation that takes place depending upon whether the user is a

[20] The green boxes in this diagram represent the related components of the improvisation framework. Preliminary versions of the CV and evolution model components can be found in chapter 3. A refined version of the CV framework and the improvisation trigger classification scheme is in chapters 5 and the refined evolution model and the evolution trigger classification scheme is in chapter 6.

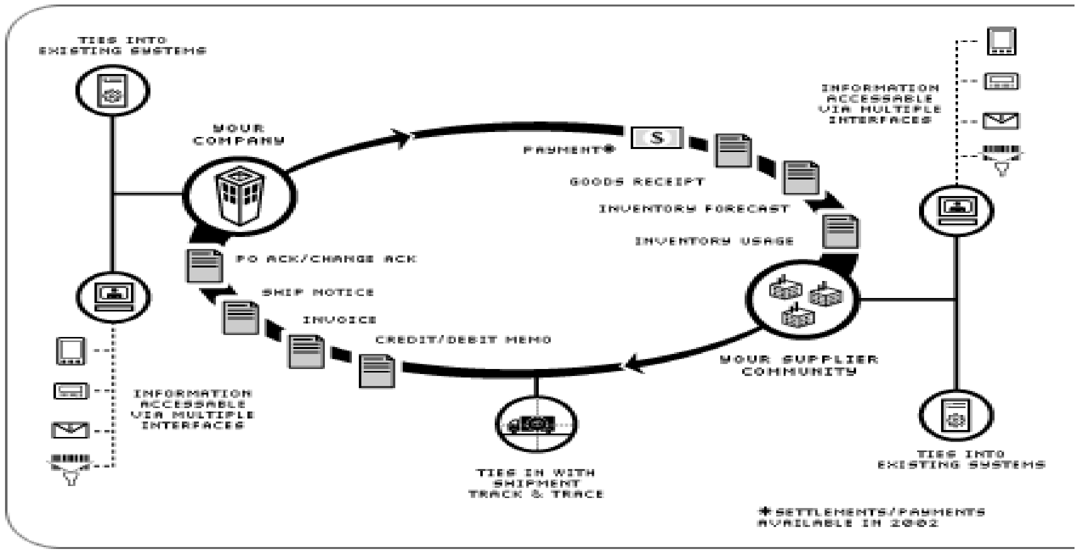
manufacturer (manufacturer improvisation CVs) or a supplier (supplier improvisation CVs). Improvisations will then evolve along one of the six paths described in the refined improvisation evolution model (see figure 6b). During this evolution, improvisations will either remain under the control of the user who created them ("User Level" box in the diagram), or ownership will shift to the organization ("Organization Level" box in the diagram). If the improvisation remains at the user level, it will not evolve further, remaining in the ad hoc adjustment stage. However, if an evolution trigger (see table 6l) takes place, the improvisation will move to the right in the model, from the user level to the organization level. This indicates a change in ownership and control from user to organization. In this process, the event transitions from an improvisation into a permanent change. It can then potentially evolve into an IT modification, process embellishment or metamorphosis. After the transition takes place from user to organization, the evolution process is driven by a different set of contextual variables, known as organizational CVs. These CVs reflect the organizational control of the evolution process. The evolution of an improvisation at the organization level can be continually triggered until it reaches its final stage. The final stage reached depends on the level of impact and direction of organizational contextual variables.

The above model represents all of the key concepts of this study and the relationships that exist between them. In the following sections, I apply these concepts to analyze the data from both cases. I first apply them individually to assess CV impact; then, across cases, I will begin to expose relationships that exist between CVs and improvisation dynamics.

BBC Improvisation Dynamics Analysis

This analysis of BBC improvisation dynamics begins with the use of a narrative that provides a detailed story of events surrounding an exemplar improvisation as it evolved from ad hoc adjustment to metamorphosis. The purpose of this narrative is to promote theory building by moving from "description to explanation" (Pentland 1999). It illustrates the concepts of the improvisation dynamics model, and assists readers by elevating their understanding of key improvisation concepts. Improvisations that were chosen as exemplars for both the BBC and the AIM narratives met the following criteria: 1) they reached metamorphosis, 2) they evolved either very slowly, as in the BBC example, or very quickly, as in the AIM example, 3) the improvisation impacted both manufacturer and suppliers and 4) the scope of the resulting organizational change was the largest of all improvisations that reached metamorphosis for that case. For each narrative, I first give an overview of the circumstances surrounding the improvisation. I then discuss what triggered it, and what type of improvisations evolved in response to these triggers. Next, I follow its evolution through the stages of the evolution model, providing details of organizational circumstances surrounding the process. Finally, I summarize the outcomes of the evolution process. To complete this analysis section, I assess the improvisational environment using CVs to examine the BBC and supplier users, and the BBC organizational environment. Finally, I use graphical analysis techniques to interpret the meaning of patterns of improvisation dynamics that occurred.

BBC Exemplar Improvisation – The VMI Process



Picture 1 – VMI Process Model

During the two-years of the project, the management of specialized inventory at BBC has undergone a significant transformation. Through the use of the web portal capabilities, user improvisations have generated new processes and software modules related to Vendor Managed Inventory (VMI) (see picture 1). As a result, a metamorphosis took place where ad hoc adjustments in the form of manual inventory communication processes (e.g. fax, phone and e-mail) and IT workarounds (e.g. custom legacy system queries and spreadsheets) evolved into major organizational change for BBC and its suppliers. This metamorphosis has taken XXX through an ISE process, which resulted in the creation of the VMI system, with its associated processes and software modules. This system has been fully developed and implemented at a number of BBC suppliers, with plans for more wide-scale adoption in the near future. A new improvisation called consignment has evolved from the VMI process. The consignment improvisation has added processes and modified the functionality of the VMI system. Consignment has been developed, but not yet implemented at any suppliers of BBC.

VMI Details

VMI is a key strategic initiative at BBC that had been used on a limited basis for high-cost parts that have consistent demand. This supply chain arrangement requires suppliers to frequently monitor BBC plant inventory levels of selected materials. When inventory reaches a predetermined level, falling below a minimum quantity or "days of supply" (DOS), the supplier must re-supply them up to a maximum number of pieces or DOS. In a VMI arrangement at BBC, inventory is warehoused and owned by their suppliers until shipment is made. According to the Director of Supply Base, who is in charge of setting strategic supply chain direction, the goal is to charge suppliers with monitoring inventory levels and keeping them to a minimum. This in turn reduces inventory carrying costs significantly. It also allows BBC material buyer/planners to focus on dealing with exceptions for parts with more erratic demand. The following quote by the Director of Supply Base summarizes the importance of the VMI model at BBC:

Picture 2 – BBC Director of Supply Base

"Our goal all along has been to cut costs, but now we are looking to force suppliers to do their part to make this happen. This means a shift to the VMI model on as many parts as possible, setting good min/max levels and measuring suppliers by the level of success achieved. This is a new way of thinking for us and our supply base, but we are optimistic that we will save a lot of money in the process". (BBC Director of Supply Base R2 2003)[21]

[21] **Quote references** such as this one are structured as follows (Company Name, Participant, Data Collection Round, Year of Quote). **Field note references** are denoted as follows: (Author name/Research Site Field note data collection round, year)

In a Phase III interview with the Director of Supply Chain Systems, emphasis was placed on another key supply chain initiative at BBC, global sourcing. In order to broaden the supply base and take advantage of lower costs offered overseas, BBC has begun to establish relationships with suppliers in different parts of Asia and Europe. This introduces another level of complexity into the buying process, as most parts carry a 30-40 day lead-time for transit across the ocean. In the past, this had resulted in high levels of expediting and stockouts for BBC planners. To alleviate this problem, BBC is implementing an extension of VMI, called consignment, for all overseas suppliers. This arrangement is the same as VMI, except large quantities of the inventory are warehoused at the manufacturer instead of the supplier; even though it is owned by the supplier. As with VMI, suppliers are expected to monitor and re-supply the warehouse to min/max levels. However, the manufacturer is not billed for the materials until they are actually used; as opposed to VMI where the trigger for billing is shipment. As manufacturers can always count on in-house materials being kept at a certain level, lead-time issues are minimized. The importance of this initiative is discussed by the Director of Supply Base, who sees consignment as the key to global sourcing success:

"Currently we are dealing with the Asian market extensively, especially China. We can save 35% from costs if we just went there and built parts. But that's not practical. Instead, we ship it here and keep stock in a large warehouse. This creates lead- time issues. But, if we buy everything landed in the piece price and we also buy everything under consignment, the lead- time issues are minimized. This is a key part of our future strategy for sourcing and cost cutting, the combination of working with Asia and the consignment model". (BBC Director of Supply Base R2 2003)

Initiation of Improvisation – VMI Reporting and Query Process – IT/Process Workaround

Before the XXX implementation, VMI was being used on a limited basis, and with little success. Transmitting demand via EDI was working for "normal parts". However, VMI suppliers had an evolving requirement for more information than EDI could provide (e.g. min/max vs. current inventory levels, cumulative shipments, forecast, etc.) in order to effectively manage inventory levels. Buyer/Planners from different BBC plants had improvised a variety of processes and information technology to meet the requirements of obtaining and communicating detailed information to VMI suppliers. Some users where querying the legacy system, printing the resulting report and faxing it. Others had improvised spreadsheets and were e-mailing them, and the phone was also used extensively to deal with daily exceptions. In many cases, suppliers were keying the data into their own systems. None of these improvisations were particularly effective. According to the functional liaison, problems stemmed from inconsistent systems in place across different plants, the legacy system only providing demand updates on a weekly basis and not having an efficient means to deliver the information to the suppliers:

Picture 3 – BBC Functional Liaison

"We have a number of plants that have been attempting VMI for awhile, but it has been a messy process. People were going in different direction, which makes it tough for us to manage from here. Suppliers were getting bad information, and some had to deal with multiple plants with different processes for VMI. Since this is an important strategic process for us, we really needed to find a way to get it under control". (BBC Functional Liaison R2 2003)

Evolutionary Path

The evolutionary path of the improvisations related to VMI is traced below, as it moves through the various stages of the evolution. This improvisation transformation progressed slowly over the course of this two-year study, through all four stages of evolution. It started off as an Ad Hoc Adjustment for six months before evolving into the process embellishment stage, which formalized the VMI process for the first time and used XXX functionality for some of the requirements (e.g. data downloads). After that process stabilized, an extensive IT modification was designed to create a new XXX software module and associated processes. The new VMI module created the impetus for the large-scale change across the supply chain as new systems and processes were implemented, a consignment strategy was developed and a plan emerged for future use of the module as a Kan Ban system ("pull" system where consumption of material automatically triggers a signal to the supplier to send another shipment) using auto-e-mail alerts to transmit demand. This provides an example of how an improvisation can drive large-scale change and information systems evolution as users and designers interact to meet evolving requirements.

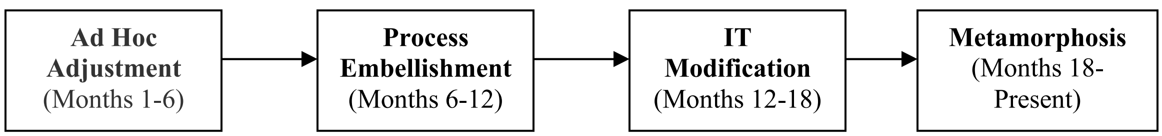


Figure 5b – BBC VMI Process Evolutionary Path

Ad Hoc Adjustment Stage (Months 1-6) – In the years leading up to the XXX implementation, users in various plants struggled to improvise VMI solutions with little success. With the XXX implementation's shift to the use of the web for supply chain collaboration came an opportunity to increase the effectiveness of this process. In the first month of Phase I, BBC buyers/planners and suppliers began to develop IT workarounds while experimenting with XXX functionality to create custom reports and views with the needed VMI data. They were using new download and filtering capabilities to take advantage of the portal's daily updates, and manipulating it with Excel and other legacy systems. These workarounds were in the Ad Hoc Adjustment stage due to their sporadic nature.

Process Embellishment Stage (Months 6-12) – Immediately after the implementation began, both the BBC project manager and the functional liaison saw an opportunity for VMI within the portal. Since it offered a consistent source of information, which was updated daily and readily available to everyone, many of the current VMI problems could be alleviated if web capabilities were used. After the initial six months of the project, the BBC team began to collaborate with designers from Express to explore possibilities to use existing XXX functionality to create a better VMI process. By the end of the eighth month, they had developed a workaround, which allowed suppliers to view and download information on their vendor-managed parts and integrate it directly into their ERP systems and spreadsheets. Over the course of the next four months, they worked to gradually refine and formalize this improvisation.

According to the functional liaison at BBC, after development of this workaround, the project team saw that XXX was a key to long-term success of the VMI process:

"We all agreed that the key to making this thing (VMI) successful was having an effective and accurate way to get information to everyone, and it had to be real-time. Before, we only had a paper report that was only updated once a week and circulated by e-mail or even in some cases fax or mail. We quickly saw the portal as a key step in that direction". (BBC Functional Liaison R1 2003)

Although XXX was not originally set up to facilitate VMI, the team found a way to meet some of the primary requirements of the VMI process through IT and process workarounds. The IT workaround first used existing XXX functionality to set up special supplier types and item identifiers to separate and readily identify VMI parts, locations and their current inventory levels. The second part of this IT workaround was to download VMI inventory data from XXX into Excel or flat file format so that suppliers could integrate it with their legacy systems and perform the remaining VMI calculations (min/max, forecast consumption and exception reports). In conjunction with this IT workaround, a process workaround was devised, which outlined a consistent procedure for obtaining VMI data, dealing with VMI issues, and suggested an initial set of performance measures. This moved the VMI improvisation to the next evolutionary stage, which was process embellishment, as the new VMI process became institutionalized into the organizational procedures. In this stage, the process was documented, support people were identified, and a set of performance measures developed.

IT Modification Stage (Months 12-18) – Immediately after the VMI IT and process workarounds were in place, BBC and Express began to collaborate on the development of modifications to the XXX software to meet VMI requirements. BBC management saw these modifications as necessary to support this strategic direction, and Express saw it as an opportunity to expand the standard functionality of XXX, reflecting "best practices" of a client. In the design of this modification, the functional liaison surveyed current processes and IT to develop a list of requirements from BBC and their supplier user base. In the process, improvisations from different plants were assessed, and best reports, queries and processes were modeled. Express also leveraged its expertise and research resources to assure a comprehensive set of modifications. At the end of this process, the decision was made to develop an entirely new software module instead of modifying existing ones. It would include an extensive list of VMI functionality including consignment (called Vendor Owned Inventory (VOI) by Express Designers). Although consignment was not to be implemented for another year, BBC and Express designers agreed that it would be prudent to include it in the initial build of the VMI Module. After three months of design, the module was piloted with three test suppliers, before it was determined that the modification was complete. By the end of month 16, the module was delivered in completed state (see Image 5a), and BBC began to plan its full-scale implementation process.

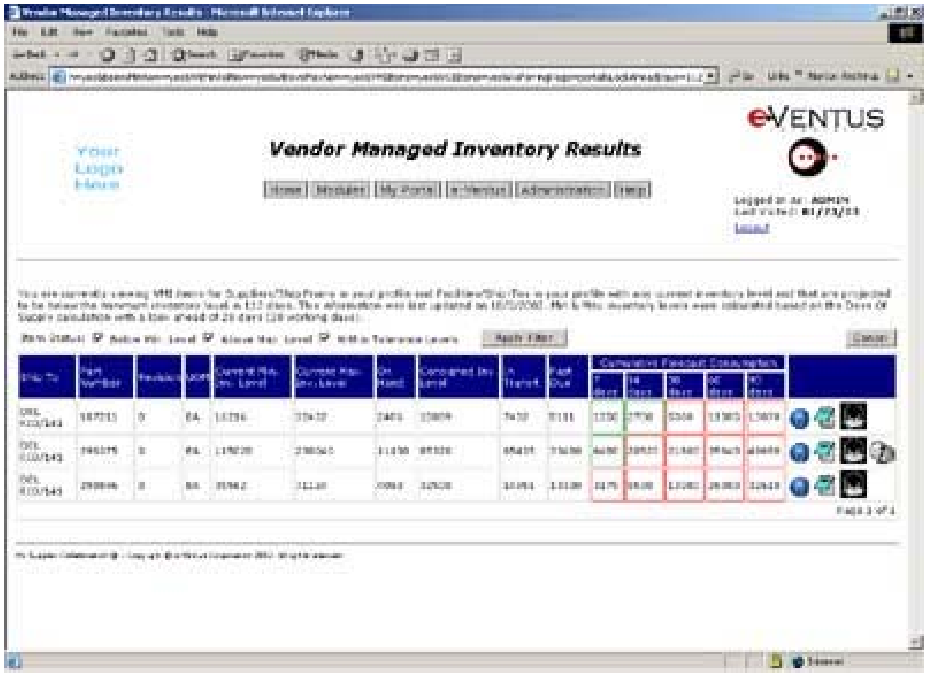


Image 5a – The New VMI Module

Metamorphosis Stage (Month 18-Present) - The implementation of the new VMI module brought widespread change to BBC and its suppliers. The software forced the design of new processes for BBC buyer/planners and their VMI suppliers, documentation of revised procedures, new training, and development of performance measures for suppliers. During my last data collection phase, the implementation was still in process, as BBC had chosen to roll out VMI to suppliers gradually (At that point, they had 11 suppliers successfully using the new process, with plans to implement 10 more in the next year). Following the VMI implementation was the Kan Ban improvisation that had recently occurred. This workaround is an extension of the VMI model, which involves the use of VMI functionality to facilitate one-for-one re-supply of specialized parts. According to the functional liaison at BBC, the Kan Ban workaround is defined as follows:

"Kan Ban is a basic pull system. When a unit of a product is used, a signal or "card" is sent to a supplier to send another unit. The unit can be cartons of material, or be one physical item. The delivery method of the "card" can be electronic (EDI/FTP), e-mail, or a physical card. The web (portal) will give suppliers access to view their inventories as well as view the forecast". (BBC Functional Liaison R3 2004)

Although this improvisation is still in the early evolutionary stage, it is expected that it will result in an embellishment of existing VMI processes and a modification of existing software, but will not evolve to the metamorphosis stage, as the primary design of VMI will not change.
The initial success of the VMI module has inspired a strategic move towards using consignment for all overseas suppliers. As a result, BBC has begun to set up an entirely new facility that will act as a consignment warehouse in the future.

Summary

The VMI process is an example of how a simple, localized improvisation can evolve into widespread change. This was certainly the case, as VMI had a significant impact within the BBC organization and across organizational boundaries. This improvisation was triggered by a set of evolving requirements, which led to the improvisation of reports and queries by buyer/planners in different plants. These tools created the initial momentum, which moved the improvisation down its evolutionary path. The outcome was the creation of an entirely new mode of operation for BBC in the form of a formalized VMI process and a new software module. This metamorphosis has opened the door to expand the benefits of VMI, with the possibility of using Kan Ban principles in the future, and has also established a foundation for consignment with overseas suppliers.

Contextual Variable Analysis

General Overview

Next, I will apply the contextual variable framework to assess the improvisational environments at BBC and AIM. As established in Chapter 3, this framework is essential in understanding the improvisational environment of studied organizations. It assists in making judgments about contextual data collected. It enabled me to analyze the impact of organizational environments, systems and users in the improvisation dynamics that were observed[22]. During the assessment process, certain contextual variables were found to have a significant impact on improvisation dynamics that occurred at BBC. The following assessment is limited to these **critical variables**.

As suggested by the Improvisation Dynamics Model, contextual variables can be divided into three sets: Manufacturer, Supplier and Organization CVs as shown in the Refined Contextual Variable Framework (see tables 5a, 5b, and 5c). Therefore, the following assessment will be divided into those three areas, and I will summarize each contextual variable area and factor. (Detailed assessments for both cases at the contextual variable level can be found in appendix 3. Individual definitions for the contextual variables can be found in appendix 2.)

[22] The individual determinations for each contextual variable were made through analysis and interpretation of interviews, field notes, user observation and other secondary data. See Chapter 4 for more details on this approach.

Refined Contextual Variable Framework

Manufacturer User CVs (Drive Improvisation Frequency and Type)

Contextual Variable Areas	Contextual Variable Factors	Contextual Variable Items	Parameters	Reference
General System	1. System Type Factor	a) Usability (1) b) Configurability (1) c) Formality (1) d) Interactivity (1)	a) Low/High b) Low/High c) Low/High d) Low/High	• Morch 1995 • Williams 1997 • Mirvis 1998 • Weick 1998
System Environment	1. New System Factor 2. Legacy System Factor	a) Reason for Implementation (1) b) Fit (1) c) Modification Policy (1) d) Release Currency (1) e) Competing Alternative Syst? (2) f) Legacy Integration w/New IS (2)	a) Users Accept/Do Not Accept b) Good/Bad c) Mods/No Mods d) Current/Not Current e) Yes/No f) Low/High	• Nambisan et al 1999 • Suchman 1983 •
Manufacturer User Type	1. User Savvy Factor 2. User Engagement Factor	a) Experience Level (New) (1) b) Tech Skills (1) c) Innovativeness (1) d) Improvisation Competence (1) e) System Enthusiasm (2) f) Level of Empowerment (2) g) Level of Use (2)	a) Low/High b) Low/High c) Low/High d) Low/High e) Low/High f) Low/High g) Low/High	• Gasser 1986 • Swanson 1978 • Cavaye 1995 • Tushman 1986 • Nambisan et al 1999
Implementation Effectiveness	1. Support Factor 2. Use Factor 3. Post Conversion Factor	a) Effectiveness of Training (1) b) Support Effectiveness (1) c) User Buy In (2) d) Actual vs. Designed Use (2) e) Missed Requirements (3) f) Number of Issues (3) g) Types of Issues (3)	a) Low/High b) Low/High c) Low/High d) Actual=Designed e) Low/High f) Low/High g) Minor Problems/Major Problems	• Swanson 1978 • Nambisan et al 1999 • Cavaye 1995

Table 5a – Manufacturer CVs

Supplier User CVs (Drive Improvisation Frequency and Type)

Contextual Variable Areas	Contextual Variable Factors	Contextual Variable Items	Parameters	Reference
Inter-organizational Environment	1. Relationship Factor 2. Supplier Factor 3. Systems Factor	a) Exchange Mode (1) b) Partnership Perception (1) c) Level of Trust (1) d) Cultural Differences (1) e) Mutual Benefit Perception (1) f) Supplier Size (2)	a) Exit/Voice b) Low/High c) Low/High Trust d) Low/High Differences e) Low/High f) Large/Small	• Helper 2002 • Williams 1997 • Bensaou 1997 • Johnston 1988 • Miner 2001 • Johnston 1988

Contextual Variable Areas	Contextual Variable Factors	Contextual Variable Items	Parameters	Reference
		g) Location (2) h) Legacy IS Integration w/IOS (3) i) Interactive Use (3)	g) Local/Regional/International h) Low/High i) Low/High	
General System	1. System Type Factor	a) Usability (1) b) Configurability (1) c) Formality (1) d) Interactivity (1)	a) Low/High b) Low/High c) Low/High d) Low/High	• Morch 1995 • Williams 1997 • Mirvis 1998 • Weick 1998
Supplier User Type	1. User Savvy Factor 2. User Engagement Factor	a) Experience Level (New) (1) b) Tech Skills (1) c) Innovativeness (1) d) Improvisation Competence (1) e) System Enthusiasm (2) f) Level of Empowerment (2) g) Level of Use (2)	a) Low/High b) Low/High c) Low/High d) Low/High e) Low/High f) Low/High g) Low/High	• Gasser 1986 • Swanson 1978 • Cavaye 1995 • Tushman 1986 • Nambisan et al 1999
Implementation Effectiveness	1. Support Factor 2. Use Factor 3. Post Conversion Factor	a) Effectiveness of Training (1) b) Support Effectiveness (1) c) User Buy In (2) d) Actual vs. Designed Use (2) e) Missed Requirements (3) f) Number of Issues (3) g) Types of Issues (3)	a) Low/High b) Low/High c) Low/High d) Actual=Designed e) Low/High f) Low/High g) Minor Problems/Major Problems	• Swanson 1978 • Nambisan et al 1999 • Cavaye 1995

Table 5b – Supplier CVs

Organizational CVs (Drive Evolution)

Contextual Variable Areas	Contextual Variable Factors	Contextual Variable Items	Parameters	Reference
Organizational Environment	1. General Organizational Factor	a) Org Size (1) b) Complexity (1) c) Change Culture (1) d) Internal Job Movement (1) e) Innovativeness (1)	a) Large/Small b) Low/High Complexity c) Adept/Averse d) Often/Not Often e) Low/High Innovativeness Level	• Van de Ven 1996 • Orlikowski 1996 • Weick 1998 • Moorman 2001 • Nambisan et al 1999
System Environment	1. New System Factor	a) Modification Policy (1) b) Future Use Plans (1)	a) Mods/No-Mods b) Low Use/High Use	• Suchman 1986

Table 5c – Organizational CVs

BBC Contextual Variable Analysis

Tables 5d, 5e and 5f below give a detailed summary of the assessment of BBC's improvisational environment for each CV factor[23]. Each factor assessment indicates whether it enables or inhibits improvisation. The assessment is backed by representative quotes from interviews with key players at BBC. Below, each critical CV assessment is explained, and an overall summary of the improvisational environment at BBC is proposed.

BBC User CV Assessment

BBC User CV Summary

I found that BBC users embraced the idea of a collaboration portal. At the same time, they have come to view it as a tool for the suppliers only. It was perceived as a substitute for phone calls, faxes and EDI, which were previously used to convey demand information. Collaborative features such as interactive messaging, promising and custom reporting were used in the early phases. Their use curtailed significantly, however, in latter phases. BBC planners reverted back to using the mainframe system for most of their functions, as they claimed that it performs better, has better analysis functionality (e.g. custom queries and reports) and offers more real-time data, because XXX is only updated daily via a batch program. Their XXX use was limited to maintaining it so that it was useful for the suppliers (e.g. data discrepancies and training/support issues) and managements' use of the supplier scorecard. This seems to position BBC users for low frequency of improvisation with XXX, as it is not their primary system. As a result, I found that they were not highly skilled at dealing with new requirements and creating workarounds.

[23] The approach for arriving at these "marks" is described in Chapter 4 on methods. A "+" means that this CV factor enables improvisation. A "-" means that it inhibits improvisation. The weighting of these marks is not equal. Therefore, within a factor, 3 CVs could be rated "-" and 1 CV rated "+", but the overall factor rating is a "+" because it has a stronger effect. These are based on my subjective interpretations that were informed by the literature review, study data, and experience accumulated through analysis in this study.

The BBC User CV assessment is summarized in table 5d as follows:

Contextual Variable Areas	Contextual Variable Factors	Overall Assessment	Illustrative Quote
General System	System Type Factor	+	"I would say it is simple for usage as far as all the information that it holds and it obtains and keeps focus on change, I would say it is not very complex. But that's a good thing because it makes it easier for us to learn and play around with.". (**Buyer Manager)** "…but like on my end when I want to look at one specific supplier, I have that option. When I run supplier reports for all of plant X, I'm able to focus just on and view the information that I've told it to look at. And so it does have a nice filtering concept to it, so I see it as very flexible with lots of options". **(Planner 2)**
System Environment	New System Factor	-	"The XXX implementation at BBC was primarily motivated by cost associated with EDI. This was not a hugely strategic move like it was at AIM, where XXX was brought in as a major part of their VC 2 initiative. Therefore, I think the motivation behind it is completely different and this has had an impact at the user level…because at AIM, they (the users) are seeing more benefit". **(Express Owner)** "…in the beginning I think it was a little lacking and as you say, I mean, we've continued to us it and give feedback. It has changed to be more of what we wanted and what we use every day, so the fit is pretty good". **(Buyer Manager)** "We've kind of just really just gotten into a "maintain" kind of phase. In fact I think Express did a version upgrade and we chose not to upgrade on that version because we wanted to just maintain what we had…" **(Project Manager)** "BBC has had a relatively limited budget in terms of a dollars focused toward enhancements. Therefore, they have not spent a lot of money in terms of enhancing the product…this has probably caused more improvisation to compensate. " **(Express Owner)**
	Legacy System Factor	-	"Basically everything I do, is on the mainframe. Unless it's like real basic tables and stuff like that. Then I pull information from the portal. But that's not very often". **(Planner 1)** "My planning processes are all based on the mainframe system. It more efficient for me and I can make my own personal queries and reports". **(Planner 2)**

Contextual Variable Areas	Contextual Variable Factors	Overall Assessment	Illustrative Quote
Manufacturer User Type	User Savvy Factor	-	"We've been using the portal for almost two years now, so I think we have gotten better at it. We have been using the mainframe longer, though so I feel more comfortable with it and that's what we focus on most". **(Planner 3)** "I'm not really sure what some of the other functions do, I just focus on a few reports that I need. I am not a huge technology person". **(Planner 4)** "I am not really sure how to work around problems a lot of the time. If I have an issue, I usually call for some help from Ralph". **(Planner 2)** "(With regards to portal use) For the most part, I just stick to what I need to do to get my job done. There might be some other creative ways, but what I have seems to be working OK". **(Planner 1)**
	User Engagement Factor	-	"I really don't make those kind of decisions (improvisations). Ralph does a great job of solving things like that". **(Planner 5)** "Put it this way. I think it's a good tool. But right now I wouldn't use it without my other tools. And I think that even our suppliers, because of the problems that we've had with them in the past, they are a little leery of going on and trusting it". **(Planner 1)**
Implementation Effectiveness	Support Factor	+	"Our support guy has been excellent all along. He has been very available and helpful. I think he deserves a lot of the credit for the success of this project". **(Planner 2)**
	Use Factor	-	"I see the portal as more of a tool for the suppliers to see information that we see, but I don't use it unless there is a problem with the supplier. I don't see the point". **(Planner 3)**
	Post Conversion Factor	-	"I mean really I would say the feedback's and issues have kind of died down because now I think People just look at it as this is just the way you do business now. " **(Project Manager)** "Most of the support calls I am getting are pretty minor and they are pretty few and far between now. I think things are stabilizing". **(Functional Liaison)**

Table 5d – BBC User CV Assessment

BBC User CVs

General System Area

System Type Factor

Overall, the XXX system was assessed as enabling improvisation. It was described by the users to have the following factors which do so: 1) **High level of configurability (+),** which gives the users the ability to tailor the IT to generate new solutions during use. Examples cited by BBC users were ability to create custom reports and views of data, customized messaging functions and e-mail alerts for themselves and suppliers. 2) **High level of interactivity** (+), which gives users the ability to collaborate during the improvisation process. The ability to interact is cited throughout the literature as a key to effective improvisation (1990; Mirvis 1998; Weick 1998). Interactivity was also indicated by users as a key difference from the previously used IOS; an EDI system. Users emphasized the fact that EDI was "strictly one-way", so the ability to carry on dialogue with users at the other end was not present. As a key user put it:

"We could never deal directly with each other when there were problems with EDI, so it was tough to work together to solve them. With the portal, if I have an issue, I can attach a message directly to the problem area and we can work together to figure it out". (BBC Planner 2 R1 2003)

In the BBC case, this led to a number of improvised solutions such as e-mail alerts when messages were submitted and the last order change date improvisation. 3) **Low level of formality (+)**, which created a user friendly, non-threatening environment. Users commented often on how much "friendlier" this tool was than EDI. They felt much more comfortable working with it, and therefore were more prone to experiment with its functionality, as summed up by one planner:

"I never touched EDI. It was just too technical for me. If there was any type of problem at all, I would let IT handle it. I am a lot more comfortable with the portal. I don't see it changing the world, but I do see some tools in it that I can experiment with to make things better for the suppliers". (BBC Planner 3 R2 2003)

All three of these contextual variable assessments indicate that the configurable, interactive and informal nature of the portal foster improvisation at BBC.

System Environment Area

New System Factor

Reason for Implementation (-) - In the case of BBC, the implementation was motivated almost entirely by the desire to cut costs (this implementation would result in a savings of over $200,000 a year in outbound EDI costs). The value proposition was primarily made to management, and as a result, I found that the benefits to users were not readily apparent. Planners at BBC consistently commented in a fashion similar to the following quote, where they stated that they understood why the implementation took place, but that they were not the beneficiaries:

"I do see why they did it, but I don't see the benefit for us (planners). I tried the portal for awhile, but I think what I had before works better for a lot of things". (BBC Planner 4 R1 2003)

My interviews and observations led me to the conclusion that the lack of strategic benefit to the primary users led to a lack of engagement and ownership, and therefore to a lower level of improvisation (McGann/BBC FN #2, 2003 #2).

Modification Policy (+) - Due to the fact that in Phases I, II and part of III, XXX was designed by BBC designers in partnership with Express, the functional liaison called it "nearly a perfect fit" in these phases of the project. Therefore, the need to improvise was low. If they had a new requirement that surfaced, instead of having to develop a workaround, I discovered that improvisation could be bypassed and they could go directly to a modification (provided the modification could take place quickly enough to meet the new requirement). Most requirements were designed directly into the initial releases of the software. However, Express only agreed to build the software with BBC for the first 18 months. After that, as new requirements surfaced, users were forced to improvise solutions or the company would have to pay for a software change (this could explain the increase in improvisations in Phases III and IV). In fact, when modifications to the software were no longer "free of charge", BBC project management adopted a strict “no modification policy”. Therefore, users had to improvise more in order to meet evolving requirements, instead of expecting modifications to meet them.

Release Currency (-) -Because the most current version of the system was not installed (BBC chose not to upgrade to new releases that came out in Phases III and IV), users were unable to take advantage of new functionality (such as more configurable views, custom reports, and the receiving module), which would have provided them with increased opportunities to improvise. In this case, I am speaking specifically about the configurable improvisation type, which is dependent upon software functionality (more configurable features correlates with more configurable improvisation opportunities). This explains the decrease (Phase III) and eventual elimination of configurable improvisations (Phase IV), as users had exhausted them in earlier phases.

Alternative System Factor

Competing Alternative System? (-) – Due to the fact that BBC is using their legacy system extensively for all business transactions, it is still the primary system for plant users. Also, a number of suppliers are still running other systems in parallel with XXX (e.g. EDI and spreadsheet based planning systems). Therefore, I found that in these situations improvisation frequency decreased, as the users did not focus on the portal system (McGann/BBC FN #3, 2004 #3). As one BBC user explains, alternative system use has detracted from improvising with XXX:

“I understand what you mean by improvisation, and I do some creative stuff like that, especially with reports and queries and stuff. But, the portal just doesn’t do it as well as the mainframe. I tried it for awhile, and it just wasn’t a better way to go”. (BBC Planner 2 R1 2003)

Legacy Integration w/New IS (-) – During the course of this study, I found that one of the primary drivers for improvisation was the need to integrate XXX with other systems (e.g. suppliers downloading data into spreadsheet systems and MS Access databases) (McGann/BBC

FN #2, 2003 #2). Unlike its suppliers, BBC had achieved a high level of legacy system integration with XXX. They had a custom interface that updated the portal database each night with new data from the mainframe. This seamless integration had made the area “invisible to us” as an IT manager put it. Therefore, it was unnecessary for them to create workarounds to integrate, thus decreasing the overall level of improvisation at BBC.

User Type Area

User Savvy Factor

Experience Level (New System) (+) – My data showed that savvy users (especially those that had worked with portals before) had a deeper appreciation for systems, and therefore a more positive attitude which promoted improvisation (McGann/BBC FN #2, 2003 #2). Although BBC users had no previous portal experience, I did see improvements in their skill level and competence over the two years of this study. This competence has promoted quality improvisations when needed, as most key users had improvised to some degree by the end of the study (McGann/BBC FN #3, 2004 #3). This increase in experience could explain the shift in the improvisation that took place during final project phases from functional liaison to the users.

Technical Skills (-) – Management and consultants I interviewed stated consistently that relative to other user communities like AIM, BBC users are not technically savvy. Reasons given were primarily that they have not been trained in general IS knowledge, as most of them come from non-technical backgrounds. Many had moved up from non-technical jobs on the manufacturing floor. My observations confirmed this. I found that they knew the mechanics of how to use the portal and other systems, but lacked an understanding of why things worked the way they did (McGann/BBC FN #1, 2003 #1). This lack of fundamental understanding of the system is analogous to the jazz analogy discussed previously. It compares to a jazz musician that knows the mechanics of making music, but has not internalized the spirit of the genre. She therefore has little ability to improvise (Berliner 1994). In the same way, this lack of fundamental IS knowledge detracts from BBC user's ability to improvise.

Innovativeness (-) –It was my observation that although users were creative and innovative, it was not an organizational priority. The lack of "creative spirit" felt by the users combined with the tendency towards maintaining the status quo by managers was evidence of this fact. Although managers claimed that users were empowered to improvise, I found that they did not feel this way. In fact, what I observed was an atmosphere of blind acceptance and the lack of initiative at the user level. A planner expressed this as follows:

"I just do what I need to do to get by with the system. I don't particularly like it all the time, and there are some things I would change, but that's not my place. I think management wants to help, but they also like to keep things the way they are most of the time. If I have issues, I call Ralph (functional liaison) . He usually takes care of it". (BBC Planner 2 R3 2004)

When asked if they thought the culture encouraged innovation, user responses were definitely not favorable. Most replied that deviating from the norm was discouraged (e.g. creating new reports or making suggestions for streamlining processes). An example of this came in a conversation with a power user, who had a reputation for being very creative and who coined the term "MacGyver" (his terminology for an improvisation). When I interviewed him, I found that he was a perfect example of someone who had great potential to improvise. Further, his improvisations had the potential to improve their system use, if adopted. He cited a number of key reports that he had created on his own and processes such as his "raw material reporting process" that gave suppliers more comprehensive information more often than the normal weekly update. However, cultural limitations kept his improvisations localized and therefore these innovations did not diffuse. His assessment of the situation is as follows"

"Yeah, I have been doing this for awhile, and I have a bunch of MacGyvers that I have invented over the years. But I gave up trying to get them accepted by the company awhile ago. They (management) just don't want to hear about it most of the time". (BBC Planner 5 R1 2003)

Improvisation Competence (-) - Overall, I did not find that there is an innovative mindset at BBC, especially at the user level. Developing ad hoc solutions was foreign to most of them. From the beginning, I had great difficulty getting them to understand what improvisation was, and the role of creativity and innovation in the continuous improvement of an organization. Users had great difficulty answering questions like: “What do you do when you get into a situation where the system won’t do something you need it to do?” and “What creative solutions have you come up with in using the new system?” Past research shows that an organizational culture that promotes improvisation is one of relaxed boundaries, creativity and empowerment (Tushman 1986; Hage 1999). My analysis shows that these were not salient characteristics of BBC.

User Engagement Factor

System Enthusiasm (-) – A key conclusion arrived at during the study was that enthusiasm for systems motivates users to improve it and innovate to make the most of its functionality. I found that this enthusiasm was correlated with improvisation; hence, the users that improvised most were those that were enthusiastic about the system (McGann/AIM Part Obs 2004). At BBC it was obvious that planners did not possess a high level of enthusiasm. For reasons cited earlier (e.g. lack of benefit to them and perception that the legacy system was better) they did not have the desire to make things better. They were satisfied with the status quo, and therefore improvised less (McGann/BBC FN #3, 2004 #3). This lack of enthusiasm has started to affect suppliers as well, as indicated by this quote:

“I send messages, and most of the time they don’t respond. If I have data issues or I can’t meet a date, I need to be able to depend on them to respond. I am not sure they see it as an important tool like I do”. (BBC Supplier 3 R3 2004)

Level of Use (-) – Looking at the data across all phases of this study, there was a definite downward trend in XXX use. Users indicated this was due to the reasons cited above (e.g. their perception that the legacy system was better), which have caused BBC planners to revert back to their legacy system. This causes support for the portal to decrease (planners are now in charge of supporting suppliers in portal use). I predict this will eventually result in a decrease in use by suppliers. The conclusion I am drawing is that less use of the system means less improvisation (McGann/BBC FN #3, 2004 #3). This position is supported by this quote from a BBC planner:

"I just don't use it as much anymore. Earlier, I was using it everyday, and also using a lot of the features and options to do different stuff. Now, I just use the mainframe and do my creative stuff over there". (BBC Planner 2 R3 2004)

Implementation Effectiveness Area

Support Factor

Effectiveness of Training (+) – Most BBC and supplier users commented on the effectiveness of training for this implementation. I attended a number of training sessions, and was impressed with the quality of presentation and the innovative means with which it was delivered (e.g. using an interactive online approach for geographically disbursed users). A number of comments such as the following by a BBC planner were recorded:

"Ralph really did a great job of getting me comfortable with the system and then following up with me to answer questions I had afterwards. I am not very technical, but he made it really easy for me". (BBC Planner 3 R2 2003)

I found that the training, which included some sections that showed users various improvisational tools (e.g. creating custom reports and views) established the necessary baseline skill level to allow users to improvise (McGann/BBC FN #3, 2004 #3).

Support Effectiveness (+) – All users were also complimentary of the ongoing support provided by the functional liaison in addressing issues and creating workarounds. Many comments paid tribute to the IS department for prompt resolution of data issues, as well as an effective design by the implementation team. The impact that this had on improvisation was illustrated by this quote from a key BBC user during Phase II:

"I was really worried about doing anything other then the bare minimum at first. I wasn't sure if I was going to break something if I tried to improvise, as you call it. But the support has been great, I have asked a lot of questions and so I've gotten a lot more comfortable with trying new things. I actually figured out three new reports that my suppliers can use this past week". (BBC Planner 1 R3 2004)

Use Factors

User Buy-In (-) – As a whole, user buy in was high in the beginning, but had diminished in the latter phases. The general perception was that the portal created more work for BBC planners. This was due to the fact that the supplier's information was updated daily, so they had to deal with exceptions/issues more often than before, when suppliers only received updated information weekly. As one BBC planner states:

"They have more information more often, so they want more answers. This is making more work for me. I am not sure if that is beneficial or not". (BBC Planner 2 R3 2004)

Actual vs. Designed Use (-) – My overall observation was that there was a trend away from using the XXX system for its designed purpose of interactive sharing of supply and demand information. One key issue is that planners took advantage of the frequently updated supplier information by "dropping orders in" at the last minute, often inside the lead-time window. This created more work for the suppliers as they had to deal with these late orders by expediting more. It was also causing "finger pointing" among BBC and its suppliers, as planners claimed that the orders had been there all along, and suppliers disagreed. An attempt was made to solve this problem through a modification that showed when orders were created, but they were still being dropped in. Another key problem was the lack of messaging. The portal was designed to create an interactive environment, and integrated messaging was a key tool to facilitate it. However, messaging use was very low. Both of these factors caused lower improvisation levels for both BBC and its supplier's users, as critical functionality was either not used or was used improperly.

Post Conversion Factors

Number of Issues (-) – As a result of the comprehensive requirements definition, strong training and system support, the number of support issues has declined steadily over the past two years. This study has shown that support issues often create a need to improvise, thus there is a positive correlation between fewer support issues and less improvisation (McGann/AIM SD 2004).

Types of Issues (-) – Interviews with the functional liaison and other system support data collected showed that major system issues (e.g. critical system failure, software malfunctions in key transaction areas) are linked to the level of improvisation (McGann/AIM SD 2004; McGann/BBC SD 2004). At BBC, there had been few major issues during Phases III and IV. This caused less need to improvise. The following excerpt from my final interview with the functional liaison supports this assertion:

"Yeah, issues are way down. I used to get as many as 30 calls a day and that was all I did was support stuff, fix things and develop workarounds. Now I get only a couple, and some days I don't get any, and now its mostly minor stuff like passwords. I think all the work we did on design and training is paying off. We are also handing off most of the support to the planners now. They are dealing with supplier portal issues. I haven't had to create a workaround in awhile. The VMI, consignment and Kan Ban stuff is pretty much the new focus, I think. We'll see how that goes". (BBC Functional Liaison R3 2004)

BBC Supplier CV Assessment

BBC Supplier CV Summary

BBC Suppliers' performance was quite impressive throughout the study. Although they faced challenges due to lack of experience and technical skills, they all seemed to find a way to contribute to the success of the system. I found that suppliers were improvising more frequently as the study progressed, as their skill level increased and as they realized benefits such as increased efficiency in communication and saved time. I also observed that they perceived XXX as primarily for their use, which increased ownership and improvisation levels (McGann/BBC FN #3, 2004 #3).

The BBC Supplier CV assessment is summarized in table 5e as follows:

Contextual Variable Areas	Contextual Variable Factors	Overall Assessment	Illustrative Quote
Inter-organizational Environment	Relationship Factor	+	"BBC relative to other US firms I think has a very high loyalty to its supply base, So they don't have a tremendous amount of supplier turnover". **(Express Owner)** "No, I don't necessarily agree with everything they do, and this implementation has been a little tough for us, but they are our biggest customer and at the end of the day, what they say goes, especially for major decisions like this. Yes, I would say they are a dictator in that regard". **(Supplier 3)** "We've been doing business with BB C for a long time, and they've always taken really good care of us. I imagine we'll be with them for many years to come". **(Supplier 4)**
	Supplier Factor	+	"We have a mix of local, regional, and international suppliers, which makes our supply process a bit complex. As a result, we run into some pretty interesting situations and have had to get pretty creative to get things done". **(Materials Manager)** "Some of our suppliers are pretty large, and then we have smaller ones that pretty much just supply us. One guy had to buy a PC just to be able to use the portal". **(Planner 2)** "BBC has distributed supply operations. They also have international operations. They're doing procurement, for example, in Mexico. So because you're dealing with multiple distributed operations, things are more complex". **(Express Owner)**

Contextual Variable Areas	Contextual Variable Factors	Overall Assessment	Illustrative Quote
	Systems Factor	+	“We’re still using a combination of the portal and our old way to get things sorted out” **(Supplier1)** “I’d say it’s (Mx) made (relationships with suppliers) better, because you don’t have to make as many phone calls, but it is kind of a pain because we haven’t got it connected directly to our system. I’ve had a lot of trouble getting the info I need the way I need it because we aren’t integrated, so we’ve had to figure out some different ways to get it. Is that what you man by improvisation?” **(Supplier3)**
General System	System Type Factor	+	“I do like the interactive environment that it provides. I don’t have to spend as much time on the phone trying to get answers. I can usually find them on the portal. It’s a lot less formal and a lot more flexible than EDI was. I actually enjoy using it most of the time”. **(Supplier 4)**
User Type	User Savvy Factor	-	“…we’re new at this portal thing, so we just bought a PC, a backup power supply, and a nice printer to go along with it. And let’s see, we went with a networking box, a router. So, I have just got the bare essentials right now”. **(Supplier 2)**
	User Engagement Factor	+	“I’ve really worked on learning this system a lot. It’s become a really important tool to me, and it’s starting to pay off”. **(Supplier 3)** “This has been tough for us to adjust to, but we’re staying positive and it has gotten a lot better. I like the improvements that this system had brought us, so we are all for it”. **(Supplier 2)**
Implementation Effectiveness	Support Factor	+	“I mean the good news, I think, I don’t have the most recent numbers but we’re down to maybe the last 5 maybe 5 or 7 suppliers out of 219 that aren’t using the site, so I would say that’s a successful implementation”. **(Project Manager)** “BBC has been great about supporting us all along. They gave us some good online training, but really the best part has been Ralph. He answers questions quickly and really knows his stuff”. **(Supplier 2)**
	Use Factor	+	“I use it everyday to me started. I have really grown to depend on it and think its helping us out a lot”. **(Supplier 5)**
	Post Conversion Factor	-	“I mean really I would say the feedback’s and issues have kind of died down because now I think People just look at it as this is just the way you do business now. ” **(Project Manager)** “Most of the support calls I am getting are pretty minor and they are pretty few and far between now. I think things are stabilizing”. **(Functional Liaison)**

Table 5e – BBC Supplier CV Assessment

BBC Supplier User CVs

Inter-Organizational Environment Area

Relationship Factor

Exchange Mode (+) - Overall, BBC's relationships with suppliers fostered improvisation due the positive nature of their interaction. Most of the suppliers interviewed had been working with BBC for over 10 years. They all felt that BBC treated them well, encouraged communication on key issues and overall were happy with the relationship. Therefore, I determined that BBC has "voice mode" relationships with its suppliers, which encourages open dialogue and long-term relationships (Helper 2002). **Level of Trust (+) -** Further, all supplier respondents commented on the high level of trust they felt between organizations (McGann/BBC FN #2, 2003 #2). **Cultural Differences (+) -** Finally, as most of BBC's suppliers are of a similar corporate culture (i.e. US/Midwest Automotive Industry), they are able to relate well, which is another key to mutual improvisation in an IOS environment. Prior research supports my assertion that this positive interaction, high level of trust, and similar mindset promotes improvisation (Weick 1998; Kamoche 2001; Miner 2001).

Partnership Perception (-) - Although most suppliers had a positive perception of the BBC relationship, when asked whether they see BBC as a partner or a dictator, most responded with the latter. The common reason cited for this was that they don't feel they have a choice when it comes to significant decisions such as the portal implementation. They see it as a mandate. For many suppliers, BBC is their primary source of revenue, so they don't feel as though they are in a position to question their decisions, as evidenced by this supplier:

"No, I don't necessarily agree with everything they do, and this implementation has been a little tough for us, but they are our biggest customer and at the end of the day, what they say goes, especially for major decisions like this. Yes, I would say they are a dictator in that regard". (BBC Supplier 3 R2 2003)

My assessment is that this lack of openness to each others mindset, which is cited as a key to creating an improvisational environment (Weick 1998), could inhibit certain types of improvisation.

Supplier Factor

Location (+) - The only critical variable found in the BBC supplier factors was location. As many of their suppliers are located long distances from the plants they supply, there are many unique logistical challenges. As a result, they have had to improvise a number of solutions to meet these requirements (e.g. the use of the VMI module for Kan Ban described earlier). This is especially true as they move towards higher utilization of overseas suppliers. As a result, BBC materials travel through more in-transit facilities, which decreases visibility of shipments though normal portal functionality. For example, one supplier had been forced to improvise a system of reports, using portal download capabilities to feed them, which enabled tracking of materials through intermediate stops in route to BBC:

"I download the consignment inventory, ah, through the vendor managed inventory part of the portal. And then I also do, we have two p.o. s that are not consignment, and so I also download that information. I put it all into this report system that I created so that I can see what is going where. Without this, I would be flying blind". (BBC Supplier 5 R2 2003)

Systems Factor

Legacy IS Integration with IOS (+) - The first critical IOS variable was legacy system integration with XXX. None of the suppliers interviewed had achieved direct integration (using what was referred to by the IT staff as a "seamless data interface") of their legacy systems with the portal. They had all improvised different workarounds to get the portal data into their systems. Some were using the portal's data download capabilities to create Excel spreadsheets or XML documents, which were then mapped to legacy systems, and imported using custom programs. Others were printing out reports and manually keying data into their systems, while others performed double entry by keying transactions directly into the portal, and keying them again in their legacy systems. In this case, I found that the lack of direct integration forced an increase in improvisation by suppliers through creation of workarounds to achieve what they called “indirect integration”.

Interactive Use (+) – As BBC suppliers garnered experience with the system, they began to use interactive features to communicate and resolve issues to improvise. My observation was that as their use of its interactive features increased, so did their ability to improvise. On a number of occasions these features were used to collaborate with BBC planners to create workarounds.

General System Area

System Type Factor

Overall, the XXX system in the context of BBC suppliers was the same as BBC plant users. It was assessed as enabling improvisation. It was described by the users to have the following factors which promoted improvisation: 1) **High level of configurability (+),** which gives users the ability to tailor the IT to improvise solutions during use to meet evolving requirements. Examples cited by BBC users were ability to create custom reports and views of data, customized messaging functions and e-mail alerts for themselves and suppliers. 2) **High level of interactivity** (+), which gives users the ability to collaborate during the improvisation process as shown in the example below from a BBC supplier:

“I really like being able to have messages automatically sent of there are problems. It has saved me time when dealing with problems with purchase orders, especially when they drop orders in on me”. (BBC Supplier 3 R2 2003)

3) **Low level of formality (+)**, which creates a user friendly, non-threatening environment. Users commented often on how much friendlier this tool was than EDI. They felt more comfortable working with it, and therefore were prone to experiment with the functionality, as summed up by this supplier:

"They sent us EDI, but all we did was print it out, and half time it was tough to make sense of with all the numbers and stuff. It really was very formal. This is just a better way to communicate". (BBC Supplier 2 R2 2003)

All these contextual variable assessments indicate that the configurable, interactive and informal nature of the portal enabled improvisation at BBC.

Supplier User Type Area

User Savvy Factor

Experience Level/Competence (New System) (-) – My data showed that users who had worked with portals before, had a deeper appreciation for systems, and therefore a more positive attitude which caused them to improvise more (McGann/BBC FN #2, 2003 #2). As with BBC users, suppliers had no previous portal experience. However, I also saw significant improvements in the skill level and competence of supplier users as the study progressed. I did find one supplier who was familiar with the portal model, and had used one with another customer. I found that she was also the one who improvised the most. As early as project Phase I, she had created a number of custom reports with portal data in Excel, which were modeled by other suppliers, and by the end of Phase III she had improvised an in-transit process using VMI functionality. This indicates a connection between portal experience and improvisation. It could also explain the increase in improvisation by suppliers in the latter phases of the study.

Tech Skills (-) – Aside from one supplier user, none had much previous experience with information systems. Most had limited experience with smaller systems to carry out business transactions. All stated that they were not comfortable with technology. I found this made them less apt to experiment, while they were focused on learning the basics. The quote below offers an accurate representation of the suppliers' technical situation:

"This is really the first system like this that I have used. Before this, I had never even been on the Internet". (BBC Supplier 2 R1 2003)

Improvisation Competence (-) – Similar to BBC users, I did not find that suppliers had an improvisational mindset. Having done only limited systems work prior to this implementation, only one had an idea of what I was talking about when I mentioned workarounds. This made posing improvisation questions to supplier users even more challenging.

User Engagement Factor

System Enthusiasm (+) – Although supplier users were lacking in technical skills, their enthusiasm helped them overcome this handicap. All suppliers interviewed showed a great deal of enthusiasm towards this implementation, and wanted to do their part to make it successful as shown by this supplier:

"This has been tough for us to adjust to, but we're staying positive and it has gotten a lot better. I like the improvements that this system had brought us, so we are all for it". (BBC Supplier 2 R3 2004)

This level of zeal helped them to achieve long-term success. This caused their level of improvisation to increase over time as they overcame technical barriers.

Level of Use (+) – The level of use by suppliers was high throughout the implementation. All of them commented that they were using the portal on a daily basis and had developed a routine around it, as one supplier explains:

"I've really worked on learning this system a lot. It's become a really important tool to me, and it's starting to pay off". (BBC Supplier 4 R3 2004)

Implementation Effectiveness Area

Support Factor

Effectiveness of Training (+) – As with BBC users, supplier users commented on the effectiveness of training for this implementation. The use of an interactive online approach for geographically disbursed supplier users was particularly effective as was confirmed by these suppliers:

"BBC has been great about supporting us all along. They gave us some good online training…" (BBC Supplier 2 R2 2003)

"The training really helped me a lot. It only took a couple of hours and I felt pretty comfortable after that". (BBC Supplier 1 R2 2003)

Support Effectiveness (+) – All supplier users recognized the importance of ongoing support provided by the functional liaison in addressing unresolved issues and creating workarounds in the initial three phases. Many of their comments paid tribute to the IS department for prompt resolution of data issues, as well as effective designs by the implementation team. This is summarized succinctly by a key supplier user:

"…but really the best part has been Ralph. He answers questions quickly and really knows his stuff". (BBC Supplier 2 R2 2003)

Use Factor

User Buy In (+) – Another component of the positive attitude exhibited by the suppliers in this study was their high level of buy-in and resulting support of the project. This dynamic caused suppliers to see the benefits, as exhibited by this supplier:

"I use it everyday to get me started. I have really grown to depend on it and think its helping us out a lot". (BBC Supplier 5 R3 2004)

However, since the planners are using their old system more and supporting the portal less, supplier user buy-in is beginning to drop. Suppliers claim that the planners don't know enough about the portal and have trouble answering questions. Therefore, overall buy-in is down.

Suppliers are the key drivers of system evolution in the future, because the system is positioned primarily as a supplier system. My prediction therefore is that the lack of buy in from BBC users will cause frequency of improvisation in all user groups to diminish in the future.

Actual vs. Designed Use (+) – Suppliers have made a sincere effort to use the system as designed for interactive sharing of supply and demand information. So for this study, this CV is rated as an enabler for suppliers. However, my overall observation is that there is a trend away from use of the XXX system for its designed purpose. The two issues cited in the manufacturer user section (i.e. dropping orders in and lack of messaging use) are the key problems. My data shows that in Phase IV, less than 5% of suppliers received messages or used a messaging function to communicate. I find that this is largely due to the fact that the BBC planners do not use the portal as their primary tool. They therefore do not send or respond to messages. A supplier expressed frustration over this in the following quote:

"In the beginning I sent a lot of messages, and got some responses. Now, it seems like they don't even look at them. I hardly use it (messaging) at all anymore. It's kind of a shame, because I thought it was a great idea". (BBC Supplier 4 R3 2004)

It is my contention that these problems between BBC and its suppliers inhibit future IOS improvisation, due to the lower level of collaboration and cooperation that is taking place (which was a key part of the design). Both of these are cited in the literature as keys to inter-organizational systems improvisation (Bensaou 1997; Weick 1998).

Post Conversion Factor

Number of Issues (-) – The explanation above given for issues in the BBC user section also rings true for supplier users. The number of issues from all users declined steadily over time.

Types of Issues (-) – The issues explanation above in the BBC user section is also true for supplier users. Major issues such as system failure, which threatened the success of the implementation or caused significant system downtime, declined steadily over time. This in turn promoted improvisation, as the system was nearly always available and functioning properly.

BBC Organizational CV Assessment

BBC Organizational CV Summary

The organizational CV analysis shows that the information systems environment at BBC is not highly integrated, as they still maintain a large number of disparate systems. The primary systems run on old mainframe technology. Therefore the organization does not have a cutting edge mindset when it comes to IT strategy. The combination of non-progressive organizational and technical mindset and antiquated technology does not promote improvisation (Orlikowski 1996; Weick 1998). Having been through many system conversions, the users at BBC have become savvy at adapting in the face of IS change. My research shows that they are adept at bricolage, or making due with what they have through improvisation. However, the goal of their improvisation seems to be maintaining the status quo, instead of venturing outside the box to promote better processes and systems (McGann/BBC FN #2, 2003 #2).

The Organizational CV assessment at BBC is summarized in Table 5f below:

Contextual Variable Area	Contextual Variable Factors	Overall Assessment	Illustrative Quote
Organizational Environment	General Organizational Factors	+	"Overall, I think the organization has worked well with us to try to get the changes we wanted because we are the people using them everyday". **(Buyer Manager)** "BBC has also been through many organizational changes and because of that, they've had a lot of different changes in their parent and parent's philosophy, which makes them more adept at embracing change". **(Express Owner)** "At BBC, approval and key decisions were limited to a small evaluation team, which limits the complexity of the approval process for design decisions and modifications". **(Express Owner)** "No, I'd say it (encouraging creativity) was pretty bad…for example, I'm a "X database" wiz and whenever I create something on it, everyone gets all upset". **(Functional Liaison)**
System Environment	New System Factors	-	"Currently, we're not interested in any more major modifications. We are considering minor enhancements. Where it's kind of like know what, if you just added this one additional piece of information. But even that isn't happening much". **(Project Manager)** "…in the beginning I think it was a little lacking and as you say, I mean, we've continued to us it and give feedback. It has changed to be more of what we wanted and what we use every day, so the fit is pretty good". **(Buyer Manager)** "We don't necessarily want to do anything major as far as trying to mess with our own internal systems like the portal right now…a lot of it is due to the potential SAP implementation. That has put a lot of things with the portal on hold". **(Functional Liaison)** "We've kind of just really just gotten into a "maintain" kind of phase. In fact I think Express did a version upgrade and we chose not to upgrade on that version because we wanted to just maintain what we had…" **(Project Manager)** "BBC has had a relatively limited budget in terms of a budget focused toward enhancements. Therefore, they have not spent a lot of money in terms of enhancing the product". **(Express Owner)**

Table 5f – BBC Organizational CV Assessment

BBC Organizational CVs

Organizational Environment Area

General Organizational Factor

Complexity (+) - According to the Express Owner and the BBC Project Manager, a key enabler of the XXX project improvisation evolution that they observed was the lack of complexity and bureaucracy:

"…I think the US firms like BBC typically move faster, and they also require approval (for modifications and design changes) from lower levels of the organization. This speeds up the improvisation process". (Express Owner R2 2003)

My observation was that employees were empowered at the manager level to make key decisions about systems design and implementation. There had also been a shift by management towards empowering users to make more design decisions. Director level personnel and above take a more hands off approach to systems, only participating in the initial strategic decisions, while having limited involvement in the implementation. Therefore system design decisions with regards to processes, configuration and modifications are all made quickly. The BBC project manager explains the effect of this organizational structure:

"For the most part, I make all the key implementation decisions, so things move quickly. We've had some things like modifications in the early stages that were turned around in a matter of days, which really kept the evolution of the software moving. Users are getting a lot more involved in this process too. There really isn't much bureaucracy that way". (BBC Project Manager R2 2003)

Interviews with key users confirm this, as they commented on the fact that their input was always taken into consideration, and acted upon quickly by the functional liaison and project manager:

"Overall, I think the organization has worked well with us to try to get the changes we wanted because we are the people using them everyday". (BBC Buyer/Supervisor R2 2003)

Change Culture (+) - The other key enabler of improvisation evolution was BBC's experience with change and adaptation. Their past record of organizational transition and the resulting successful systems integrations show that they have a culture that is capable of managing and adapting to change. This "spirit of flexibility" was cited by the functional liaison as one of the key reasons they have been able to survive so many implementations and also a key reason why he thought the potential was there for improvisation and evolution:

> ***"****These guys have been through a lot of these types of implementations in the past, so they can be pretty creative. There are a couple of users, Jim and Peggy that do these things called "MacGyvers" with the mainframe system. You should definitely talk to them".* (BBC Functional Liaison R1 2003)

Innovativeness (-) - Although some general organizational characteristics were present at BBC which seemed to promote improvisation, I found that this was negated in part by the lack of a culture of innovation, which is necessary to promote improvisation (Orlikowski 1996). In a number of cases, I discovered that not only were users not encouraged to innovate in situations where the need arose, they were often discouraged, for fear that it might "rock the boat" as one user put it (McGann/BBC FN #1, 2003 #1). My experience in this study showed me that improvisations are driven by the innovativeness of individual users, but the user's mindset is driven by a culture of innovation within the organization.

System Environment Area

New System Factor

Modification Policy (+) - Due to the fact that in Phases I, II and part of III XXX was designed by BBC designers in close partnership with Express, the functional liaison called it "nearly a perfect fit" in these phases of the project. Therefore, the need to improvise was low. When a new requirement surfaced, instead of developing a workaround, I discovered that improvisation could be bypassed altogether and the organization could go directly to modification; provided the modification could take place quickly enough to meet the new requirement. Most requirements were designed directly into the initial releases of the software. However, Express only agreed to build the software for BBC for the 18 months. After that, when new requirements surfaced, users were forced to improvise solutions. This could explain the increase in improvisations in Phases

III and IV. When modifications were no longer free, BBC project management adopted a strict no modification policy, and users had to improvise more in order to meet evolving requirements,. Due to this policy, however, improvisations did not evolve into IT modifications. They either remained as Ad Hoc Adjustments, or evolved into process embellishments.

Future Use Plans (-) – During the course of this study, BBC became less focused on building and maintaining XXX. This was primarily caused by the uncertainty surrounding the upcoming SAP ERP implementation. If they chose this system, there was a threat that it would replace XXX. By Phase IV, management had put a freeze on any further investment of time or resources in upgrading, or modifying XXX, pending this decision. This essentially halted most of the evolution that took place. This is summed up by the supply chain project manager as follows:

"We've kind of just really just gotten into a "maintain" kind of phase. In fact I think Express did a version upgrade and we chose not to upgrade on that version because we wanted to just maintain what we had…" (BBC Project Manager R2 2003)

BBC Improvisational Environment Summary

Based on the above analysis, my conclusion is that BBC's environment is one that does not strongly promote improvisation. Key factors that enable improvisation in the use of XXX are as follows: 1) They have excellent relationships with their suppliers, who have unique requirements for critical parts coming from geographically dispersed locations 2) The portal system is designed to promote improvisation through flexibility and configurability 3) Users are experienced (due to two years of use) and have been trained/supported effectively.

However, this study indicates that the factors inhibiting improvisation are significantly more prevalent. They are as follows: 1) the general organizational structure could promote improvisation, but the culture does not. Innovation and creativity are not encouraged and in many cases I saw evidence that users felt it was discouraged, 2) Planners are not leading by example for the suppliers. They do not use the portal for demand planning, do not use it to interact and their support of it is ineffective. This is affecting supplier use and enthusiasm. 3) Users are not familiar with the concept of improvisation/workarounds, and do not feel empowered to create them 4) The system was designed and implemented well enough that there were few major issues that caused change. Therefore the need to develop significant improvisations in response to design flaws and software errors was lowered.

BBC Improvisation Analysis

In this section, I summarize the improvisations that occurred at BBC over the four phases of the project (see appendix 4 for a detailed listing of all improvisations). I will present counts, graphs and analyses of improvisation triggers, frequency, types and stages sorted by project phase and user group. This will be used as a tangible representation of improvisation dynamics at BBC.

Table 5g and Figure 5c summarize improvisation triggers that were present across all project phases, Table 5h and Figure 5d below summarize types of improvisation by project phase[24], Table 5i and Figure 5e summarize the final stages of evolution that these improvisations reached and Table 5j and Figure 5f show frequency of improvisation by user group across phases[25]. The following are summaries of this data, followed by explanations of improvisation dynamics for each phase, primarily using the CV framework as an interpretive lens.

BBC Improvisation Dynamics Summary

The majority of improvisations at BBC were triggered by evolving requirements. This was indicative of normal IS evolution due to improvisation (Orlikowski 1996; Miner 2001). Missed requirements were consistently low throughout the first three phases of the project, but increased in the final phase as the functional liaison moved out of the primary design role. There were almost no unmet requirements, which was a tribute to the stability and effective development of Express. BBC has a low frequency of improvisation overall (only 45 discovered in the two years of this study). This seems to coincide with the User Savvy CVs assessment, which predicted that their lack of savvy would inhibit improvisation by users. Another possible explanation is the fact that through most of the project, they had the luxury of free modifications to meet new

[24] Some improvisations were both process and IT workarounds. Therefore some improvisations in the appendix were counted as both.
[25] In some cases, more than one user group was involved in a given improvisation. Therefore, the counts of improvisations by user may be higher than counts of improvisation types by phase.

requirements. This minimized the need to improvise until the latter phases of the implementation, when this “free mod policy” was revoked.

Overall, there was an upward trend in the frequency of improvisation over the first three phases, with a significant spike in phase III, then a decrease in phase IV. This trend is supported by a number of CVs. For the upward trend: First, the System Environment area analysis, which concluded that when modifications were not available to meet new requirements, users would need to improvise more. This transition away from modifications took place throughout Phase III, which is the point where I observed a significant increase in improvisation frequency. Second, the User Savvy CV analysis, which stated that as users became more experienced, they would improvise more frequently. This seems to be another possible explanation for the increase, as I observed that users were demonstrating much higher levels of proficiency in Phase III (McGann/BBC FN #3, 2004 #3). The downward trend in Phase IV is attributed primarily to the lack of enthusiasm that surfaced as they decided the mainframe was a better solution (Legacy System CVs) and the support of the portal was turned over to the planners from the functional liaison (Support Effectiveness CV). This was the point where their lack of enthusiasm was made more evident to suppliers, through lack of support. The result was less improvisation, as the functional liaison, who had done most of the improvising up to that point, was no longer involved in the process.

Improvisation Trigger Analysis Overview

As shown in the Improvisation Dynamics Model, the improvisation process is triggered by events that cause the process to move from its expected course. In this section of the analysis, I define the types of triggers that were discovered in the study. I then display graphical representations of triggers frequencies by type across project phases, drawing conclusions about their relationship to the frequency of improvisation that took place in both cases.

Improvisation Trigger Classification

Based on the analysis of requirements that drove improvisations and a review of exception handling literature, the classification scheme that follows was developed for improvisation triggers. This scheme draws primarily on Strong's research, which distinguished between exceptions that should be eliminated (i.e. software errors) and those that are an important part of remaining flexible as information systems evolve (i.e. evolving requirements) (Strong 1995). I found that improvisation triggers at BBC and AIM fit into these classifications, and further refined it as follows:

Missed Requirements Trigger – error in the requirements specification and software design process causes existing business requirements to be excluded from the development process. I found that these are usually discovered shortly after use of a new system or when a new modification begins, as users will check immediately to see that their needs were met. Users are forced to improvise immediately in order to meet these requirements, as they are often a vital part of their business process (e.g. design team missing the fact that suppliers had their own version of part numbers that needed to be included in the inventory transaction process).

Evolving Requirements Trigger – natural evolution of system requirements that can result from evolution of the business environment (e.g. the VMI requirement which evolved out a strategy evolution) or learning of the users which make them want more functionality (e.g. users began to want more information, such as in-transit figures, on reports as they became more knowledgeable). I also found that there are evolving requirements that are created by the fact that a client or designer simply changes their mind (e.g. decision that an invoice number needed to be included on a pull report). These triggers surfaced after enough time had elapsed for users to develop deeper system knowledge, which generated ideas for new requirements, or for new business requirements to evolve. In both cases, the majority of improvisations were triggered by evolving requirements.

Unmet Requirements Trigger – improvisation is triggered because the system doesn't perform as expected/designed. Examples are issues such as software malfunctions, training deficiencies, system and data problems and administrative issues such as user ID and password re-setting. Users are often forced to improvise workarounds in order to keep their business processes operational, while waiting for technical support to resolve these issues.

BBC Improvisation Triggers Across Phases

The following is a summary and interpretation of improvisation triggers that were present across different implementation phases:

Phase I - In this phase, there were no evolving requirements. This was due to the early project phase. My interpretation was that requirements in a less innovative environment such as BBC's evolve slowly. Also, since software design and development was taking place in conjunction with the early implementation phases, evolving requirements did not trigger improvisation. Instead, they triggered IT modifications, due to the free modification policy. There were five missed requirements, which is a relatively high number compared to other project phases at BBC and AIM. This can be attributed to the high volume of design that was taking place. The team was essentially building an entire software package, thus the number of missed requirements can be attributed to that process. There was only one unmet requirement, and this was a minor issue connected with supplier training issues.

Phase II - This phase saw a rise in evolving requirements (5), which can be primarily attributed to users' increased learning. While their understanding of the system increased, so did their requirements. Missed requirements dropped down to only two, and they were residuals of the design process in Phase I. As in the previous phase, there was only one unmet requirement, which was primarily due to poor performance of the XXX web server.

Phase III - In the third phase, evolving requirements peaked at a high level (13). This was due to combined effect of BBC user's learning continuing to increase, supplier's learning finally beginning to make a difference, and evolving business requirements such as VMI and Supplier Scorecard. Missed requirements remained relatively low (3) and there were no unmet requirements.

Phase IV – In the final phase, missed requirements climbed to six, while evolving requirements dropped off to only five. The shift in evolving requirements can be linked to BBC user's lack of system use and support, as well as the functional liaison's departure from the primary support role. This trend shows a strong connection between improvisation and evolving requirements as discussed in the Design and Use Model in Chapter 2, which describes the cyclical nature of the improvisation, requirements and systems evolution processes. In this phase, BBC users improvised much less due to their lack of enthusiasm. Therefore requirements did not evolve and less improvisation resulted. I correlate the increase in missed requirements to suppliers taking ownership of the portal and discovering needs that were previously not exposed by BBC users.

BBC Improvisation Type and Evolution

The following is a summary of improvisation types and the evolutions that took place across different implementation phases:

Phase I - improvisations consisted of three IT workarounds and two process workarounds, evolving into four modifications and one embellishment. In this phase, the functional liaison and BBC users accounted for the improvisation almost equally.

Interpretation: The first observation for phase I is that the overall level of improvisation was at its lowest. This can be explained by the policy of free modifications to meet evolving requirements (Modification Policy CV) outlined earlier. Another reason is that user experience was still low (User Savvy CVs) as none of the BBC and supplier users had previous portal experience. Suppliers lacked the necessary knowledge needed to improvise. The fact that most all of the improvisations that did occur in Phase I evolved quickly into modifications could also be attributed to the free modification policy.

In this early stage, suppliers were still receiving training. This partly explains why they did not improvise. Planners made process and IT adjustments which are a common part of the initial phase of any planned change (Orlikowski 1996). This, I found, explained the improvisation that took place in Phase I. While the functional liaison focused on designing modifications, he was not focused on developing workarounds (McGann/BBC FN #1, 2003 #1).

Phase II – Improvisation frequency doubled. Most improvisations were workarounds. They consisted largely of IT workarounds, with five occurring, and two process workarounds. Configured improvisations surfaced for the first time in this phase as three were identified. The improvisation evolution mix began to expand, as all improvisation stages were represented. The overall count was two Ad Hoc Adjustments, three IT modifications, three process embellishments and two metamorphoses. In this phase, suppliers made their first improvisations. MFG users and functional liaison improvisation increased.

Interpretation: At this stage of the project, I noticed that BBC and supplier users were more enthusiastic about the portal than in any other phase (User Engagement CVs). They were all taking time to increase their knowledge through training, so experience increased dramatically. They were also experimenting with different functionality, which explains the increase in configured improvisations. The functional liaison became more skilled at developing workarounds, and his role evolved from a subordinate analyst into a central support person for all issues involving the portal. In this role, he began to see the importance of developing workarounds to resolve issues, and he emphasized this with his users. They seemed to pick this up during this phase. Therefore, improvisational awareness increased (improvisation competence CV) which increased the overall level of improvisation that took place. This momentum also carried over into Phase III, where I saw improvisation frequency reach its highest level.

Phase III – During this phase, improvisation levels peaked. There was a significant jump in process workarounds (11), with IT workarounds climbing as well (7). There was only one configured improvisation. These evolved into the largest number of IT modifications (8) and process embellishments (5), along with two ad hoc adjustments and two more metamorphoses. In this phase, the functional liaison improvised most and suppliers overtook BBC users as the main source of improvisation.

Interpretation: At this stage of the project, a number of dynamics coincided that caused a large increase in improvisation frequency. First, I observed that user competence had increased significantly (User Savvy CVs). I remember being very impressed with the users and the functional liaison during my observations, while they demonstrated the new skills they had developed. Although BBC planners were still only concerned with learning the minimum needed to do their jobs, they demonstrated marked improvement. Some were able to demonstrate new process and IT workarounds that they had developed. Supplier users showed the most significant improvement during this phase. Prior to this phase, they really hadn't demonstrated competency in portal use, and had only developed three improvisations. In Phase III they began to play a much more important role in the improvisation process. They provided feedback to the functional liaison about missed and new requirements, and created a number of workarounds that resulted in key modifications. In this phase, I also saw the functional liaison reach his peak in system savvy and improvisation development. His understanding of the system and the improvisational process resulted in significant changes such as the use of the VMI module for consignment, Kan Ban development and the creation of the supplier scorecard module. Most improvisations in this phase evolved quickly into modifications. My interpretation of the change is as follows: First, this was the final phase in which free modifications were being offered. Second, the functional liaison and suppliers combined their heightened experience to create improvisations that were important enough to warrant software changes, despite the fact that some were not free.

The other significant evolution stage that was reached frequently was Process Embellishment. I found that this was due to the system reaching a stage that the functional liaison called "modification saturation". He explained that this was the point where they had identified all major areas in the software that needed to be changed. Hence the focus from that point onward shifted to process improvement. Another reason for this change was the announcement stating that modifications were no longer an option after Phase III. This set the stage for Phase IV's focus on process embellishments.

Phase IV – At this stage overall improvisation levels dropped significantly. Process workarounds were most prevalent, with IT workarounds second. These mostly evolved into embellishments, with only one modification and one ad hoc process adjustment. In this phase, the functional liaison and BBC user's improvisation dropped significantly, while suppliers continued to improvise frequently.

Interpretation: Phase IV's decline in improvisation was a result of a number of issues that surfaced. First of all, this was the point where the BBC planners had decided that the mainframe was a better tool to meet their needs. Therefore, their portal use declined significantly. They only used it if suppliers had a data issue that needed to be resolved. Therefore, I found that their enthusiasm and support level dropped (System Enthusiasm CV). Second, BBC's primary improviser, the functional liaison, was no longer involved in the support of the portal. This task had been delegated to the already non-enthusiastic planners (Support Effectiveness CV). This move seems to further explain a large portion of the drop in improvisation. The final possible cause for the drop in improvisation was the shift to "maintain mode" by project management (Future Use Plans CV). As a result of uncertainty for the future of the portal, management "shifted out of continuous improvement mode", as one IT manager put it. The improvisations evolved primarily into process embellishments, which is consistent with the shift away from modification at the end of Phase III. Even though BBC user's improvisation dropped, BBC supplier's improvisation frequency remained relatively high. This is consistent with the previous "Reason for Implementation" CV analysis. In the long term, the portal was positioned as a system primarily to benefit them, so there was a trend towards suppliers making use of the tool for improvisation.

BBC Improvisation Dynamics Summary

The application of the Improvisation Dynamics Model at BBC facilitated a deeper understanding of the improvisation process that occurred in the BBC user, supplier user and organizational contexts. Through this understanding, I can explain how and why improvisations occurred and evolved as they did. This is a key first step in the theorizing process that will follow. I now apply the same approach at AIM that will replicate the analysis and offer a basis for cross-case comparison of results.

BBC Improvisation Triggers by Project Phase

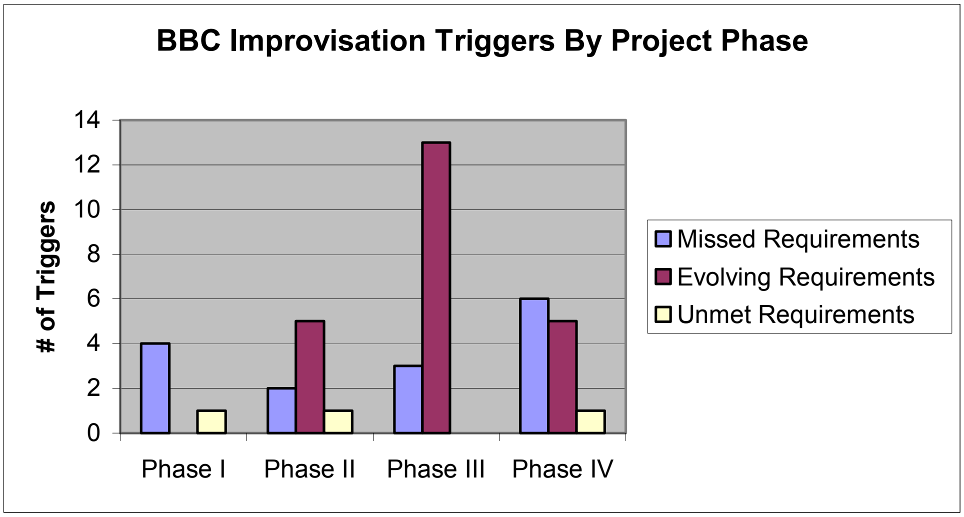


Figure 5c – BBC Improvisation Triggers

	Phase I	Phase II	Phase III	Phase IV
Missed Requirements	4	2	3	6
Evolving Requirements	0	5	13	5
Unmet Requirements	1	1	0	1

Table 5g – BBC Improvisation Triggers

BBC Improvisation Type Frequency by Project Phase

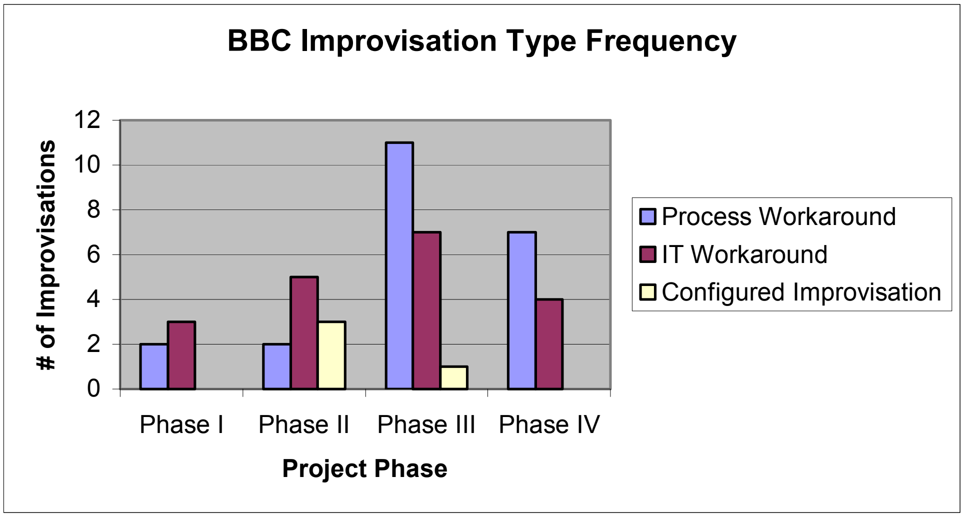


Figure 5d – BBC Improvisation Type Frequency

	Phase I	Phase II	Phase III	Phase IV	Total Type
Process Workaround	2	2	11	7	**22**
IT Workaround	3	5	7	4	**19**
Configured Improvisation	0	3	1	0	**4**
Total Improvisations By Phase	**5**	**10**	**19**	**11**	**45**

Table 5h - BBC Improvisation Type Frequency

BBC Final Evolutionary Stages by Project Phase

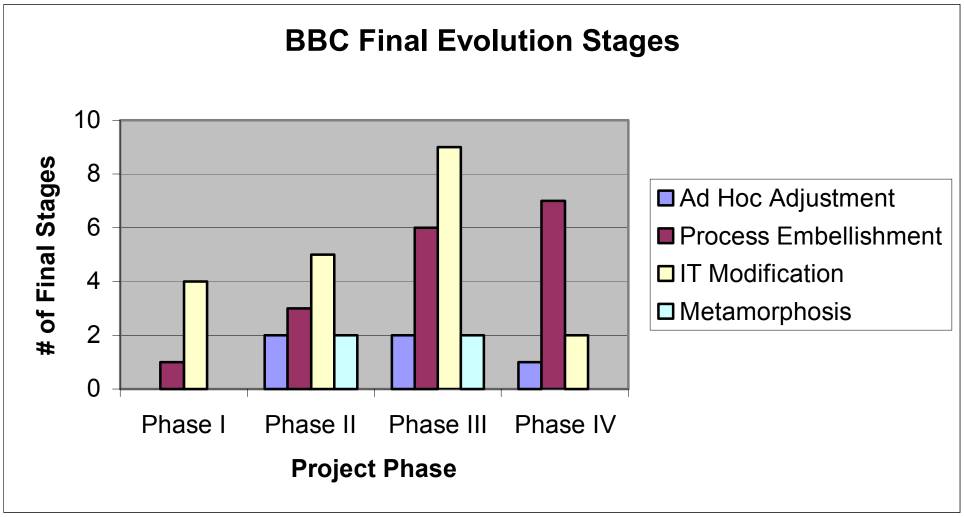


Figure 5e – BBC Final Evolution Stages

Evolutions (All Phases)	Phase I	Phase II	Phase III	Phase IV	
Ad Hoc Adjustment	0	2	2	1	**Total Evolution Results**
Process Embellishment	1	3	6	7	**5**
IT Modification	4	5	9	2	**17**
Metamorphosis	0	2	2	0	**20**

Table 5i - BBC Final Evolution Stages

BBC User Improvisation Frequency by Project Phase

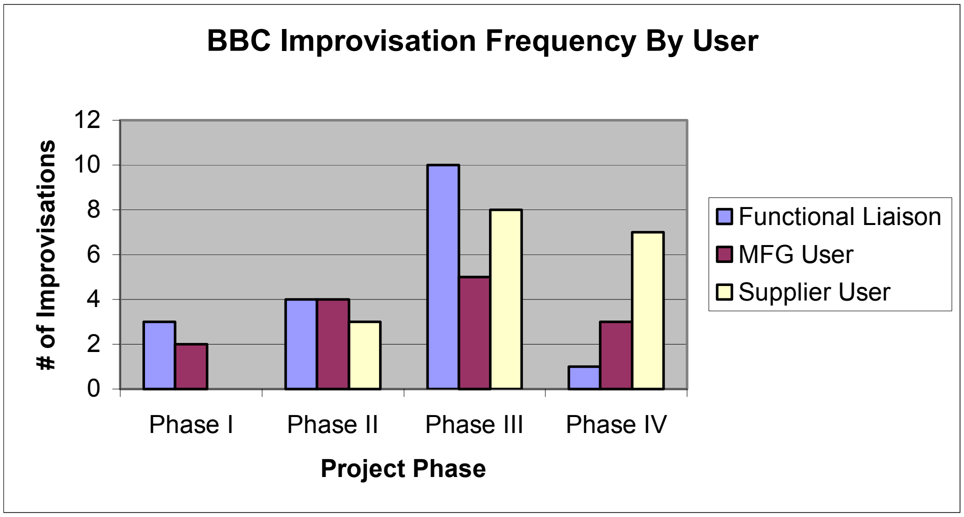


Figure 5f – BBC Improvisation Frequency by User

	Phase I	Phase II	Phase III	Phase IV	
Functional Liaison	3	4	10	1	18
MFG User	2	4	5	3	14
Supplier User	0	3	8	7	18

Table 5j - BBC Improvisation Frequency by User

AIM Improvisation Dynamics Analysis

The analysis of AIM improvisation dynamics is organized in the same fashion as the preceding BBC analysis. I will use an exemplar improvisation, which was selected using the same criteria as the BBC exemplar. It seeks to illustrate improvisation dynamics concepts in the context of AIM. I then assess the improvisational environment using proposed CVs to examine why and how AIM users and supplier users, and the AIM organizational environment fostered improvisation. Finally, I will use graphical analysis to interpret the meaning of patterns of improvisation dynamics that occurred.

AIM Exemplar Improvisation – The Material Tracking and Receiving Process

Picture 4 – A material handler unloads a shipment on the AIM receiving dock.

In the years leading up to the XXX implementation at AIM, one of the most significant organizational problems that they faced was a lack of shipment visibility and tracking, which resulted in lost materials. Under their current business model, there was no way to track shipments from suppliers. This created immediate problems for AIM receiving personnel and material handlers. With no visibility of in-transit material, there was no means to know whether the proper items and quantities had been shipped on time. “Once materials left suppliers, they sort of entered a black hole”, according to an AIM materials manager. In a lean manufacturing environment such as AIM, which involves carrying only one day of raw material and finished goods inventory on hand, this is problematic as material shortages can stop production.

The problem was furthered by the fact that receipt transactions were not being performed accurately and on a timely basis. Once materials finally arrived at the receiving dock, the receiving clerk had to manually key the transactions into AIM’s ERP system. This was a long process, which took several minutes for each receiver. With hundreds of receivers coming in each day, it created a constant struggle for her. This problem was compounded by the fact that she had many other responsibilities in addition to keying in receipts. As a result, she fell behind as much as three days on entering receipts. Also, with manual entry of so many transactions, there were numerous human errors, which added more time to the process. Another problem was the fact that receivers were being sent from suppliers in hundreds of different formats, some difficult to decipher. Some suppliers didn’t send receivers at all. To make matters worse, material handlers were forced to move shipments out to production line before the receipts were recorded, in order to keep the line moving. In this process, shipments were often not entered into the ERP system, receivers were lost, and the Accounts Payable department had no record of whether material was received, so they did not know which invoices to pay.

This chain of events in the receiving process rendered the ERP system information virtually useless, as the inventory positions were never accurate. This meant that material planners often had no idea what to order. Many days, they had to resort to time-consuming physical counts to establish an accurate inventory position. This also caused major problems for A/P, as they were constantly on the phone trying to trace invoiced materials to decide whether they could pay for them or not. Large volumes of materials were never accounted for, angry vendors were not getting paid, material handlers were growing increasingly frustrated and the receiving clerk’s job was unmanageable. The magnitude of the problem is summed up by an AIM project manager as follows:

Picture 5 – AIM Senior Materials Director and XXX Project Manager

"…but I guess my point is, we knew we were having so many issues internally, with identifying where Associates were not doing their job and getting the data in the system so that accounting could do their job, it was obvious that receiving though was just not doing their job…and accounting couldn't actually pay bills, you know, these are huge issues with inventory accuracy cause you're not receiving inventory in the system. We really needed the ability to really count and project from month to month our profitability and our inventory shrinkage and all kinds of things, so we saw that as being a huge potential benefit". (AIM Project Manager R2 2003)

Initiation of Improvisation – Material Discrepancy Process – IT/Process Workaround

When the senior materials director became aware of this crisis, it became his top priority. He was concerned because the list of problems associated with materials was affecting departments throughout the organization. Top management was insisting on a better solution. Most importantly, according to a senior production manager, it affected AIM's ability to serve its customer properly:

"We run really lean and I only carry one day of raw material and one day of finished goods. If anything goes wrong in the materials process, my line shuts down and I can't serve the customer. The problems with raw material were a huge concern for me because of this". (AIM Production Manager R2 2003)

To begin the resolution process, he began to trace the materials flow, identifying the problem areas mentioned earlier (supplier shipping, AIM receiving, AIM material handling). He then improvised an interim tracking process and associated report called the "Material Discrepancy Log". This process was designed to identify lost material, so that managers could contact vendors, receiving clerks and material handlers to trace shipments and identify disconnects in the material flow. At the peak of the crisis in the Summer of 2003, there were over 100 material discrepancies [26], leaving almost 25% of raw material inventory unaccounted for.

Evolutionary Path

The path of the Material Tracking Process/Receiving Process improvisation evolution will be traced below (see Figure 5g). Due to the severity of the situation, this transformation progressed rapidly, moving from an ad hoc adjustment to a metamorphosis in the first three months of the XXX implementation. It started off as an ad hoc adjustment for one month, while managers experimented with various temporary tracking processes. Next, in order to save time, the stages of modification and embellishment proceeded in tandem. This yielded a new XXX software module and associated new processes for supplier shipping and AIM receiving. The receiving module carried with it the necessity for significant change across the supply chain, as suppliers were now required to complete shipping transactions through the portal, in order to give visibility of shipments to AIM users. They were also required to print out and attach a standardized master packing list to all materials. The standardized master packing list was then quickly scanned by a receiving clerk upon delivery, cutting each receiving transaction time down from a few minutes to a few seconds. This allowed for prompt movement of materials to the shop floor. This process also gave A/P visibility of all shipments and receipts on the portal and the ERP system, because they were synchronized daily through an interface. This visibility assisted with the payment and tracking processes. This provides an example of how an improvisation, which is designed to meet an urgent need, can quickly create a large-scale change and speed up information system evolution.

[26] Material discrepancies are identified as shipments of material that were not accounted for on the system.

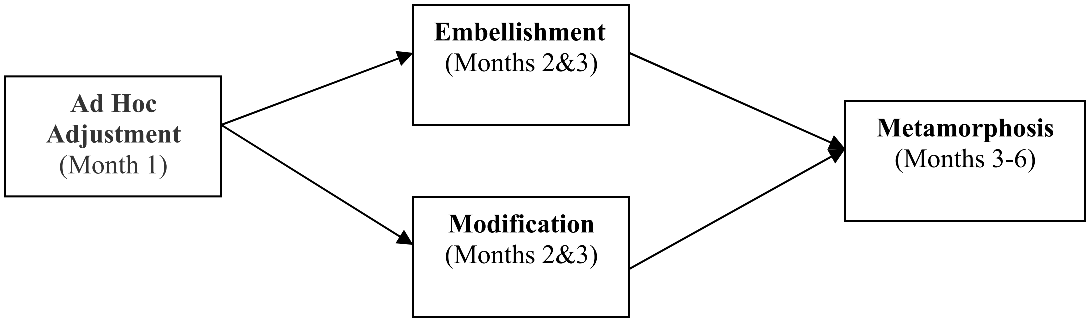


Figure 5g – AIM Material Tracking and Receiving Process Evolutionary Path

Ad Hoc Adjustment Stage (Month 1) - Before the XXX implementation, the problems related to material discrepancies were apparent and the Material Tracking Process improvisation was already in its early stages. The responsible Senior Manager used the newly created discrepancy reporting process to do research on the problem, establishing patterns of lost materials and isolating specific problem areas in the material flow process. Although discrepancy reporting was an important tool at that point, it was only used sporadically. There was no established process to support it. The improvisation was therefore in the ad hoc adjustment stage.

IT Modification Stage (Months 2 & 3) – Immediately after the implementation began, the AIM project manager and Express designers began to discuss opportunities which the new XXX portal offered to help with the material tracking process. A decision was made to utilize existing Advanced Shipping Notices (ASN) functionality, which solved the problem of visibility of shipped/in-transit inventory. They also decided upon adding a standardized master packing list to the shipping module. However, the problems in the receiving process were the most severe and there was no receiving module in the current XXX functionality. After only a few initial meetings, both the AIM project manager and Express owner agreed that this set of requirements warranted the development of an entirely new software module. As in the BBC case, the situation was seen as mutually beneficial. AIM would be the recipient of a custom-developed software module at no cost, and Express would get the benefit of AIM's experience in the design of functionality, modeling the improvised material tracking process, thus making XXX a more comprehensive software package. This excerpt from my interview with the AIM project manager describes the inception of the receiving module:

"…the new receiving functionality was the way that I could justify this further to my Board. I mean, let's throw everything else out, here, you have a very conservative Board. But if I can go from 100 issues in July to 50, is it not worth it for us to do this? And you know that was the easiest way for me to justify this to them to get this thing approved, because they knew that, you know, we are slow to change, we've got to get our, IT projects are never easy, and to get our buyers on board, and suppliers on board, and all that, it was going to be difficult. But if you can integrate the receiving side of this, huge value, especially in an area where we're having tremendous, tremendous issues. (AIM Project Manager R2 2003)

The design of the Receiving Module was an expedient process, as the requirements and issues were already well understood by the AIM project manager. The new receiving functionality was primarily based on the ability to scan master packing list barcodes, which was automatically created by the shipping module at the time of supplier shipment. This allows the receiving clerk to receive one line of a purchase order at a time, or to receive all of them at once[27]. The design team speculated that the ability to quickly and accurately scan receipts would solve the majority of the receiving and material discrepancy issues, as material could be scanned and used within minutes after it physically arrived. Also, there was almost no chance of human error in the receipt transaction, as manual data entry was eliminated with scanner technology. Finally, the receiving clerk was freed up to do her job as receiving exceptions would be virtually eliminated. To complete the modification process, reports were developed to support the material tracking process. These reports used critical information from the improvised Material Discrepancy Log as a model. See image 5b below for a view of the primary screen from the receiving module.

[27]Most of the time the "receive all" function is used, which saves significant time on purchase orders with hundreds of lines.

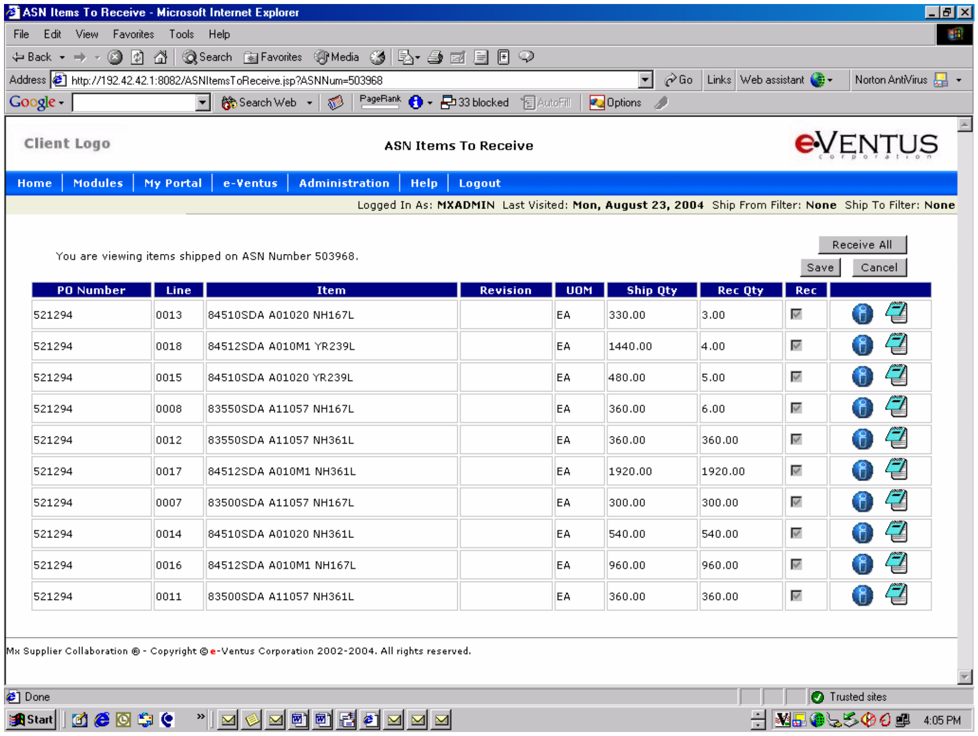


Image 5b – The XXX Receiving Module

Process Embellishment Stage (Months 2 & 3) – At the same time the above IT modifications were being designed, the AIM/Express team designed matching processes. The first process, supplier shipping was completely new to all vendors. In the past they were not required to provide any type of notice to AIM when material had been shipped. Many vendors did not even have formal systems that tracked shipments. The new process required them to enter an advanced shipping notice in the XXX portal the day it was being shipped. Another key part of the process was to attach the AIM master packing list, which was automatically printed out (in Adobe Acrobat format), for all shipments.

To formalize the process, all suppliers were required to attend training and corrective measures were put in place to assure compliance. The AIM Domestic Trouble Report (DTR) was the primary compliance instrument. The DTR served as a warning that a violation in the procedure had occurred, and a response as to why this happened was required. These were delivered via e-mail. If a number of DTRs accumulated, suppliers could be dropped. The AIM procedure dictated that any supplier sending materials without having first entered a shipping transaction in XXX, without attaching a master packing list, entering a transaction where actual material shipped did not match the entry on the portal, would receive a DTR.

The second and most significant process was receiving. The new design reduced the clerical procedure to simply assuring that master packing lists matched actual shipments, scanning the master packing list and then releasing the material to the shop floor. She was also charged with dealing with exceptions such as shipments not matching master packing lists, master packing lists not being attached at all, and material arriving that had not been shipped on the portal. In all of these cases, she sends out a domestic trouble report and contacts the supplier on the phone as needed to investigate reasons for the violation. However, the exceptions had been minimized as a result of the new process, as summarized by the head receiving clerk:

Picture 5 – The AIM Receiving Clerk monitors daily receipts.

"The master packing slip that we receive in, the guys on the dock love it because it's just, it's easy to read, it's usually just one sheet. A lot of times on like the other pack slips they were hand written, hard to read, some of the information would be missing. And they were messy, triple pages, you know carbons and all that. So far less paper work and much easier for the guys on the dock to read and check off. It's really made things smoother out here, the process is great". (AIM Receiving Clerk R2 2003)

Metamorphosis

The complete redesign of the supply side material flow at AIM quickly evolved into a wide range of organizational changes, which resulted in a metamorphosis. Immediately after the process embellishment and IT modifications were in place, a supporting committee of material managers and supervisors was formed. Daily committee meetings are now held to review material discrepancies by using a special material tracking report that was designed as part of this process. Controlling lost material has become a focal point at AIM. Everyone across the supply chain that I interviewed described how their job had changed, and how the XXX material control process had affected them, as exemplified by this material handler:

Picture 6 – An AIM Material Handler pulls newly received parts for use on the manufacturing floor.

"Now, with the new process, I have lots of different options. I mean like for instance, if I don't have an ASN, if I don't have a master packing slip for a supplier but you know I think it's likely they probably did use the Portal to make their shipment, I can search out that ASN several different ways. So I mean I don't necessarily have to have that master packing slip, I can probably find one myself and print it myself. This really makes my life much easier and the whole way that I do my job has changed for the better. Suppliers are happy, I am happy and my managers are happy". (AIM Material Handler R2 2003)

The success of the processes and IT was apparent within the first two months of its implementation, as material discrepancies were reduced from over 100 down to less than 50. Currently, six months after this change, there are less than 10 discrepancies. A/P and receiving clerks are spending a fraction of this time resolving exceptions than before this change. This interview excerpt from the project manager who carried out this transformation process encapsulates the success of this change:

"It's just been a tremendous benefit already, and the way that we're using the system too. I guess, I know that this is standard in the system but I'm hoping they won't use it this way, maybe they would, so getting into the impact of improvisation here for a second. We, every day, every single day, we talk about inventory. Every single day we've run a query out of the Portal that tells what has been confirmed to ship by the supplier. (AIM Project Manager R2 2003)

Basically, what ASNs are out there that have not yet been received into, in the Portal or into, basically, if it's not received in Portal, it's not received in the ERP system. This is really an amazing change for us". (AIM Project Manager R2 2003)

What we've been able to, to do by doing that is to quickly identify where we've got problems, cause we've got 20 confirmed ASNs out there that have not been received. What's going on? Who's not doing their job? What do we need to do? We know immediately when there's a problem and we go start and hold people accountable like we talked earlier. And people become aware that there's somebody that's watching them. So that is, you know, that's a huge tool, a huge benefit, and we feel like we're starting to get this thing under control. Even if right now, for outdating issues in this log are 39, total, going back to August". (AIM Project Manager R2 2003)

Summary

The metamorphosis of the Material Tracking and Receiving Process shows how an urgent set of requirements can create improvisations, which will evolve into a metamorphosis in a compressed timeframe. At AIM, the threats that lost material were posing to the company motivated management to first improvise an interim solution, while quickly using this experience as a model for a complete transformation of the supply-side material management process. During this evolution, new processes and technology were developed, jobs descriptions and performance measures changed, as did the company's relationship with its suppliers. The transformation resulted in a significant evolution of the XXX system, as the existing shipping module was modified and an entirely new receiving module was created. This case serves as an example of how constant improvisation drives ISE, thus establishing a connection between improvisation dynamics and the ISE process.

AIM Contextual Variable Analysis

Tables 5k, 5l and 5m below show the assessment of AIM's improvisational environment at the CV factor level[28]. Each critical CV factor assessment indicates whether the factor enables or inhibits improvisation. Each factor assessment is supported by representative quotes from AIM interviews. After the tables, the impact of each critical CV on improvisation is explained, followed by an overall summary of the improvisational environment at AIM.

AIM User CV Assessment

AIM User CV Summary

A number of key CVs drove AIM users to improvise. Users perceived the system to be easy to use, they were innovative, technically savvy and most importantly, they recognized the strategic importance of the XXX implementation. This sense of importance was effectively communicated to the core team, and set a different stage for system use than BBC. "I think everyone in my area sees why this is important, and it has really helped me a lot", commented an A/P clerk. As a result, I observed receiving, A/P and inventory control personnel using XXX consistently, and their support of the implementation was high. My overall assessment was that this enthusiasm triggered the high frequency of improvisations that occurred at AIM, as this core group has carried out most improvisations to date (McGann/AIM FN #2, 2004 #5).

[28] The approach for arriving at these "marks" is described in Chapter 4 on methods. A "+" means that this CV factor enables improvisation. A "-" means that it inhibits improvisation.

The AIM User CV Assessment is summarized in table 5k as follows:

Contextual Variable Area	Contextual Variable Factors	Overall Assessment	Illustrative Quote
General System	System Type Factor	+	"…anybody can use it, so it, so and because of that you know the intuitiveness, people are not afraid of it or not, they're not afraid to try it, to experiment with it. So that gives you a, you know, a more openness to change now that they're getting comfortable with it". **(Senior Manager)** "With the portal, we have a lot of interaction, a lot of communication, you know, we're taking their ideas for quality improvement and we're integrating that into our process and pushing that all on Honda, and again, the feedback from Honda's coming all the way back to the suppliers". **(Project Manager)** **"**It has a lot of features and functionality that are popular with our users. When you do a search you can use a filter by various, you know, information you added, like a weigh status or a receipt status, or if they were received or confirmed or unconfirmed, you know, like the messaging you can filtering out information that you don't want to see". **(Project Manager)** "Many of the options allow you to improvise. If you want to configure something a certain way or code it a certain way, look it up a certain way, download it a certain way, you can do it for a date range or you know part number or whatever it is that you're looking for. So to me that's what gives you a lot of flexibility". **(Materials Manager)**
System Environment	New System Factor	+	"The XXX implementation at BBC was primarily motivated by cost associated with EDI. This was not a hugely strategic move like it was at AIM, where XXX was brought in as a major part of their VC 2 initiative. Therefore, I think the motivation behind it is completely different and this has had an impact at the user level…because at AIM, they (the users) are seeing more benefit". **(Express Owner)** "The overall fit of the system has been good from the perspective of the users. We did quite a bit of improvising in the beginning, but that has leveled off. Lately, (in Phase II) we really haven't gotten a lot feedback from plant or supplier users about suggested changes and my level of workarounds has been lower as a result". **(Functional Liaison)** "… there are some things that it can't do… Right now, from what I understand, a lot of those things will be changed soon, which is minimizing the urgency to develop workarounds". **(Functional Liaison)** "My expectation based on their approach is that AIM will be doing more enhancements and spending more money enhancing their supply chain, than other clients. And one of the reasons I feel that way is that AIM has been very focused on doing things like serving the entire supply base and not just on satisfaction for current product. " **(Express Owner)**

Contextual Variable Area	Contextual Variable Factors	Overall Assessment	Illustrative Quote
	Legacy System Factor	+	"And you know the way that it has to take the data from our ERP system and also exchange it back and forth, there is some complexity to it. But this minimizes the use of our ERP system for a lot of the users, which puts more focus on the portal". **(Functional Liaison)** "We have been working on our ERP implementation off and on for years now with limited success. At this point, its use is pretty limited". **(Materials Manager)**
User Type	User Savvy	+	"Many of our users are like Jim, who is certainly more technical, which definitely promotes improvisation". **(Project Manager)** "AIM is very much a leader in IT, especially in Japanese areas. A lot of their equipment, their servers, their operating systems are much newer than you'll find at most manufacturers, so I think there's a much more savvy technical user on average at AIM". **(Express Owner)** "I have created a number of workarounds, especially in the beginning of the project, like this one for supplier pass through parts, which was a little tough, but we got it figured out". **(Functional Liaison)** "I've been working with the users for a few months now, and have been really impressed with their level of creativity and innovation. Across the board, people are always looking for a better way of using the system and processes". **(Functional Liaison)**
	User Engagement	+	"In the past, if something doesn't jive, I had to go through the purchasing department to try to resolve the matter because they're the ones who are communicating with the supplier. But with the Portal, really everybody's communicating with everybody. You can kind of get in and see what everybody's doing. I really like that part of it". **(A/P Clerk)** "In terms of enthusiasm AIM definitely has more enthusiastic users. Again, I think that was partially due to the Japanese process of the buy-in and explaining why this worked and there was a little bit more time spent with those processes". **(Express Owner)** "Management definitely, you know they want you to try to come up with better ways. We even have like an idea kind of contest thing that we have for most creative way to solve problems". **(A/P Clerk)**

Contextual Variable Area	Contextual Variable Factors	Overall Assessment	Illustrative Quote
Implementation Effectiveness	Support Factor	+	"I think the initial training was pretty successful as far as getting the users up to speed on the basics. But, now that we have people that know how the system works, we need to come back in and give them another overview of how there are other tools in the system that can allow them to do their job more easily". **(Project Manager)** "I probably had a couple hours worth of training I think it was. And then I went that day and I was using it. So, I mean it's a piece of cake. It's super easy to learn, and the training team did an excellent job". **(Buyer/Planner)** "A great support mechanism that is in place is for solicitation of different types of concepts and ideas that might be valuable. They actually created their own survey mechanism to specifically address types of questions like "what enhancements would benefit you?", and that is for solicitation of enhancements from the supply base as well". **(Express Owner)** "We have been using an issues database to log all calls and assure proper follow with the users. Once they started to utilize this process, the support process became a lot more effective". **(Functional Liaison)** "Ted has done an excellent job with support. I feel pretty comfortable with the portal now, and he deserves a lot of the credit for that". **(A/P Clerk)**
	Use Factor	+	"AIM has been up roughly for 4 months, 5 months versus BBC up at 4 to 5 months, I think the use is higher both at the, certainly at the plant level, at the company level and probably similar at the supplier level". **(Express Owner)** "We have spent a lot time working with our users to support them. That has been my full-time responsibility since the beginning. This has gone a long way towards getting them to buy in, at least here at the plant. The suppliers are a little tougher to deal with…" **(Functional Liaison)**
	Post Conversion Factor	-	"We posted a survey on the portal a few months ago for users to suggest enhancements. At this point we have received only a few minor suggestions. I think we have nailed most of the key requirements" **(Functional Liaison)** "The issue database volume was pretty high at first, with as many as 30 calls a day. Now we are down to only a few and its usually pretty minor stuff. I haven't had to develop any workarounds for awhile". **(Functional Liaison)**

Table 5k – AIM User CV Assessment

AIM User CVs

General System Area

System Type Factor

The system version implemented at AIM was a “more mature version of XXX”, as the Express Owner described it. Therefore it is assessed as enabling improvisation. The system had undergone significant changes to increase simplicity and ease of use. It therefore had a higher level of **Usability (+),** which “promoted experimentation”, as the functional liaison put it. The AIM project manager expressed his impressions of the effects of its ease of use on improvisation as follows:

“…anybody can use it, so it, so and because of that you know the intuitiveness, people are not afraid of it or not, they’re not afraid to try it, to experiment with it. So that gives you a, you know, a more openness to change now that they’re getting comfortable with it”. (AIM Project Manager R2 2003)

This assessment is also based on the higher levels of **Configurability (+) and Interactivity (+).** The Express Owner described the latest release as follows:

“AIM is using a more mature version of the product so there are fewer technical issues. We’ve also added new functionality to make allow users to configure views, reports and many other options… The 3.2 product has a lot of capability that uses concepts that were already in MX, for example, the messaging system we used to tie a message to a release. Now users have capability in accounts payable to tie a message to a specific invoice. This increases interactivity”. (Express Owner R2 2003)

“We’ve also identified different types of requirements that suppliers have. For example, some suppliers actually go through a picking or staging process prior to actual shipment and we’ve actually created a pick list that the suppliers can print that can allow them to help with their own internal operations. That’s very valuable for suppliers that don’t have that capability at this point. We’ve also noticed that different clients have different requirements for their ASNs in terms of which fields are required. We’ve been able to add the capability to allow any of these fields to be either required or not required, based on client environment. We’ve also enhanced the receipt error logging and tracking and now actually have methods to identify when receipts have actually been sent to the ERP system and, you know, whether they have posted properly. If not, what those exceptions are”. (Express Owner R2 2003)

System Environment Area

New System Factor

Reason for Implementation (+) – The implementation at AIM was of significant strategic importance to the organization and to the users. I found that the organization did an effective job of communicating this to the user base, and achieved buy in at all levels. This proved to be an important part of the success of the implementation, as users had an incentive to do their part to continually improve in system use, which increased levels of improvisation. The Express owner's perspective on this situation was as follows:

"The XXX implementation at BBC was primarily motivated by cost associated with EDI. This was not a hugely strategic move like it was at AIM, where XXX was brought in as a major part of their VC 2 initiative. Therefore, I think the motivation behind it is completely different and this has had an impact at the user level…because at AIM, they (the users) are seeing more benefit". (Express Owner R2 2003)

Fit (-) – With the exception of the receiving and material tracking process (which was added in Phase I), the XXX system met all critical requirements of AIM. As unmet/new requirements are a key driver of improvisation in IS (Orlikowski 1996), the need to improvise was diminished. The AIM functional liaison supports this assertion as follows:

"The overall fit of the system has been good from the perspective of the users. We did quite a bit of improvising in the beginning, but that has leveled off. Lately, (in Phase II) we really haven't gotten a lot feedback from plant or supplier users about suggested changes and my level of workarounds has been lower as a result". (AIM Functional Liaison R3 2004)

Modification Policy (+) - AIM project management has held a "no modification" policy through the first two phases, which could explain high frequency of improvisation in Phase I. However, the impression by users and support staff in the latter part of Phase II was that management intends to make modifications in the near future. The functional liaison points out that this seems to have decreased improvisation frequency (for non-urgent improvisations), as users anticipate requirements resolution through modifications:

"… there are some things that it can't do… Right now, from what I understand, a lot of those things will be changed soon, which is minimizing the urgency to develop workarounds". (AIM Functional Liaison R3 2004)

Level of Use (+) – Use of the XXX system for all key users was high from the beginning of the implementation. This was expected, as the system offered many benefits to the users, and they were all supportive of the overall mission of the project. Although planners are not currently using the system extensively, receiving, A/P and inventory control are. For reasons cited in the narrative above, the XXX system has become the focal point for managing material processes, and most use it exclusively. Therefore, I observed use levels to be high. Further, management expects use levels to climb as planners and suppliers start using the system more in the future. Because my assessment in this study is that high use levels result in high improvisation levels (McGann/AIM Part Obs 2004), this partially explains the higher frequency of improvisation at AIM.

Legacy System Factor

Competing Alternative System? (+) – For the primary users of XXX, AIM had no legacy systems that performed their inventory management functions (e.g. receiving, A/P, inventory tracking) so there was no system conflict (e.g. the mainframe at BBC) in which they could use an alternate system instead of XXX. My observation in this case was that it kept their focus on the portal, which increased improvisation (McGann/AIM FN #2, 2004 #5).

Legacy Integration w/New IS (-) – AIM's legacy systems are not integrated internally, or externally with XXX. They are using a combination of spreadsheets and a partially implemented ERP system that is being used primarily for financials. This lack of integration is detracting from the proper use of XXX, as the inventory data that feeds it lacks integrity and is often not timely. My data shows that most legacy system issues were related to timing of interfaces between the ERP system and the portal and resulted in inaccurate data being loaded, due to database errors. I found that in some cases, this translated to less improvisation with the portal, as it decreased user confidence (McGann/AIM FN #1, 2003 #4).

User Type Area

User Savvy Factor

Experience Level (New System) (+) – Although AIM users had been using the system for less than a year, I was impressed with the level of competence they had developed. I found that their ability to learn new systems was a product of the overall technical competence that was present in the organization. The AIM functional liaison reflected on this as follows:

"Our overall technical abilities really helped our users develop portal skills quickly. This certainly showed during the different phases of the portal implementation and I think you will see that translate into improvisation at all levels. They all picked up on it really fast. I feel like we have a pretty solid user base already". (AIM Functional Liaison R2 2003)

The overall competence I observed by the end of Phases II at AIM was significantly higher than BBC had through all four phases. My conclusion based on the data from this study is that there is a strong connection between the level of experience/competence with the IS and the frequency of improvisation (McGann/AIM FN #2, 2004 #5; McGann/BBC FN #3, 2004 #3).

Tech Skills (+) – One organizational trait that strongly affected improvisation was AIM's technically oriented culture. I found that all levels of the organization emphasized cutting edge use of IS and developed strategies around them. The AIM project manager points this out as follows:

"…we have really opened up as far as IT spending and so we are working with some really cutting edge technology. I think this has really rubbed off on our users, as they have become very comfortable working with systems". (AIM Project Manager R3 2004)

This trait was also emphasized by the Express Owner, who thought that AIM stood out technically above his other clients:

"The AIM user community is probably more tech savvy, in general, than my other clients. Of course, there's specific exceptions on both levels, but AIM is very much a leader in IT, especially in Japanese areas. They really are doing some innovative stuff with IT and their users are picking up on it and improvising more". (Express Owner R2 2003)

My finding is that technical skills provide the foundation for improvisation. Without exception, those users who were more technically competent improvised more. Further, the improvisations they created were more complex and more likely to evolve into permanent changes, such as IT modifications (McGann/AIM FN #1, 2003 #4; McGann/AIM FN #2, 2004 #5).

Innovativeness (+) – One of the most significant enablers of improvisation at AIM is their culture of innovation and creativity. I was continually impressed with how pervasive this mentality was, from upper management down to the system users and floor staff. This type of continuous improvement through innovation was encouraged at all levels and is an important part of the evaluation and compensation system. During participant observation at AIM, each user that I worked with was anxious to show me the improvisations they had come up with, or ideas they had for improvement. AIM data showed a clear link between this CV and improvisation (McGann/AIM FN #1, 2003 #4; McGann/AIM FN #2, 2004 #5). The spirit of innovativeness was exemplified by this associate:

"Management definitely, you know they want you to try to come up with better ways. We even have like an idea kind of contest thing that we have for most creative way to solve problems". (AIM A/P Clerk R2 2003)

Improvisation Competence (+) – Along with the spirit of continuous improvement, I found that most users were aware of the concept of improvisation and workarounds. Although they did not refer to them in those terms, calling them "improvements" and "tweaks", they understood the idea behind it. I found it was easy to explain the types of events that I was looking for. I also found that many users had examples of improvisation that they were prepared to discuss. The functional liaison at AIM was the most skilled improviser in this study. He saw creating workarounds (and he did refer to them as "workarounds" without any prompting from me) as a key part of his responsibility on this project. Within the first five minutes of our interview, he was demonstrating and discussing an elaborate improvisation he had developed:

"We have a lot of unique things, like this supplier pass through parts process that I have to figure out how to do on the portal. This was a tough one, but after a couple days, I found that I could set up an alternate supplier and link it to the original one. It's a pretty slick workaround". (AIM Functional Liaison R2 2003)

User Engagement Factor

System Enthusiasm (+) – In the AIM case, I found that the organization had done a effective job at managing the change (with regards to XXX). The effect of this was a high level of enthusiasm and ownership among all key users. It became obvious during all interviews and observation that the users, with the exception of the planners, were enthusiastic about the portal, and wanted to do their part to make it work. I therefore came to the conclusion that enthusiasm for a system motivates users to improve it and innovate to make the most out of the functionality it offers. I found that this attitude promoted improvisation, and the users that improvised the most were those that were most enthusiastic (McGann/AIM Part Obs 2004).

Level of empowerment (+) – A key dynamic that I observed at AIM was the high level of improvisation that occurred at the user level (as opposed to depending on the functional liaison to develop workarounds, as was the case at BBC) as early as the latter stages of Phase I. Interviews showed that users felt empowered to create new and better ways of doing their job (i.e. improvise) as evidenced by this quote from a receiving clerk:

"All of us have been working on different ways to make things better with the portal. I figured out a couple of new processes since last time we talked that have made the receiving process a lot smoother". (AIM Receiving Clerk R2 2003)

My finding is that improvisations began with individual ideas, and the initial implementation of them required individual empowerment. Therefore the policy of empowerment at AIM was a key enabler of improvisation (McGann/AIM FN #1, 2003 #4; McGann/AIM Part Obs 2004).

Implementation Effectiveness Area

Support Factor

Effectiveness of Training (+) – Although the supplier consensus was that their training was not adequate, AIM users felt it was helpful. User training at AIM was given high ratings as a user mentioned:

"I probably had a couple hours worth of training I think it was. And then I went that day and I was using it. So, I mean it's a piece of cake. It's super easy to learn, and the training team did an excellent job". (AIM Planner 2 R2 2003)

In this analysis, I reviewed all training materials, and went through the training myself. I found it to be detailed and informative. It included a number of sections on the configurable options such as reports and views, which form the key to configurable improvisations. Further, the materials were set up to act as a user manual for ongoing reference. In light of these observations, I assess the training to be strong enough to enable improvisation (McGann/BBC FN #2, 2003 #2).

Support Effectiveness (+) – I found this to be one of the highest impact variables. As with BBC, all users, such as the one quoted below, were complimentary of the ongoing support provided by the functional liaison in creating workarounds:

"Ted has done an excellent job with support. I feel pretty comfortable with the portal now, and he deserves a lot of the credit for that". (AIM A/P Clerk R2 2003)

The liason had a high level of functional and technical knowledge, which allowed him to address emerging design issues and create workarounds. He also used an issues tracking database to assure that proper follow up and tracking of support took place:

"We have been using an issues database to log all calls and assure proper follow with the users. Once they started to utilize this process, the support process became a lot more effective". (AIM Functional Liaison R2 2003)

The effectiveness of the support process was important in maintaining the positive momentum behind the implementation. User's first impression of the portal was largely based on the quality of support they received (McGann/AIM FN #1, 2003 #4; McGann/BBC FN #1, 2003 #1). My conclusion is that effective support was a key enabler of improvisation.

Use Factor

User Buy-In (+) – The overall effect of above CVs (e.g. strategic reason for implementation, seeing benefits, overall enthusiasm and support) was user acceptance in key areas. Quotes like the one that follows from a key user made it obvious that the user community supported the strategic initiative:

"I see the portal as a very good thing. It has changed a lot of things we do, and that has been a little hard, but it has solved a lot of our problems too. I really think they did a great job figuring out how to use it to help us with these material problems. I see it getting better too, because we're adding new functions". (AIM Receiving Clerk R2 2003)

This type of buy-in has been a key enabler of improvisation. As users committed to the portal as an important part of their job, they tried try to make it better for themselves and for the organization (McGann/BBC FN #3, 2004 #3).

Post Conversion Factor

Missed Requirements (-) – As with BBC, AIM designers did a thorough job of analyzing and meeting requirements in the design and initial implementation phases. They also had the advantage of working with a "more mature" version of the software, which means it had significantly more functionality (than the version at BBC). Also, the new receiving module and inventory control functionality was designed to meet specific AIM requirements. Overall, I found that from the beginning, there were few missed requirements and the trend (over the course of the study) was towards even fewer. This is confirmed by the functional liaison:

"We posted a survey on the portal a few months ago for users to suggest enhancements. At this point we have received only a few minor suggestions. I think we have nailed most of the key requirements" (AIM Functional Liaison R3 2004)

Since improvisation is driven by new system requirements (Orlikowski 1996), I conclude that this lowers the frequency of improvisation.

Number of Issues (-) – As a result of the thorough requirements definition and strong training and support, the number of issues has declined steadily since phase I of the project. As issues were in the form of new requirements, they created a need to improvise. As a result, there is a strong correlation between fewer issues and less improvisation (McGann/AIM FN #2, 2004 #5).

Types of Issues (-) – Along with the number of issues, I was concerned with assessing the type of issues. My finding was that issues such as major design flaws and missed requirements (e.g. the receiving module) result in higher levels of improvisation. At AIM there have been few major issues since Phase I. This trend is explained by the functional liaison as follows:

"The issue database volume was pretty high at first, with as many as 30 calls a day. Now we are down to only a few and it's usually pretty minor stuff. I haven't had to develop any workarounds for awhile". (AIM Functional Liaison R3 2004)

This trend in issues could explain the drop in improvisation from Phase I to Phase II.

AIM Supplier CV Assessment

AIM Supplier CV Summary

My overall finding for suppliers was quite different from that of AIM users. They had more difficulties in adjusting, use levels were low, and they did not accept the cause of the portal implementation. I observed that AIM management had not been effective at positioning this tool as mutually beneficial for suppliers. As a result, they saw it as nothing more than another "mandate". These factors combined to inhibit improvisation, which was supported by the data, as suppliers accounted for a low percentage of the workarounds that occurred.

This situation was compounded by the fact that the AIM planners, who were the primary source of demand data for the suppliers, were not supportive of the implementation. Simply put, they don't use it. Spreadsheets and phone calls/e-mails are being used as before for demand planning. Planners' attitude toward the portal is summed up in this quote: "I have yet to see the value in it. To me, it's just an electronic fax". This attitude affected suppliers' desire and ability to use the system. As planners do not effectively provide demand information to suppliers through the portal, suppliers cannot use it for its designed purpose of demand planning.

The Supplier CV Assessment is summarized in table 5l as follows:

Contextual Variable Area	Contextual Variable Factors	Overall Assessment	Illustrative Quote
Inter-organizational Factors	Relationship Factor	-	"We've always worked very closely with suppliers, yeah I think we've got a pretty good reputation for that and I think that's another strength of the Japanese philosophies Relationships are long-term and there is a lot of trust involved. **(Project Manager)** "If they want to get paid on time, they must use the portal. It's pretty much that simple". **(Project Manager)** "It's (XXX implementation) really put a burden onto our suppliers to become more flexible, which is tough for many of them". **(Project Manager)** "We really consider AIM one of our best customers, but things like this portal make it tough on us. But, they're calling the shots, so we just have to adjust". **(Supplier 2)** "I think at this stage from a supplier's standpoint, I think we're still in the mode where, you know, we say why are we doing is and it's extra work kind of thing. I think it'll take a bit of time before the, we see the benefit, because as of now, I don't". **(Supplier 1)** "At this point, we are doing this as a courtesy to our customer only. There is no benefit to us that I can see". **(Supplier 4)**
	Supplier Factor	-	"We work with a lot of local and regional suppliers. This gives a lot more flexibility and helps us keep inventory levels down so we can run lean". **(Planner 1)**
General System	System Type Factor	-	"I still don't know a whole lot about how to use all those things like messaging and creating custom reports that you are talking about. I must have missed that". **(Supplier 1)** "I don't have a lot of experience with this type of system, so it doesn't seem very user friendly to me". **(Supplier 2)** "I don't know of any suppliers that are integrating their legacy systems with the portal. I don't think they are to that point yet, and frankly I am not sure they will take it that far. At the same time, I don't see any of them improvising any processes to get data into their systems. They just don't use it (the data)". **(Functional Liaison)**
Supplier User Type	User Savvy	-	"I've only been using this for a few months, so I am still getting the hang of it. I am sure I will be able to do more later. For now, I am just doing what I can to get by". **(Supplier 4)** "I know how to print out the labels and do the ASN, that's about it". **(Supplier 3)** "I got lost pretty early in the process, and I'm usually pretty good with computers. I think I need more training or something". **(Supplier 2)**

Contextual Variable Area	Contextual Variable Factors	Overall Assessment	Illustrative Quote
	User Engagement	-	"The suppliers are a little tougher to deal with as they haven't really picked up on it was quickly and don't seem as enthused as the plant users". **(Functional Liaison)**
Implementation Effectiveness	Support Factor	-	"I have been struggling with this system all along, and I didn't get much from the training. I do think the support has been excellent, though". **(Supplier 1)** "Now that we've got things stabilized, we probably need to go in for another round of training with the suppliers. I think there are some issues there". **(Functional Liaison)**
	Use Factor	-	"I use this to send out the MPL and do the shipping transactions only. I don't use any of the other stuff and I am not sure what a lot of it does". **(Supplier 3)**
	Post Conversion Factor	-	"Calls from suppliers are way down this past month, so I think the main issues are taken care of there". **(Functional Liaison)**

Table 5l – AIM Supplier CV Assessment

AIM Supplier CVs

Inter-Organizational Environment Area

Relationship Factor

Exchange Mode (+) – AIM has "voice mode" relationships with its suppliers, which encourages open dialogue and values long-term relationships (Helper 2002). These traits were established previously as enablers of improvisation. Evidence of this was the fact that most suppliers had been with AIM for over ten years, felt that there was good communication with their customer on day-to-day issues and there was a high level of trust. This dynamic is summed up by a supplier, who had been with AIM for 15 years:

"They expect a lot, but they are a good customer. We have been supplying them for over 15 years…more than any of our other customers. They have always been fair with us, and I would say that yes, there is a lot of trust that has been built up. They do listen too, when we make suggestions or have issues. They're real good about that". (AIM Supplier 2 R2 2003)

Partnership Perception (-) – Despite the fact that they had positive relationships, my interviews and research showed that negative effects of AIM imposing the system inhibited supplier's improvisation significantly (McGann/AIM FN #2, 2004 #5). I found that when given the choice between Dictatorship or Partnership to describe the relationship, all except one chose the former. This translates into a spirit of forced compliance, which created resentment among suppliers. I found that little effort was made to achieve commitment from their supplier base by AIM management. This quote from the senior manager is symptomatic of this problem:

"If they want to get paid on time, they must use the portal. It's pretty much that simple". (AIM Project Manager R3 2004)

Many suppliers were quick to point out the faults of XXX, but felt powerless to change them. Most interviewed did not see the benefit and felt the portal was more of an inconvenience than anything else. I found this to be the most critical inhibitor of improvisation for suppliers, which negated the general voice mode relationship. As one supplier summed it up:

"*"I think at this stage from a supplier's standpoint, I think we're still in the mode where, you know, we say why are we doing this and it's extra work kind of thing. I think it'll take a bit of time before the, we see the benefit, because as of now, I don't".* (AIM Supplier 1 R2 2003)

Level of Trust (+) – One common factor that all suppliers had was their trust in AIM. They all commented on the fact that they had been treated fairly and honestly and thus felt comfortable doing business with AIM, as this supplier states:

"I feel real comfortable with AIM and we've been working with them for awhile. Billy in purchasing always tells it like it is and I have always appreciated that". (AIM Supplier 4 R2 2003)

This seemed to cause some of them to want to make this implementation work for their customer, despite the fact that they saw no benefit. I found that this made them accomplish the minimum to get by, though, which falls short of the level of interest needed to promote improvisation.

Mutual Benefit Perception (-) – I found no supplier that saw any real benefit of this implementation to them. All could pinpoint benefits for AIM, and so pleasing them was an incentive to make the implementation a success. As stated by one supplier, courtesy to the customer was important, but not a large enough incentive to do more than the minimum:

"At this point, we are doing this as a courtesy to our customer only. There is no benefit to us that I can see". (AIM Supplier 5 R2 2003)

General System Area

System Type Factor

The system type variable assessment is quite different for the suppliers that the BBC users. They had difficulty seeing it as a usable, configurable, interactive tool. Therefore I assessed it as inhibiting improvisation for the supplier users as follows: **Usability (-)**, **Configurability (-), Interactivity (-).**

User comments such as these were typical of the suppliers interviewed:

"I still don't know a whole lot about how to use all those things like messaging and creating custom reports that you are talking about. I must have missed that". (AIM Supplier 1 R2 2003)

"I don't have a lot of experience with this type of system, so it doesn't seem very user friendly to me". (AIM Supplier 2 R2 2003)

The challenges indicated above were not necessarily an indication that the system was not strong in the mentioned areas, but that users perceived it that way. I found that this was due to factors such as ineffective training, lack of mutual benefit and lack of enthusiasm (McGann/AIM FN #1, 2003 #4).

User Type Area

User Savvy Factor

Experience Level (New System) (-) – Supplier users' experienced additional problems due to their lack of experience with the new system. I found they were much slower at learning the fundamentals than the AIM users, and even when they did, their knowledge was limited. The following quotes area depiction of this situation:

"I've only been using this for a few months, so I am still getting the hang of it. I am sure I will be able to do more later. For now, I am just doing what I can to get by". (AIM Supplier 4 R2 2003)

"I know how to print out the labels and do the ASN, that's about it". (AIM Supplier 3 R2 2003)

"I got lost pretty early in the process, and I'm usually pretty good with computers. I think I need more training or something". (AIM Supplier 2 R2 2003)

I found that the supplier users were rarely involved in the improvisation process, which further supports my assertion that there is a link between experience/competence and improvisation (McGann/AIM FN #2, 2004 #5).

Tech Skills (+) – Despite the challenges they faced with the new system, I found the suppliers to be generally skilled. Most expressed that they were comfortable with technology, as one supplier expressed:

"I am an IS person, and I work with computers and interfaces often. I just haven't taken the time to get this one integrated". (AIM Supplier 1 R2 2003)

Statements like these led me to believe that the lack of improvisation by suppliers must be rooted in other factors than their general computer literacy.

Improvisation Competence (-) – Interviewed suppliers had great difficulty in understanding improvisation and workaround. I was unable to clarify these concepts adequately. Therefore, I reverted to asking questions such as "What creative ways do you handle situations where the system can't do what you need it to do?" An example answer was:

"I am not sure what you mean by that…I guess I would call someone else for help". (AIM Supplier 5 R2 2003)

This was another obvious cause for low improvisation frequency.

User Engagement Factor

System Enthusiasm (-) – Supplier users showed little enthusiasm for the project. I found the primary cause of this was the lack of mutual benefit. Suppliers saw this as something that was being forced on them, and they resented it. This was accurately conveyed by the functional liaison:

"The suppliers are a little tougher to deal with as they haven't really picked up on it was quickly and don't seem as enthused as the plant users". (AIM Functional Liaison R2 2003)

Implementation Effectiveness Area

Support Factor

Effectiveness of Training (-) – Supplier consensus was that their training was not adequate. Most thought that the amount they received did not prepare them for effective use. Probing this further with the project manager, I found that a number of suppliers did not even attend the training. Further, as this was mandatory training, some sent someone else to fill in for them. Often the person sent was not the primary user of the system, so effective knowledge transfer did not take place. This problem was acknowledged by the project manager, and he plans to attempt to resolve this issue with another round of sessions:

"Now that we've got things stabilized, we probably need to go in for another round of training with the suppliers. I think there are some issues there". (AIM Project Manager R3 2004)

Support Effectiveness (-) – Despite the problems with training, supplier users were cognizant of the support provided by the project manager and the functional liaison, as noted below:

"I have been struggling with this system all along, and I didn't get much from the training. I do think the support has been excellent, though". (AIM Supplier 5 R3 2004)

Use Factor

User Buy In (-) - Their support of suppliers was only effective at keeping the system up and running for the minimum supplier processes, as described by this user:

"I use this to send out the MPL and do the shipping transactions only. I don't use any of the other stuff and I am not sure what a lot of it does".(AIM Supplier 4 R3 2004)

This attitude of only doing the minimum was indicative of a lack of user commitment, and was a result of a combination of several factors discussed above. The net effect of this was a lack of improvisation by the suppliers.

Post Conversion Factor

The number and severity of issues from suppliers was relatively low throughout the implementation, therefore I assessed these variables as: **Number of Issues (-)** and **Types of Issues (-).** Most issues were related to administrative issues like resetting passwords and helping with simple transactions. No issues resulted in a workaround. By the end of this study, issues traffic had subsided almost completely except for new suppliers who were just learning the system (McGann/AIM FN #2, 2004 #5).

AIM Organizational CV Assessment

AIM Organizational CV Summary

AIM's organization was positioned well to encourage improvisation and to promote its evolution, which resulted in a high number of permanent changes during the IS evolution process. I found that two primary CV factors drove this evolution. First, AIM had a culture that understands and encourages innovativeness (Innovativeness CV). Second, the Honda Value Chain 2 initiative and material discrepancy drivers made the XXX implementation a strategic priority, (Reason for Implementation CV) that offered them immediate benefits as described in the narrative above. Therefore, the resulting implementation had significant strategic implications for the organizations. This fact was widely known by all AIM associates.

The Organizational CVs at AIM are summarized in table 5m below:

Contextual Variable Area	Contextual Variable Factors	Overall Assessment	Illustrative Quote
Organizational Environment	General Organizational Factors	+	"What I would like to say is we have adopted the best of the Japanese culture and the best of the American culture… the Japanese part is the openness, we have an open door policy, you know, basically our Board members are all accessible to line associates. If you look at our manufacturing process, Our layouts are very, you know again, very lean and efficient" **(Project Manager)** "…on the American side of things we tried to implement more systems, we got more sophisticated and innovative, you know, to put more tools on the floor for associates to become more efficient". **(Project Manager)** "I think from the main plant standpoint, there's not a whole lot of bureaucracy. If we need to make a change, we make it. I think this has promoted a lot of the improvisation that took place". **(Project Manager)** "One of the weaknesses that we adapted from the Japanese culture is that we like to promote within, which is a good thing in some respects, but there's a lot of adjustments that you have to make, and associates you bring in from the line and turn them into an accounts payable clerk, for example. So that's an inhibitor of improvisation". **(Senior Manager)** "This whole process has put a burden on us to turn around our information, get it into the hands of our suppliers much more quickly. And that's really what's driven a lot of our project activity is to try use innovative and efficient ways to pass information directly from our customer to our supply base. **(Division Vice President)** "I would probably identify AIM as having a superior level of innovation and creativity. Because of the environment that they're in with Honda in automotive, they have to continuously innovate, come up with new methods, new processes, better ways of doing that. That's built into their culture, into the Japanese culture with just in time and continuous improvement. I see improvisation as a cycle of continuous improvement, so AIM is effective at it. " **(Express Owner)**
System Environment	New System Factors	+	"My expectation based on their approach is that AIM will be doing more enhancements and spending more money enhancing their supply chain, than other clients. And one of the reasons I feel that way is that AIM has been very focused on doing things like serving the entire supply base and not just on satisfaction for current product. " **(Express Owner)** "This implementation is an important part of our future strategy and impacts our ability to meet our customer's requirements like VC2. As a result, we are putting a lot of focus in it and it has already paid off". **(Project Manager)**

Table 5m – AIM Organizational CV Assessment

AIM Organizational CVs

Organizational Environment Area

General Organizational Factor

Complexity (+) – AIM's management worked to alleviate traditional bureaucratic barriers that exist in Japanese organizations. Senior management representatives interviewed were proud of the fact that their subordinates are empowered to make key decisions from the senior manager level down to the most junior associate. Especially in the context of the XXX implementation, the structure of the project team facilitated quick decision-making at all levels. My assessment was that this encouraged users to experiment with new system features, as they felt they would make a difference. (McGann/AIM FN #1, 2003 #4).

Change Culture (+) – Although AIM has only had one parent company, they have been through a number of internal restructurings. The spirit of continuous improvement and openness that is part of the Japanese culture (Helper 2002) implies constant incremental change. I found that this had given them the ability to adapt (McGann/AIM FN #1, 2003 #4), which is a key competence that organizations need to improvise effectively (Weick 1998)..

Internal Job Movement (-) – AIM makes internal personnel changes often. This makes it challenging for users to accumulate system experience in any given position. As this study has shown a strong correlation between experience with the system and improvisation ability, this has acted as an inhibitor. An example of this situation occurred at AIM, as the project manager was removed from direct involvement with the portal implementation in the middle of Phase II, as a result of internal restructuring. His replacement knew very little about the system and the implementation. I found that this move broke the momentum of the project team, which inhibited the improvisation evolution process. Below is the former the project manager's assessment of this issue at AIM:

> *"One of the weaknesses that we adapted from the Japanese culture is that we like to promote within, which is a good thing in some respects, but there's a lot of adjustments that you have to make, and associates you bring in from the line and turn them into an accounts payable clerk, for example. So that's an inhibitor of improvisation, because you don't always have the most qualified person using the system. This was certainly the case with the latest move on the portal project".* (AIM Project Manager R3 2004)

Innovativeness (+) – One of the most significant enablers of improvisation at AIM is their culture of innovation and creativity. I was impressed with how pervasive this mentality was, from upper management down to the system users and floor staff. This dynamic was characterized by a production manager as "continuous improvement through innovation" and forms part of the evaluation and compensation system.

System Environment Area

New System Factor

Modification Policy (+) - AIM project management held a "no modification" policy through the first two phases, which limited evolution of improvisations into IT modifications. This seems to have shifted system evolution to process embellishments in the early phases. However, as the Express owner speculates, this situation is expected to change, as management will be considering software changes in the near future.

> *"My expectation based on their approach is that AIM will be doing more enhancements and spending more money enhancing their supply chain, than other clients. And one of the reasons I feel that way is that AIM has been very focused on doing things like serving the entire supply base and not just on satisfaction for current product".* (Express Owner R2 2003)

Future Use Plans (+) – As AIM sees XXX as a key part of its future supply chain strategy, driven by Honda's VC2 initiative and the new material control process. Management has made it clear to everyone in the AIM organization as well as its suppliers that they are building a significant portion of their strategy around the portal:

"…my position on MX from the very beginning has been that it is an important part of our future strategy, and we had a supplier kickoff meeting back in July, made a statement at that point in time, our main goal was to gain a presence with it. We needed to get things started basically get a foundation out there because we knew that the Value Chain two is going to make a lot of changes and we needed to give our suppliers and our buyers some tools and what we've done, I think we do have a foundation, have we seen the real value of XXX yet? I think we're still, yeah we're still evolving with XXX and I think our associates see how important this is strategically to us". (AIM Project Manager R2 2003)

I found this level of emphasis on XXX to be a key element of their future supply chain strategy, which caused users to improvise more frequently, as they saw that the portal was an important part of their collective futures (McGann/AIM FN #2, 2004 #5) and they wanted to be a part of its evolution.

AIM Improvisational Environment Summary

My conclusion is that AIM's environment strongly promotes improvisation. Key factors that enable improvisation in the use of XXX are as follows: 1) The AIM organizational environment is well suited for improvisation. AIM has a culture that not only promotes innovation, but also provides incentives for producing ideas that increase efficiency and effectiveness. As a result, users are familiar with the ideas of improvising and generating workarounds both with processes and technologies. My interviews revealed that users had experience with the improvisation process, and that most had improvised to improve their existing processes. 2) The users at AIM were enthusiastic towards XXX and accepted its importance to them as individuals and as a company. 3) System use is high, and due to the integral nature of XXX in AIM's supply chain strategy, and the expectation that integration of XXX with their ERP system will occur, this level of use should grow in the future. 4) I found users at AIM to be excellent improvisers. They were savvy with the XXX system and with technology in general. They were empowered to use that knowledge to create solutions to everyday problems they faced. 5) The system support at AIM was strong. The functional liaison and other tech support staff were proficient at addressing unresolved issues and working with users to generate workarounds.

I observed several factors that inhibit improvisation, but I found them to be far less significant than the enablers. They are as follows: 1) Planners do not support the implementation, which is causing a significant disconnect in the system. 2) Suppliers do not benefit from the system, as they do not receive accurate demand data from it. 3) Suppliers were given little training and were expected to convert their processes over to the portal very quickly (the turnaround time between initial meetings, training and implementation was about 2 weeks). 4) Suppliers feel that XXX is being forced on them and they do not see the rationale behind the implementation. They see no mutual benefit. They also felt that they were powerless to change anything, so they were just accepting it as the price of doing business with AIM. Until the planner/supplier situation is resolved, I don't expect to see significant improvisation by these two groups.

AIM Improvisation Analysis

This section examines the improvisation dynamics that occurred at AIM over the two phases of the project. I will look at the improvisation dynamics that took place (see appendix 4 for a detailed listing of all improvisations). I will present counts, graphs and analyze improvisation triggers, frequency, types and evolutionary stages sorted by project phase and user group. This will serve as a tangible representation of improvisation dynamics at AIM.

Figures 5h and Table 5n below summarize the improvisation triggers that were present across various project phases, Figure 5i and Table 5o below summarize frequency of types of improvisation by project phase, Figure 5j and Table 5p summarize the final stages of evolution that these improvisations reached and Figure 5k and Table 5q show frequency of improvisation by user group. The following are summaries of this data, followed by explanations of improvisation dynamics for each phase, primarily using the CV framework as an interpretive lens.

AIM Improvisation Dynamics Summary

As with BBC, most improvisation triggers at AIM were caused by evolving requirements. However, there were few missed requirements and even fewer unmet requirements. AIM had a significantly high frequency of evolving requirements in Phase I, which can be attributed to their innovative user base. AIM had a high frequency of improvisation relative to BBC, with 22 discovered in Phase I alone (compared to BBC’s count of five in Phase I). This seems to coincide with the Organizational Environment and User CV assessment, which predicted that their culture would enable improvisation. However, there was a significant downward trend in the frequency of improvisation between Phase I and Phase II (down to only 8 improvisations in Phase II). This trend is supported by a number of CVs. First, the modification policy assessment, which concluded that as the modifications were not available to meet new requirements, users would need to improvise more. This transition towards modifications took place in the middle of Phase II, which is the point where I observed a significant decrease in improvisation frequency. Second, the Implementation Effectiveness assessment, which concluded that the design and support team had done an outstanding job meeting key requirements in Phase I. Thus the need to improvise decreased significantly in Phase II.

AIM Improvisation Triggers Across Phases

The following summarizes and interprets the role of improvisation triggers that were present across implementation phases:

Phase I – This phase's triggers were predominately evolving requirements (16), due to the innovative users, who proactively improvised solutions or worked with their functional liaison to design workarounds. Users' ability to learn quickly also contributed to the evolution of requirements. Users often found new ways to make their processes more efficient. There were only three missed requirements, which resulted from business processes, such as supplier drop shipping, which were unique to AIM, and were not previously considered. The one unmet requirement was due to a database design error, and was easily corrected.

Phase II – In phase II, there was a drastic drop in improvisation frequency, but the distribution of triggers was roughly the same, with four evolving requirements, two missed requirements and one unmet requirement. I found the reasons for the distribution to be the same as well. Increased learning was the primary driver for evolving requirements. Missed requirements were exposed as interaction between BBC and suppliers increased. One unmet requirement was a legacy system interface, which was resolved with a minor process adjustment.

Improvisation Type and Evolution

The following is a summary of improvisation types and the evolutions that took place across Phases I and II:

Phase I - Improvisations were mostly IT (9) and process workarounds (12), with 1 configured improvisation. Process embellishments (12) and IT modifications (6) were the most frequent final stages of evolution, with 3 ad hoc adjustments and 1 metamorphosis. In this phase, improvisation was divided fairly evenly between the functional liaison and AIM users. Suppliers only accounted for one improvisation in this phase.

Interpretation: During phase I the overall level of improvisation was at its peak. The first explanation for this is the adjustment period that organizations go through when systems are first implemented (Orlikowski 1996). During this period, users struggle to resolve the high level of exceptions (Saastamoinen 1995) through the use of localized improvisations (Orlikowski 1996). This is confirmed in the data by the functional liaisons statements about the high level of issues that were present during the initial implementation process (Number of Issues CV). Another reason for the high frequency of improvisation was the “no modification” policy (Modification Policy CV), which presents an interesting contrast to BBC’s “free modification policy” in Phases I-III. The final explanation for the high improvisation level is a combination of the innovativeness, the level of enthusiasm, buy in and technical expertise of AIM users (Organizational Environment, User Type and Implementation Effectiveness CVs). I found that all these variables combined to enable/promote frequent improvisation by key users in Phase I. All improvisations were IT and process workarounds, which is consistent with AIM users’ ability to innovate processes and apply technical skills. However, there was only one configured improvisation. Observing this, I revisited the training materials and found that there was little emphasis on the configurable options in XXX during the training. This is one possible explanation. I also re-examined my interview protocols to assure that there were sufficient questions in this area. I concluded that there were, but there is a possibility that users did not understand what I was looking for when questions like "what creative and configurable options in the portal do you use to make it do what you need it to do?" This area of inquiry will likely be re-worded in the future.

Improvisations in Phase I evolved mostly into Process embellishments. This occurred for three reasons: First, the software was robust enough that it did not need to be heavily modified (System Type CVs). Second, users were experienced in innovating with new processes. This was a product of their culture of continuous improvement (Organizational Environment and User Type CVs). Third, modifications were not permitted (Modification Policy CV) unless it was a "critical modification" (e.g. system would not function properly without it) due to the cost involved. As users did not see modification as an option to meet new requirements, they improvised more. Although there were six modifications in Phase I, they were all related to the new receiving/materials process or to design flaws that users exposed. So, Express absorbed the cost.

The equality in improvisation between the functional liaison and the AIM users was a result of the overall culture of innovation, where all are expected to continually innovate (Organizational Environment and User Type CVs). The lack of improvisation by suppliers is consistent with the Inter-organizational CV assessment, which concluded that suppliers were not bought in to the rationale of the implementation and saw no benefit.

Phase II – Improvisation frequency dropped significantly in this phase (from 22 to 8). They were mostly process workarounds (6), with only two IT workarounds occurring. There were no configured improvisations. Improvisation evolution was equally divided among all stages with two each, with the exception of metamorphosis (1). In this phase, improvisations were again divided equally between AIM users and the functional liaison. Suppliers continued to improvise infrequently, accounting for only two.

Interpretation: My assessment was that the primary reason for the drop in improvisation frequency was that the designers, users and support staff did such a thorough job of implementing the system in Phase I, that there was little adjustment necessary in Phase II (Implementation Effectiveness CVs). A secondary reason was that I found users and the functional liaison had begun to look forward to modifications as an option to meet evolving requirements. They had begun to put off developing workarounds until they saw whether a modification was going to be developed.

AIM Improvisation Dynamics Summary

The second application of the Improvisation Dynamics Model at AIM served to deepen understanding of the improvisation dynamics process, the constructs within that process and the relationships between them. In this analysis, a number of variables and relationships emerged as salient (e.g. reason for implementation and improvisation frequency), while others were observed not to be prominent as expected (e.g. internal job movement and improvisation frequency). Successful replication of this analysis in the AIM case further validated the framework and positioned me well for the next step, which dealt with cross-case comparison.

Chapter 5 Summary

In summary, through application of the Improvisation Dynamics Model across two cases, this section has validated its theoretical potential to describe the improvisation and evolution processes from an initial trigger to the final stage of organizational transformation. Through this analysis, I was better able to understand the integration of the concepts in the model, such as how CVs impact improvisation frequency, type and evolution, and how the process moves from the User to the Organizational context as the dynamic shifts from improvisation to evolution. This analysis also enabled me to further refine the dynamics model and its contextual variable framework, while exposing new classification schemes for improvisation and evolution triggers. Considering all components of improvisation dynamics, I was able to draw conclusions about the nature of improvisations that occurred at BBC and AIM, as well as make predictions about future improvisation dynamics at these sites. The next step is to decide which of these findings are generalizable, and to what contexts they will generalize, as I move towards a theory on improvisation dynamics.

AIM Improvisation Triggers By Project Phase

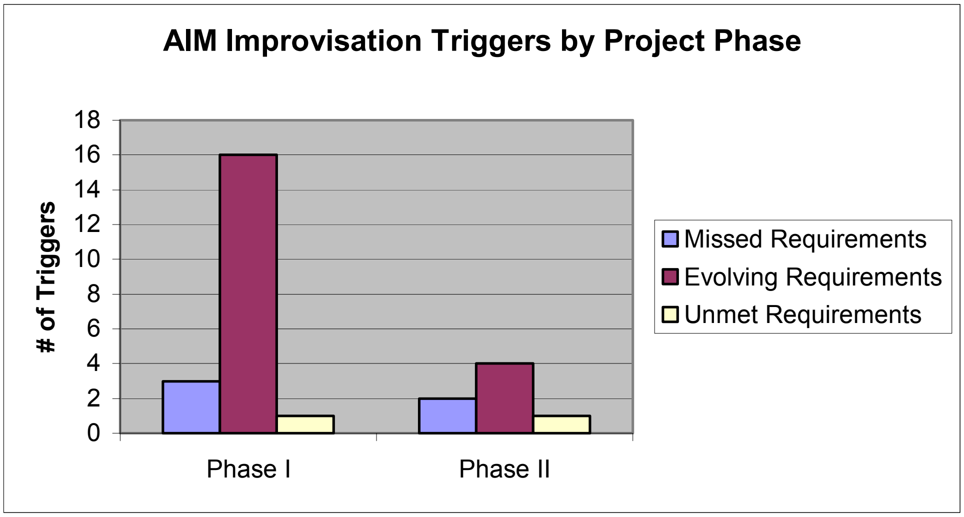


Figure 5h – AIM Improvisation Triggers

	Phase I	Phase II
Missed Requirements	3	2
Evolving Requirements	16	4
Unmet Requirements	1	1

Table 5n - AIM Improvisation Triggers

AIM Improvisation Frequency By Project Phase

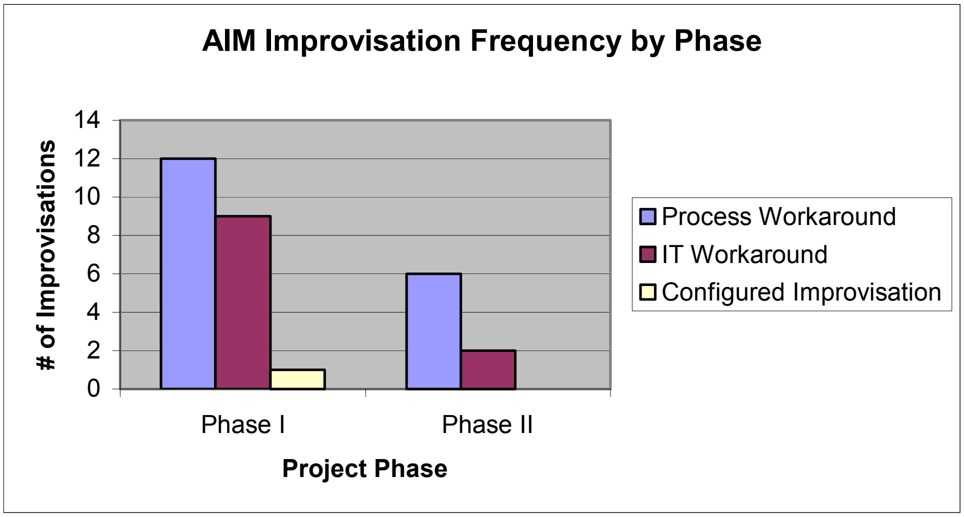


Figure 5i – AIM Improvisation Frequency

	Phase I	Phase II	Total Type
IT Workaround	9	2	**11**
Configured Improvisation	1	0	**1**
Process Workaround	12	6	**18**
Total Improvisations By Phase	**22**	**8**	

Table 5o - AIM Improvisation Frequency

AIM Final Stage Frequency By Project Phase

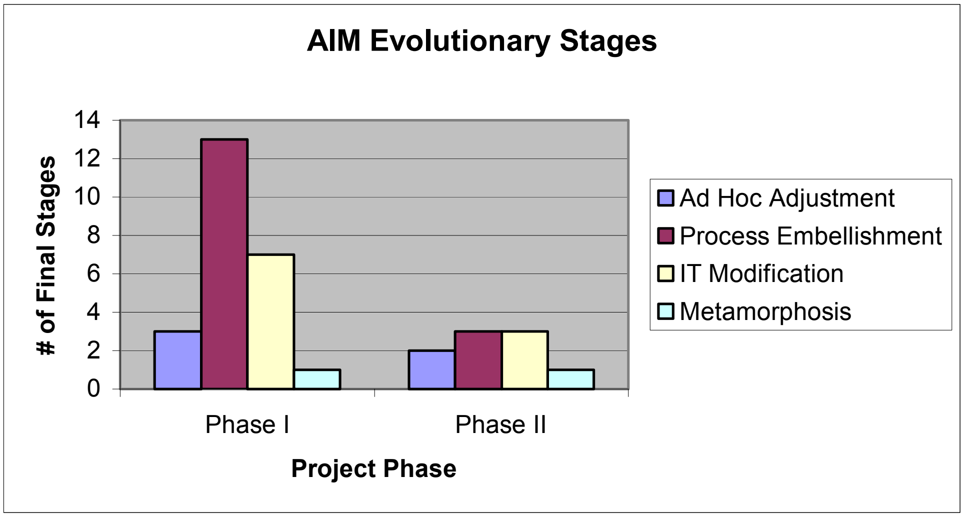


Figure 5j – AIM Final Stage Frequency

	Phase I	Phase II	Total Final Stages
Ad Hoc Adjustment	3	2	**5**
Process Embellishment	13	3	**16**
IT Modification	7	3	**10**
Metamorphosis	1	1	**2**

Table 5p - AIM Final Stage Frequency

AIM User Improvisation Frequency By Project Phase

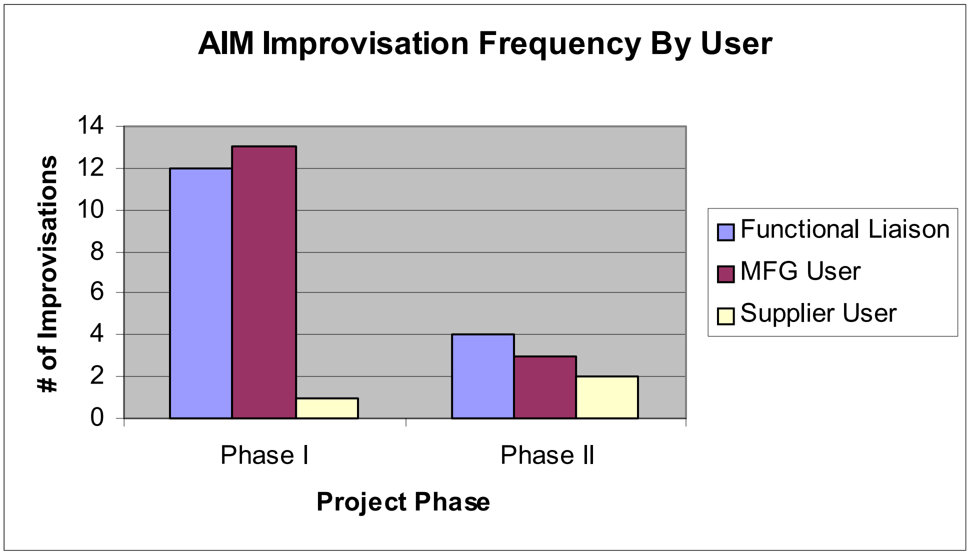


Figure 5k – AIM Improvisation Frequency by User

	Phase I	Phase II	Total By User
Functional Liaison	12	4	**16**
MFG User	13	3	**16**
Supplier User	1	2	**3**

Table 5q - AIM Improvisation Frequency by User

VI. Towards a Theory on Improvisation Dynamics

In this chapter, my goal is to use the analyses in the previous chapter to formulate a theory on improvisation dynamics. The theory seeks to explain the impact of various components of the improvisation process as identified in the previous data analysis. Specifically, I seek to describe how and why improvisation: 1) is triggered, 2) patterns vary, and 3) evolution occurs. Using improvisation dynamics concepts such as improvisation triggers and contextual variables, and evolution triggers, contextual variables and evolutionary stages, I seek to provide an integrated characterization of the relationships between these components, thus moving towards an overall theory of improvisation dynamics.

Theory building is executed in the sections that follow by comparing similarities and differences[29] in both cases' improvisation dynamics using tables and pattern matching (Eisenhardt 1989). These comparisons are then summarized into a set of propositions, which form the principle components of the theory. The theory is further elaborated by formulating a refined version of the Improvisation Evolution Model (see figure 6b). It shows important sequential relationships in the evolution processes. Finally, I will summarize key relationships between the constructs of the theory (see figures 6c, 6d and 6e), by highlighting the complexity of the causal interactions between key constructs that characterize improvisation dynamics.

I will next outline the strategy employed to formulate the propositions in the following sections. First, I reviewed all the analyses in chapter 5 to formulate relationships between key constructs. Thus, the propositions flow directly from the observed patterns of improvisation dynamics. For

[29] As the first two phases at BBC were spent on design and development of the version of XXX that AIM used in its Phases I and II, the AIM user base developed skills much quicker and the implementation team was able to integrate the system much quicker (due to previous experience at BBC), it could be argued that the comparison of Phases I-IV at BBC to Phases I and II at AIM is valid (as opposed to limiting this to comparing phase by phase). Given this rationale, I divide the phases up into "initial" and "latter" for purposes of this analysis.

each of the improvisation dynamics that were assessed, I compared similarities and differences across cases. I then used contextual variables to explain these juxtapositions. In these comparisons, I was looking for salient relationships between observed patterns and contextual variables. I defined salient relationships as those which: 1) were consistently similar, or different across cases, 2) were exhibited strongly (as evidenced by frequent occurrence), and 3) were cited frequently in interviews as being prevalent. Each such relationship was then converted into a proposition.

This chapter is divided into two primary sections, which align with the Improvisation Dynamics Model. Section I explains the improvisation process (i.e. how improvisation by users is triggered and affected by contextual variables). Section II outlines the improvisation evolution process, (i.e. how improvisations are shifted to the control of the organization, and thereafter institutionalized into organizational procedures, and reified into IT design).

Theory Section I – How and Why Improvisation Occurs

This section focuses on the drivers behind improvisation, seeking to explain what causes various improvisation patterns. In particular, I will examine the role of improvisation triggers, their frequencies and types, and link them to contextual variables across cases. This helps induce theoretical relationships between formulated constructs.

Theory Component 1a - Explaining Improvisation Triggers

This section outlines the similarities and differences in improvisation trigger patterns, and explains their connection to improvisation types and frequencies. This comparison is summarized in Table 6a.

Improvisation Trigger	Similarities	Differences	Explanation
Missed Requirements	• Highest levels in initial phase. • Ranked distant second in frequency across all phases for both sites	• AIM showed a decreasing trend. BBC showed an increasing trend, with most appearing in the final phase. • AIM had fewer overall. • Ranked second across all phases	• Missed requirements in latter phases at BBC were a result of design process breakdowns after functional liaison was removed. Users were in charge of design at that point. AIM had solid design support all along.
Evolving Requirements	• Highest frequency across all phases for both sites.	• BBC had few until latter phases, when there was significant increase. AIM had many in the initial phase, then decreased.	• Improvisation levels were highest in latter phases for BBC and lowest in latter phases for AIM. • Direct tie between evolving requirements and workarounds.
Unmet Requirements	• Insignificant frequency across all phases for both sites	• **None**	• Solid software design and development, so few unmet requirements.

Table 6a – Improvisation Trigger Comparison

Improvisation Trigger Findings

In both cases, I found that most improvisations were triggered by evolving requirements, with missed requirements placing second in frequency and unmet requirements a distant third (see table 6b for a summary).

Improvisation Trigger Summary

	Evolving Requirements	Missed Requirements	Unmet Requirements
BBC	57%	37%	6%
AIM	75%	19%	6%

Table 6b[30]

At AIM and BBC, the response to triggers was almost always workarounds, which accounted for approximately 95% of improvisations across sites. Trends in evolving requirements were opposite across the two cases, with AIM peaking in the initial phase and BBC peaking in the latter phases. AIM showed a decreasing trend in missed requirements, while BBC showed the opposite trend. Possible explanations and related findings based on my interpretation of the data are as follows:

Correlation to Improvisations - Overall, the pattern of improvisation triggers in this study seems to indicate a correlation between triggers and improvisation frequency. This study showed that in both cases, as the number of triggers increased, so did the number improvisations.

Proposition TRG1: If the number and frequency of improvisation triggers increase, so will improvisation frequency.

Lack of Configured Improvisations - In almost all situations, the response to improvisation triggers was workarounds instead of configured improvisations. As the system was recognized as

[30] These percentages were calculated using counts of improvisations from the Master Improvisation List in Appendix 1. The figures in this table are statistically significant, with a chi square value of 7.7417, 2 degrees of freedom, $p<.025$.

highly configurable by all those interviewed, my conclusion is that users typically respond to triggers through the creation of workarounds.

Proposition TRG2: When improvisation triggers increase, workaround frequency will increase significantly more than configured improvisation frequency.

Support Effectiveness and Unmet Requirements - The frequencies of different trigger types in this study were quite different. Unmet requirements analysis showed that they were almost non-existent throughout the scope of this study. Only one occurred in most phases at either site, which could be attributed to the fact that the support team was doing an effective job at keeping the system up and keeping system issues to a minimum. This kept the need for the development of workarounds in response to these triggers down.

Proposition TRG3: *Support Effectiveness*[31] will decrease the number of unmet requirements, which will decrease workarounds.

Support Effectiveness and Missed Requirements - In both cases, I observed a significant number of missed requirements in the initial phases. However, at AIM missed requirements trended downward, while at BBC they trended upward. The first explanation I offer for this is that *support effectiveness* and *user enthusiasm* decreased over time at BBC, which caused these missed requirements as the system evolved and new process and IT workarounds were needed.

Proposition TRG4: As *support effectiveness* and *user enthusiasm* decreases, the frequency of missed requirements will increase, thus increasing the number of workarounds to address them.

User Experience and Missed Requirements - The second explanation for the increase in missed requirements in the latter phases at BBC was the fact that users gained experience with XXX and

[31] Italicization of key words in propositions indicates that they are CVs. See tables 5a-5c and appendix 2 for detailed information on CVs.

recognized missed requirements they had missed earlier. AIM users gained experience more quickly, so their missed requirements surfaced in the initial phases.

Proposition TRG5: When *user experience* with a system increases, they will more frequently find missed requirements, thus increasing the number of workarounds to address them.

Workarounds and Evolving Requirements - Evolving requirements were by far the most prevalent trigger. They were most frequent in the latter phases for BBC and early phase for AIM. My data shows that there is a connection between improvisation frequency and evolving requirements. The data suggests that as users create more workarounds and they evolve, the system itself evolves and new requirements are exposed. In this study, AIM users were more skilled in the early phases. Thus they improvised more workarounds, and consequently more new requirements resulted. Although BBC users needed more time to develop enough skills to improvise and drive new requirements, this trend also surfaced in the latter phases.

Proposition TRG6: When the frequency of workarounds increases, the number of evolving requirements will increase.

Evolving Requirements and Workarounds - Conversely, the connection between evolving requirements and workarounds across cases was similar. This suggests the following correlation between them.

Proposition TRG7: When evolving requirements increase, the frequency of workarounds will increase.

Triggers for Different Improvisation Types - Finally, the data shows that although configurable improvisations were rare, they were always triggered by an evolving requirement.

Proposition TRG8: Configured improvisations will be primarily triggered by an evolving requirement, while workarounds will be triggered by unmet, missed or evolving requirements.

Improvisation Trigger Proposition Summary

These propositions are summarized in table 6c. From these propositions, I observed that improvisation triggers correlate strongly with improvisation frequency as expected. However, an unexpected finding was that they are also linked to contextual variables and specific improvisation types.

Proposition	Description
TRG1	Correlation of triggers to improvisation frequency
TRG2	Lack of configured improvisations
TRG3	Support effectiveness and unmet requirements
TRG4	Support effectiveness and missed requirements
TRG5	User experience and missed requirements
TRG6	Workarounds and evolving requirements
TRG7	Evolving requirements and workarounds
TRG8	Triggers for different improvisation types

Table 6c – Improvisation Trigger Proposition Summary

Theory Component 1b - Explaining Manufacturer Improvisation Frequency

This section uses CVs to explain manufacturer improvisation frequency by comparing the results of the improvisation contextual variable analyses to detect similarities and differences, and their possible effects on improvisation frequency. In this process, I compared the CV assessments to determine which CV factors showed consistent impact patterns[32] on improvisation dynamics across sites. The results in table 6d list key similarities and differences in contextual variables. I use these to CV explain impact on improvisation frequency across cases.

[32] Consistent impact patterns of CV factors means that both cases showed strong correlations, which were either consistently positive, consistently negative or one was positive while the other was negative. All of these were determined to be the most significant patterns for theory building.

Manufacturer CV Comparison

Contextual Variable Factor	Similarities	Differences	Possible CV Explanations
General System Area **System Type Factor**	Described by key users as: • Highly usable • Highly configurable • Highly interactive	• **None**	**System Type Factor** - Overall, the system type CVs enabled improvisation for both sites, as users perceived XXX to be usable, configurable and interactive.
System Environment Area **New System Factor**	• XXX was described by key users as an excellent fit for both companies.	• BBC's reason for implementation was for cost purposes. AIM's purpose was highly strategic. • BBC had "Free mods" in Phases I and II and AIM had "No mods" until late Phase II • BBC was using an outdated version of XXX with no plans to upgrade, while AIM upgraded frequently. • AIM users were using XXX frequently with a trend towards more use, while BBC users were scaling use back over time.	**Fit CV** - The system's excellent fit inhibited improvisation for both sites, as there was less need to develop workarounds. **Reason for Implementation CV** – this inhibited improvisation for BBC, as the users did not support it, therefore their enthusiasm diminished. The opposite was true for AIM users. **Modification Policy CV** - Free modifications inhibited improvisation for BBC users in the early phases, as their requirements were met through modifications. No modifications drove increased improvisation for AIM, as they were forced to create workarounds to meet requirements until late in the project. **Release Currency CV** - Lack of upgrades inhibited the ability for BBC users to do configured improvisations. Using current version enabled configured improvisation for AIM users as they had more options. **Release Currency CV** - Lack of upgrades in the latter phases drove increased workarounds by BBC users, as they had to work around shortcomings of outdated software. Consistent upgrading throughout inhibited the need for workarounds, as deficiencies were met in new versions. **Level of Use CV** - High level of use enabled improvisation for AIM as users developed comfort with the system and increased their skills and enthusiasm, which in turn increased their improvisation competence and innovativeness. Lack of use inhibited improvisation for BBC. This lack of use was caused by low levels of enthusiasm and buy in.
System Environment Area **Alternative System Factor**	• **None**	• BBC users had a alternative system that they reverted back to. AIM had no competing alternative systems.	**Alternative System Competes CV** – An alternative system inhibited improvisation with XXX for BBC. This was caused by the fact that they stopped using it due to lack of enthusiasm. Lack of competing alternative system enabled improvisation for AIM.
Manufacturer User Type Area **User Savvy Factor**	• **None**	• AIM users were more proficient with XXX in a shorter timeframe. • AIM users were more technically competent • AIM users were more proactive about innovating	**Experience Level New CV** - AIM user's skills with the portal enabled improvisation. BBC users failed to develop deep skills with XXX. **Tech Skills CV** - AIM user's technical skills enabled improvisation. BBC's lack of technical skills inhibited improvisation.

		with XXX. • AIM users had strong improvisational awareness, BBC knew little about this concept.	**Innovativeness CV** - High levels of user innovation drove increased improvisation at AIM and led to infrequent improvisation at BBC. **Improvisation Competence CV** - Improvisation Competence enabled user improvisation at AIM and inhibited it at BBC.
Manufacturer User Type Area **User Engagement Factor**	• **None**	AIM users had a much higher level of enthusiasm towards XXX	**System Enthusiasm CV** - AIM's user enthusiasm promoted improvisation and higher levels of use. BBC's lack of enthusiasm inhibited it.
Implementation Effectiveness Area **Support Factor**	• Both had effective training programs • Both had excellent support systems	• **None**	**Support Effectiveness CV** - Training and support promoted improvisation at both sites.
Implementation Effectiveness Area **Use Factor**	• **None**	AIM users showed high levels of buy-in, BBC users were not bought in.	**User Buy In CV** - The high level of buy-in from users at AIM increased use and enabled improvisation. BBC users were not bought in, which inhibited use and improvisation.
Implementation Effectiveness Area **Post-Conversion Factor**	• Both had few missed requirements • Both showed a trend of decreasing issues. • Both had no major issues after initial phases.	• **None**	**Issues CV** - In both cases, the effective design and implementation resulted in few issues and missed requirements. This inhibited the need for improvisation.

Table 6d – Manufacturer CV Comparison

Manufacturer User Improvisation Frequency Findings

My initial finding regarding improvisation frequency is that users at AIM improvised twice as much as BBC users, with 30 through the first two phases and only 15 for BBC[33]. Based on my interpretation of the study data and the CV framework, the following are what I found to be the primary explanations for why this occurred:

Reasons for Implementation - The two firms had very different reasons for the implementation, which also played a key role in improvisation frequency. BBC's reason was primarily to eliminate the cost of EDI, but there were no real benefits for its users. At AIM, the opposite was true. Although cost cutting was an issue, the primary reason was to improve their supply chain

[33] This assessment is statistically significant, with a Chi-square of 6.6667, 1 degree of freedom, $p < .001$.

processes and gain control over raw material inventory. This entailed a number of key benefits to organization as a whole and to the users.

Proposition MFGFRQ1: Information systems that are recognized as having a highly-strategic *reason for implementation* that is beneficial to the organization and to the users will have a higher frequency of improvisation than those that are not.

Modification Policy - The modification policy was a factor at BBC which enabled them to meet evolving requirements through modifications (instead of improvisation) in the initial phases. However, this changed in the latter phases. AIM had a policy that did not allow it at first, but this also changed in the latter phases. In both cases, when the pro-modification policy was in effect, improvisation frequency dropped.

Proposition MFGFRQ2: Improvisation frequency will be lower for organizations that chose *IT modification* as a strategy to meet new requirements than those that do not.

Release Currency – Upgrading was a significant issue at both sites that drove the level of configured improvisations and also workarounds. At BBC, they chose not to upgrade in the latter phases. As a result, they were forced to workaround shortcomings of the software that could have been met by the new version. At AIM, they upgraded and were thus able to take advantage of more configurable improvisations.

Proposition MFGFRQ3a: If *release currency* is upgraded, the level of workarounds will decrease.

Proposition MFGFRQ3b: If *release currency* is upgraded, the level of configured improvisations will increase.

Level of Use - At AIM, improvisation frequency increased as levels of use increased. This was because users gained new skills through an increased exposure to the system. This enabled them to more effectively create workarounds and configured improvisations. At BBC, where the use lowered in latter phases, so did improvisation frequency.

Proposition MFGFRQ4: If information systems *level of use* increases, so will improvisation frequency.

Alternative System Competition - BBC never stopped using their legacy system for key functions in supply chain management. At one point in Phase II and III, they gave the portal chance, but decided that it was not a better solution. They therefore reverted back to the mainframe and virtually abandoned XXX except for supporting supplier use. AIM had no alternative to XXX, so their use and commitment levels were higher.

Proposition MFGFRQ5: Systems that share a *competing alternative system,* which is perceived by users as a better solution than the proposed system, will have lower frequency of improvisation than systems that have no alternative systems.

Experience Level of Users– At AIM, users were able to gain skills through experience quickly, and as a result their improvisation frequencies were high in the initial phase. BBC users did not improvise reach their peak improvisation level until phase III, as they gained experience slowly.

Proposition MFGFRQ6: When *user experience* with a system increases, so does the frequency of improvisation.

Technical Skills of Users – AIM users were more technically competent, which enabled their improvisation to reach a more sophisticated level than that of BBC's. At BBC, the frequency was also much lower (even after Phase IV of the implementation).

Proposition MFGFRQ7: Users with high levels of general technical competency will improvise more frequently than those that are less technically competent.

User Innovativeness - AIM has a user base which is highly innovative and creative, especially in the design of processes supporting IT, while BBC's users are the opposite. BBC users perceived that being creative was actually seen as threatening by management.

Proposition MFGFRQ8: Users who are more *innovative* will improvise more frequently than those that are not.

Improvisation Competence of Users - AIM users had a high level of awareness of the concepts of improvisation and workarounds. Because of this, many of them took responsibility for creating their own workarounds (primarily process workarounds). At BBC, they were not familiar with these practices. They therefore relied on the functional liaison for most of their workarounds.

Proposition MFGFRQ9: Users with a high level of *improvisation competence* and experience in creating workarounds will improvise more frequently than users are not familiar with improvisation.

System Enthusiasm - User enthusiasm was high at AIM throughout the study, while BBC's diminished significantly in the latter phases. I found this was due to a reason for implementation at AIM that was supported by the users.

Proposition MFGFRQ10: As user's *system enthusiasm* increases, so does frequency of improvisation.

Support Effectiveness - In the latter phases, BBC's support for the portal diminished significantly. This was exhibited by the fact that they removed the functional liaison from the primary support role and placed that responsibility on users. AIM's support was strong throughout. They even showed signs of getting stronger through the integration of an online feedback system for users.

Proposition MFGFRQ11: Organizations that have high levels of *support effectiveness* for their IS will experience more improvisation.

Manufacturer Improvisation Frequency Proposition Summary

Propositions on improvisation frequency are summarized in table 6e. These propositions illustrate the complexity of the network of dependencies that influence the frequency of improvisation.

Proposition Acronym	Description
MFGFRQ1	Reason for implementation and improvisation frequency
MFGFRQ2	Modification policy and improvisation frequency
MFGFRQ3a	Release currency and improvisation frequency (workarounds)
MFGFRQ3b	Release currency and improvisation frequency (configured)
MFGFRQ4	Level of use and improvisation frequency
MFGFRQ5	Competing alternative system and improvisation frequency
MFGFRQ6	Experience level of users and improvisation frequency
MFGFRQ7	Technical skills of users and improvisation frequency
MFGFRQ8	User innovativeness and improvisation frequency
MFGFRQ9	Improvisation competence and improvisation frequency
MFGFRQ10	System enthusiasm and improvisation frequency
MFGFRQ11	Support effectiveness and improvisation frequency

Table 6e – Manufacturer Improvisation Frequency Summary

Theory Component 1c - Explaining IOS Improvisation Frequency

In this section, I view improvisation from the supplier's perspective in the use of XXX. Therefore these findings will be specific to improvisation in an IOS environment. I will explain how the contextual variables impacted IOS improvisation frequency[34]. Contextual variable comparisons are listed in table 6f below.

Supplier CV Comparison

Contextual Variable Factor	Similarities	Differences	Possible CV Explanations
Inter-organizational Environment Area **Relationship Factor**	• Exchange mode relationships • High level of trust	• AIM's dictator relationship overshadowed all of the positive aspects of their relationship, while BBC's suppliers were still eager to make the implementation successful despite the fact that it was mandated. • BBC's suppliers perceived the system to be mutually beneficial, while AIM suppliers saw it as solely for their customer.	**Relationship Factor** - The combination of all relationship factors enabled improvisation for BBC suppliers, as their relationships remained positive despite the implementation. The forceful nature of the implementation inhibited improvisation for AIM, as it caused resentment. **Mutual Benefit Perception CV** - The lack of mutual benefit perception by AIM suppliers caused a lack of enthusiasm and inhibited improvisation. The perception of benefit at BBC increased enthusiasm and improvisation frequency.
Inter-organizational Environment Area **Systems Factor**	• Lack of IOS integration with legacy systems	• **None**	**Integration with IOS CV** - Lack of IOS integration drove improvisation for suppliers to both companies, as they both were forced to invent workarounds to accomplish this integration.
General System Area **System Type Factor**	• **None**	• Supplier users at BBC perceived the system as highly usable, configurable and interactive, while AIM suppliers had the opposite perception.	**System Type Factor** - The system type enabled improvisation for BBC suppliers, but inhibited it for AIM suppliers. This was due to ineffective training by AIM and effective training and support at BBC.
Supplier User Type Area **User Savvy Factor**	• Both BBC and AIM suppliers had no previous experience with the system, low levels of innovativeness and improvisational knowledge.	• AIM supplier users had a higher level of technical skill than BBC suppliers.	**User Savvy Factor** - Both AIM and BBC suppliers had low levels of experience, innovativeness, and improvisational knowledge. These inhibited their ability to improvise with XXX. **Tech Skills CV** - AIM suppliers had superior technical skills than BBCs, which enabled them to improvise more frequently.
Supplier User Type Area **User Engagement Factor**	• **None**	• BBC supplier system enthusiasm was significantly higher than AIM suppliers. • BBC supplier's level of use was significantly	**System Enthusiasm CV** - Although both supply base's had low levels of savvy, BBC users had high levels of enthusiasm, which caused them to develop these traits over time. AIM users lacked this enthusiasm throughout. Therefore, in the latter phases of the project, BBC supplier users

[34] As some of the CVs in this section are the same as those in the manufacturer section, I did not include their analyses in the findings unless they produced a proposition unique to the IOS environment.

		higher than AIM users.	improvised frequently, while, despite their technical skills, AIM suppliers' frequency remained low. **Level of Use CV** - The enthusiasm exhibited by BBC suppliers caused increased use and more improvisation by them, while AIM suppliers' use was consistently low. This inhibited their improvisation.
Implementation Effectiveness Area **Support Factor**	• Both AIM and BBC suppliers perceived the support systems for XXX to be effective.	• BBCs training was cited by suppliers are being highly effective, while AIM's training was not effective according to suppliers and AIM support stafff	**Support Factor** - Support promoted improvisation at both sites, as functional liaisons assisted in the development of workarounds and promoted general understanding of the system. This increased enthusiasm and use. **Effectiveness of Training CV** - Effectiveness of training was a key to enabling BBC suppliers to improvise, while lack of training inhibited improvisation for AIM suppliers.
Implementation Effectiveness Area **Use Factor**	• **None**	• BBC suppliers showed high levels of buy-in, AIM suppliers were not bought in. • BBC suppliers used the system as designed, AIM suppliers failed to use many of the interactive features.	**User Buy In CV** - The high level of buy-in from users at AIM enabled improvisation. BBC users were not bought in, which inhibited improvisation. **Use as Designed CV** - BBC supplier's use of the system for collaboration and interaction promoted mutual creation of IOS improvisations. AIM's lack of interactive use inhibited IOS improvisation. However, BBC users stopped using the system as designed, which inhibited suppliers' ability to create improvisations that required participation of both organizations.
Post-Conversion Factor	• Both had few missed requirements • Both showed a trend of decreasing issues. • Both had no major issues after initial phases.	• **None**	**Issues CVs** - In both cases, the effective design and implementation resulted in few issues and missed requirements. This lowered the need to improvise workarounds.

Table 6f – Supplier CV Comparison

Supplier User Improvisation Frequency Findings

Overall, BBC suppliers improvised much more than AIM suppliers. The following explains why:

Manufacturer/Supplier Relationship Factor – All relationship CVs in the two cases had a positive effect on improvisation frequency with the exception of *partnership perception* and *mutual benefit* at AIM. I found that despite the strength of their "voice" relationship with their suppliers, the fact that they attempted to force the IOS on them without getting their buy in or showing mutual benefit, detracted greatly from system enthusiasm and improvisation frequency.

Proposition SUPFRQ1a: Manufacturers that attempt to force an implementation of an IOS on suppliers without achieving *user buy in* and showing *mutual benefit* will see lower levels of improvisation from supplier users than those that do achieve *buy in* and show *mutual benefit*.

Proposition SUPFRQ1b: If an IOS is forced on suppliers by a manufacturer, without achieving *buy in* and *showing mutual benefit*, its suppliers will collaborate less with them in the improvisation process. Therefore, fewer improvisations will involve IT and process workarounds that cross organizational boundaries.

Level of Integration with IOS – Neither supplier base had effectively integrated their legacy systems with the IOS. As a result, I observed a large number of workarounds developed to transfer data between their systems.

Proposition SUPFRQ2: Suppliers who have not integrated their legacy systems with the IOS being implemented will improvise workarounds more frequently than those that are integrated[35].

System Type Factor – Although the system was perceived by AIM users to enable improvisation, AIM suppliers did not share this perception. Therefore, suppliers had difficulty with all except the most basic functionality. This inhibited improvisation. The outcome of this was fewer IOS improvisations, because improvisations were localized to AIM. At BBC, the opposite was true. Suppliers were more effective with the system, improvised more and as a result more of their improvisations were accomplished in cooperation with the BBC planners and functional liaison.

Proposition SUPFRQ3: Suppliers that perceive an IOS to be *usable*, *configurable* and *interactive* will create IOS improvisations in cooperation with manufacturers more frequently than those that do not have this perception.

[35] However, one could also speculate that if integration was achieved, there would be increased potential for other types of IOS improvisation. However, this was not observed at either site.

User Savvy – BBC suppliers were more skilled with XXX than AIM suppliers and therefore, created more improvisations. This allowed BBC to enjoy the benefits of having an additional set of users contributing to the continuous improvement of their IOS.

Proposition SUPFRQ4: IOS implementations that have *savvy* suppliers participating with will have a more complete set of improvisations and more evolved system over time than those that do not.

Use of Systems for Interaction – One of the primary benefits of this IOS is its ability to facilitate collaboration between suppliers and manufacturers. This collaboration is a key to IOS improvisation, as it allows users to interact directly in the development of workarounds. BBC users were more effective at this than AIM, and this contributed to their development of IOS improvisations.

Proposition SUPFRQ5: Higher *use of interactive* features of an IOS promotes increased frequency of improvisation.

IOS Improvisation Frequency Proposition Summary

The propositions on IOS improvisation frequency are summarized in table 6g. These findings show that IOS improvisation is caused by similar variables as manufacturer users (e.g. System type and user savvy factors). However, I also found that the IOS variables such as relationship factors, level of integration of legacy systems with the IOS and use of interactive features are all key antecedents of increased improvisation frequency in an IOS environment. This shows the increased complexity when systems cross organizational boundaries.

Proposition Acronym	Description
SUPFRQ1a	Relationship factor and improvisation frequency
SUPFRQ1b	Relationship factor and IOS improvisation frequency
SUPFRQ2	Level of integration with IOS and improvisation frequency
SUPFRQ3	System type factor and improvisation frequency
SUPFRQ4	User savvy and improvisation frequency
SUPFRQ5	Use for interaction and improvisation frequency

Table 6g – IOS Improvisation Frequency Summary

Theory Component 1d - Explaining Improvisation Type Patterns

This section summarizes similarities and differences in observed improvisation type patterns over time. I will use contextual variables to explain these variations (see Table 6h). In this process, I establish a connection between CVs and improvisation types.

Improvisation Type Patterns

	Similarities	Differences	Possible CV Explanations
Improvisation Types Across Phases	Both sites had very few configured improvisations across all phases.	**Improvisation Type Trends (Initial Phases)** Initially, AIM showed a heavy emphasis on process workarounds, while BBC's emphasis was on IT workarounds.	**Release Currency CV** - AIM had a more mature version of the software, with more IT functionality, so less IT workarounds were necessary. Therefore, there was more emphasis process workarounds. **Reason for Implementation CV** - BBC was not focused on creating and revamping processes in the early phases (as this was not seen as a strategic project). They were more focused on adjusting the new technology (IT workarounds). As this was seen as a strategic process re-engineering project at AIM, they designed entirely new processes (A/P, Receiving, Shipping, etc). **Modification Policy CV**- BBC was focused on adjusting the technology to their processes due to "free modification" policy. AIM was focused on adjusting processes to fit the technology, due to the "no modification" policy.
		Improvisation Type Trends (Latter Phases) This trend reversed in the latter phases, as BBC shifted to a process workaround focus and AIM to an IT workaround focus.	**Post Conversion Factors** - AIM completed the majority of process improvements in the initial phase. BBC had significant new processes (e.g. VMI and Supplier Scorecard) that emerged in latter phases. **Modification Policy CV** - AIM began to focus on modification of the IT in the latter phase, while BBC was no longer using modifications at that point (therefore becoming more process focused).

Table 6h – Improvisation Type Pattern Comparison

Improvisation Type Pattern Findings

The emphasis on improvisation types shifted over time in both organizations. At BBC, the shift was from IT to process workarounds while the opposite was true for AIM. Neither site took advantage of available options to create configurable improvisations. My interpretation of these patterns is as follows:

Release Currency and IT Workarounds - From the beginning, AIM had a more “mature version” of XXX, so there were fewer IT workarounds needed. They therefore were able to concentrate on process workarounds. BBC was working with a Beta version of XXX, as they served as a test site. Therefore, there was much less stable functionality and they needed to improvise IT workarounds to compensate for this. This pattern confirms the proposition offered with regards to release currency.

Proposition TYP1: Users working with later versions of software with increased functionality will improvise fewer IT workarounds than those working with earlier releases.

Reason for Implementation and Process Workarounds - This was an urgent strategic change for AIM, and accordingly they were focused on designing and revamping processes in conjunction with the implementation. In the initial phases, they developed a number of new processes for the receiving, A/P and inventory control functions. BBC was not focused on making any major process changes with this implementation. In fact, their goal was to minimize this type of disruption.

Proposition TYP2: Systems implementations associated with orchestration of new processes will result in more process workarounds than those that integrate the system with existing processes.

Modification Policy and Process Workarounds - BBC focused on adjusting the IT to match their existing processes. They were able to use IT modifications to accomplish this. AIM was not interested in modifications, but instead adjusted processes to fit with the technology. BBC used modifications early in the project, but in latter phases they were not allowed. They therefore shifted to process workarounds to meet new requirements. As the implementation progressed, AIM shifted to deploying IT workarounds because they did not need to improvise new processes. They had had met all key requirements in the initial phase. However, BBC saw significant new requirements emerge in latter phases. They therefore had to improvise new processes for functions such as VMI.

Proposition TYP3: Systems implementations that do not allow *IT modifications* will have more process workarounds than those that do allow *IT modification* as a response to evolving requirements.

Configured Improvisation Frequency -In both cases I observed few configured improvisations. This indicates that although the users perceive the system to be highly configurable, they chose not to take advantage of these options. This can be partly explained by the fact that at BBC, users were interested in minimum interaction with the system, due to lowered enthusiasm.

Proposition TYP4: Users who are not *enthusiastic* about an implementation will use configured improvisations less than those that are *enthusiastic*.

Improvisation Type Pattern Proposition Summary

Propositions on improvisation type patterns are summarized in table 6i. These findings show that the currency of the software release, reason for implementation and modification policies impact the number of workarounds. It also indicates a connection to user enthusiasm as a reason why so few configured improvisations occurred. However, it also shows that this study failed to expose other reasons, and therefore may be an opportunity for future research.

Proposition Acronym	**Description**
TYP1	Release currency and IT workarounds
TYP2	Reason for implementation and process workarounds
TYP3	Modification policy and process workarounds
TYP4	Configured improvisation and improvisation frequency

Table 6i – Improvisation Type Pattern Proposition Summary

Theory Component 1e - Explaining User Improvisation Patterns

This section summarizes similarities and differences in improvisation user patterns over time. I will use contextual variables to explain observed variations (see Table 6j) and establish a connection between antecedent CVs. In this process, I establish a link between CVs and user improvisation frequency.

User Improvisation Patterns

	Similarities	Differences	Possible CV Explanations
User Improvisation Frequency Over Time	• **None**	**Functional Liaison/User Frequency Trends** At BBC, the functional liaison improvised most until the final phase. At AIM, the functional liaison and users improvisation frequencies were nearly equal throughout.	**Experience Level CV (New)** - BBC users were inexperienced in the initial phases. AIM users were able gain experience more quickly. **Level of Empowerment CV** - At BBC, the users depended more on the functional liaison as a general rule. At AIM, users would try to resolve problems first, then contact the functional liaison as a last resort. By the latter phase, most issues were resolved at the user level. **Support Effectiveness CV** - At BBC, the functional liaison was removed from the support role in the latter phase. At AIM, the functional liaison was in the same role throughout the project.
		Supplier Frequency Trends Supplier users at BBC showed a steady increase in improvisation frequency over time, and eventually became the leaders. AIM suppliers improvised very little throughout the project.	**Mutual Benefit Perceived CV** - BBC suppliers gained experience and saw benefit over time. The portal was labeled as a tool for them, which caused an increase in enthusiasm. AIM suppliers used the system for minimum functions (shipping only), so experience was minimized. They saw no mutual benefit. **Support Effectiveness CV** – the BBC functional liaison supported the portal heavily, which increased use by suppliers. At AIM, the primary support personnel were planners, who were not effective at assuring that accurate data was available through the portal. Therefore, supplier use and improvisation was low.

Table 6j – User Improvisation Pattern Comparison

Improvisation User Pattern Findings

At BBC, the functional liaison improvised significantly more than the plant users. At AIM, the functional liaison and the plant users improvised nearly equally. BBC Suppliers showed an increasing trend in improvisation, and eventually became the leaders. AIM suppliers improvised infrequently throughout the implementation. This distribution in improvisation frequency is explained as follows:

User Experience CV - BBC users were inexperienced with XXX in the early phases of project, and did not show proficiency until phase III. AIM users learned quickly, and showed proficiency in the early weeks of phase I. Many had already developed improvisations of their own before the initial phase ended.

Proposition USR1: When user experience level increases, the improvisation frequency by the functional liaison will decrease.

Level of Empowerment CV - BBC users claimed that they did not feel empowered to improvise, and were told to depend on the functional liaison for this. AIM is an environment that promotes empowerment of the users. The first reaction of users when issues arose was to try to solve these problems by themselves. The functional liaison was only involved in more complex improvisations.

Proposition USR2: When users feel empowered to resolve new requirements, they will improvise more and the functional liaison will improvise less.

Support Effectiveness CV - BBC support was lifted in the final phase, when the functional liaison was removed from his role as the primary support person for the portal. Users were then charged with this task. Because they had developed the needed system skills in earlier phases, this enabled them to surpass him in improvisation frequency. The AIM functional liaison provided the same level of support throughout the implementation.

Proposition USR3: When the support of the functional liaison diminishes, users' level of improvisation will increase.

User Improvisation Pattern Proposition Summary

The propositions on improvisation frequency are summarized in table 6k. These findings show that user experience with a new system combined with effective support are important in promoting improvisation. Users must also feel empowered to make these types of process and IT adjustments.

Proposition Acronym	Description
USR1	User experience and improvisation frequency
USR2	Level of empowerment and improvisation frequency
USR3	Support effectiveness and improvisation frequency

Table 6k – User Improvisation Pattern Proposition Summary

Section I Summary

This section theorized on improvisation dynamics by analyzing improvisation processes from the user's perspective. I described how and why improvisation is initiated by triggers, and elaborated causal relationships between manufacturer/supplier contextual variables and observed improvisation frequency and types. Having established theoretical understanding of the improvisation process, I will next move on to theorizing at the organizational level, where improvisations evolve into permanent organizational change.

Theory Section II – How and Why Improvisation Evolution Occurs

This section formulates a theory of the evolution of improvisations. Based on my analysis, I offer the following definition of improvisation evolution:

The transition of improvisations from the user context to the organizational context and their subsequent movement towards institutionalization into organizational procedures and reification IT design.

As explained in the previous section, improvisation is triggered by specific events, and is also enabled or inhibited by certain contextual variables. Similarly, I found that improvisation evolution events are initiated by a set of triggers that drive organizational movement which will transfer "control" of new organizational change from the user to managers, and status of this change from temporary to permanent. The movement of such change is illustrated in the Improvisation Evolution Model (see figure 6b). The observed movement is regulated by a set of contextual variables, which are based on the structure and culture of the organization, as well as its IT strategy.

In developing theory on improvisation evolution, I first focus on defining improvisation triggers. I will explain how contextual variables affect this evolution by analyzing case data to develop propositions. Finally, I will elaborate the alternative paths of organizational change as identified in the Improvisation Evolution Model. This will explain how improvisations evolve as they become institutionalized.

Theory Component 2a - Explaining Evolution Triggers

As I analyzed events in the improvisation dynamics process, I discovered they were divided into two categories: improvisations and improvisation evolutions, and I observed the need to define separate triggers for both. In studying the evolution process at AIM and BBC, I consistently found that triggers that initiate the movement of improvisations between the various stages were broader organizational phenomena that stemmed from each organization's desire to take an ad hoc adjustment that it considered to be a viable idea, and render it a permanent part of the IT or organizational routine (e.g. management deciding that adding an entire software module and set of procedures to support the implementation of the VMI process). I found that triggers that push improvisations from one stage to another involved the same events at both sites. The evolution triggers were not counted and analyzed like other events in the improvisation process (e.g. improvisations and improvisation triggers). In contrast, I identified, classified and described them as seen in table 6l. I will use the classification scheme that follows to develop my theory on improvisation evolution more completely:

Evolution Trigger Classification Scheme

Evolutionary Path	Organizational Trigger	Organizational Outcome
Paths 1,4 Process Embellishment	**Champion takes ownership of improvisation idea (often the creator of the improvisation)**	• Meets with management to make value proposition • Recognition of value by management • Hand off from User Level to Organization Level
	Formal Planning and Design	• Process design teams formed • Owner assigned • Planning and design
	Institutionalization of new and refined processes	• Process development • Documentation of new procedures • Training on new process • Formal implementation

Paths 3,5 IT Modification	**Champion takes ownership of improvisation idea (often the creator of the improvisation)**	• Champion meets with management to make value proposition • Recognition of value by management • Hand off from user context to organization context
	Formal Planning and Design	• Funds Allocated for modification • IT design teams formed • Owner formally assigned • Planning and design
	Modification of software and implementation of inherent changes	• IT development process • Training on new modification • Formal implementation
Path 6 Metamorphosis	**Decision to initiate significant organizational change**	• Restructuring/creating multiple processes • Creating new and redefining old jobs • Refining key performance indicators (KPIs) • KPIs are significantly impacted • Process and IT integration • Formal rollout

Table 6l – Evolution Trigger Classification Scheme

In creating the trigger classification scheme, I identified specific events that drive evolution and aligned them with the appropriate paths that are possibly followed during the evolution process[36]. In the process, I also identified corresponding organizational events associated with each trigger. Such events provide a tangible means to identify when a trigger occurs. Triggers followed similar progressions, as ad hoc adjustments moved to process embellishment and IT modifications. These were:

1. A user champion decides that she/he wants to take the initiative to meet with management to discuss the value of their improvisation and proposes that it be accepted as a permanent change. If management accepts the idea, they then take ownership of moving the improvisation through the rest of the evolution process. This is the formal transition between the user and organization contexts in the evolution process.

[36] Evolutionary paths are explained in detail in the improvisation evolution model section of this chapter that follows.

2. A formal owner is identified and associated teams are formed, and charged with the planning and design of the new process or IT modification.
3. The process embellishment or IT modification is developed and implemented.

After an improvisation has evolved to the process embellishment or IT modification stages, I then found that the trigger to move the improvisation to metamorphosis was much more significant. This was triggered by a management decision to initiate a large-scale organizational change. This involved restructuring existing processes and the creation of new ones, which often entailed revamping an entire functional area (e.g. the complete reengineering of the receiving and shipping processes at AIM). As a result of this type of change, job descriptions were changed and created, performance measures modified, and a formal implementation, which involved the integration of the new IT and processes, ensued.

Theory Component 2b – Explaining Improvisation Evolution

In this section, I compare similarities and differences in the organizational CVs, which affected improvisation evolution (see table 6m). I will use these comparisons to identify key relationships between specific CVs and evolution steps. I will also show how the final stages of evolution that these improvisations reached were driven by patterns of improvisation types that occurred previously (see table 6n).

Organizational CV Factor Comparison

Contextual Variable Factor	Similarities	Differences	Possible CV Explanations
Organizational Environment Area **General Organizational Factor**	• Lack of complexity in organizational structure • Change adept cultures	• AIM has a culture that promotes innovation, BBC discourages it.	**Complexity CV** - Lack of complexity and ability to embrace change enabled improvisation evolution for both organizations. **Innovativeness CV** - AIM's culture of innovation was key to promoting the institutionalization of improvisations, while BBC's lack of innovation slowed the evolution process.
System Environment Area **New System Factor**		• AIM had long-term strategic plans for XXX, while BBC was not sure whether they were planning to use it long-term.	**Future Use Plans CV** - Future use plans enabled improvisation evolution for AIM, as they were willing to invest in modifications and embellishments. Lack of future use plans inhibited this process for BBC.

Table 6m – Organization CV Factor Comparison

Organization CV Comparison Findings

The comparison of CVs between AIM and BBC showed that both organizations successfully evolved a significant number of improvisations in this study. However, I found AIM to be superior in this regard. My interpretations of these results are as follows:

Organizational Complexity - Both organizations had structures that promoted the evolution of improvisations. They had a low level of rigidity, thus making the approval process for formal changes quicker. Managers were empowered to make decisions about IT modifications and organizational changes within certain parameters. In both cases, this enabled them to show the agility needed to make key changes at the organizational level. This is confirmed through the percentage of improvisations that made it past the ad hoc adjustment stage. At BBC, 90% evolved and AIM 85% evolved[37], which shows their organizational agility.

Proposition EVO1: Organizations that have low levels of *complexity* will evolve more improvisations than those that are complex and bureaucratic.

[37] These statistics are significant with a chi square of 9.839, 1 degree of freedom, $p<.01$.

Innovativeness as a Priority - I found that AIM's organization was more conducive to improvisation evolution, as they recognized the importance of promoting user innovations. They had an incentive system that recognized and rewarded such innovation. This encouraged champions to move more improvisations to the organizational level. As a result, the organization had the ability to evolve significant improvisations in a shorter amount of time than BBC. This is exemplified by comparing their most significant improvisation evolution processes. At AIM, this was the receiving/inventory control process, while at BBC it was VMI. The emphasis that these organizations put on the evolution of their respective improvisations was different. AIM allowed this improvisation to develop significantly in scope to cover many functional areas and drove this large-scale implementation in a short timeframe. I saw this as an indication of their commitment to innovation. At BBC, VMI took a much longer amount of time to evolve. I found that this was not because of a lack of organizational agility, but because it was not a priority. This has caused the implementation to expand over a larger timeframe, and at the time of completion of this study, the system was still in the early rollout stages.

Proposition EVO2: Organizations that recognize and promote user *innovation* will drive more improvisations further in the evolution process than those that do not make innovation an organizational priority.

Future Use Plans for the System - I found that AIM's plans to use XXX as a key part of their future strategy made the organizational managers more willing to invest the time and resources into making these ideas evolve. As a result, improvisation evolutions were more consistent across phases. However, as BBC made the decision to potentially move away from the portal as a long-term strategy, evolution of improvisations diminished.

Proposition EVO3: Organizations that see an information system as a key element of their strategy will drive more improvisations ahead in the evolution process than those organizations that do not recognize the strategic importance of the system.

Improvisation Evolution Pattern Comparison

	Similarities	Differences	Possible CV Explanations
Final Evolutionary Stages Over Time	**Metamorphoses and Ad Hoc Adjustment Observation -** Metamorphoses and Ad Hoc Adjustments were rare at both sites.	**IT Modification Trend** BBC showed a steady increase in IT modifications throughout the project, peaking after 3 phases. AIM had few IT modifications (except those related to design flaws and software errors) throughout all phases.	**Modification Policy CV** - BBC's "free mod" policy, AIM's "no mod" policy in the initial phases.
		Process Embellishment Trend BBC showed an increasing trend of improvisations reaching the process embellishment stage. AIM showed the opposite trend, with process embellishment being the final stage for most of their improvisations in the early phase, then decreasing significantly in Phase II.	**Modification Policy CV** - BBC's shift to "no mod" policy and AIM's shift to allowing modifications. Also, AIM's initial process workaround focus due to no mods and BBC's initial IT workaround focus due to pro-mods.

Table 6n – Improvisation Evolution Pattern Comparison

Evolution Pattern Findings

In examining the patterns of evolution over time, I found that in both cases improvisations evolved primarily into IT modifications and process embellishments. There were few improvisations that stopped evolving at the ad hoc adjustment stage and few that reached the metamorphosis stage. BBC showed more emphasis on IT modifications throughout the project, while AIM emphasized process embellishments. I interpret these results as follows:

Ability to Embrace Change – Both organizations had historically shown that they were adept at embracing change. Therefore, they had no problem accepting the need to permanently instantiate users' improvisations, and rallying support behind them in the evolution process. This explains why very few improvisations remained at the ad hoc adjustment stage.

Proposition EVO4: Organizations that are able to embrace change will evolve more ad hoc adjustments than those that are not.

Implications of Metamorphoses - Because metamorphoses require a great deal of resources, they are less common relative to the other stages of improvisation evolution. In both organizations, metamorphoses occurred only when an improvisation evolution was triggered by an urgent, highly strategic need.

Proposition EVO5: Improvisations will evolve to the metamorphosis stage only when they are driven by a highly strategic and/or urgent need.

Modification Policy Effect on Improvisation Type – At BBC the primary emphasis during the early implementation phases was on changing XXX to fit with BBC's organizational processes. They did so by developing workarounds and evolving them into IT modifications through the use of a pro-modification policy. At AIM, the opposite was true. They focused on changing their process to meet functionality of the software by developing workarounds during the implementation process. These evolved mostly into process embellishments, as they followed a no-modification policy.

Proposition EVO6: Organizations using a pro-*modification policy* will drive workarounds to evolve into IT modifications more frequently than organizations that have a no modification policy.

Relationship between IT modifications and Process Embellishments - In both cases as the number of process embellishments increased, IT modifications decreased and vice versa. This shows an inverse relationship between these two stages of improvisation evolution.

Proposition EVO7a: As organizations increase the number of improvisations that evolve into IT modifications, the number of process embellishments will decrease.

Proposition EVO7b: As organizations increase the number of improvisations that evolve into process embellishments, the number of IT modifications will decrease.

Bypassing Improvisation – At BBC, a number of modifications took place in the initial phases that did not result from any improvisation. As new requirements surfaced, the functional liaison would quickly design modifications, have them developed by Express and implement them in a short timeframe, which was sometimes only a matter of days. This precluded the need for users to improvise, unless the requirement was urgent. I therefore found that the improvisation process can be bypassed and triggers can be satisfied directly through IT modifications if they are implemented quickly enough and the new requirement that is driving it is not urgent.

Proposition EVO8: Organizations that can develop and implement IT modifications quickly enough to satisfy user requirements will have fewer improvisations than those that have slower IT modification processes.

Improvisation Evolution Proposition Summary

The propositions on improvisation evolution are summarized in table 6o below. These propositions demonstrate that all CVs were found to be influential on evolution except internal job movement. Although this CV was observed to be a factor at AIM, it was not observed at BBC. Therefore, it was not indicated as a salient relationship in this study. Another key observation is the relationship between the improvisation and evolution processes that is captured in proposition EVO6. This shows that there is a causal relationship between the user and organizational contexts.

Proposition Acronym	Description
EVO1	Organizational complexity improvisation evolution
EVO2	Innovativeness and improvisation evolution
EVO3	Future use plans and improvisation evolution
EVO4	Change culture and improvisation evolution
EVO5	Implications of metamorphosis
EVO6	Modification policy and improvisation type
EVO7a	IT modifications and Process embellishment
EVO7b	IT modifications and Process embellishment
EVO8	Bypassing improvisation

Table 6o – Improvisation Evolution Proposition Summary

Section II Summary

This section focused on the improvisation evolution process from the organizational perspective. It described how this evolution is initiated by triggers, and elaborated the causal relationships between organizational contextual variables and improvisation evolution. It also explained why and how improvisations can evolve into permanent organizational change.

Proposition Sections I and II Summary

The findings above show the large number of salient relationships that explain improvisation dynamics. To put these findings into context, I will outline the Improvisation Dynamics Model with the propositions located in their appropriate impact areas (see figure 6a). This summary model illustrates the broad coverage of these findings. It also shows the level of focus that this study had on the manufacturer user process and suggests a number of different areas (i.e. more emphasis on the supplier perspective and on evolution) for future research, which will be expanded upon in the conclusion section of this dissertation.

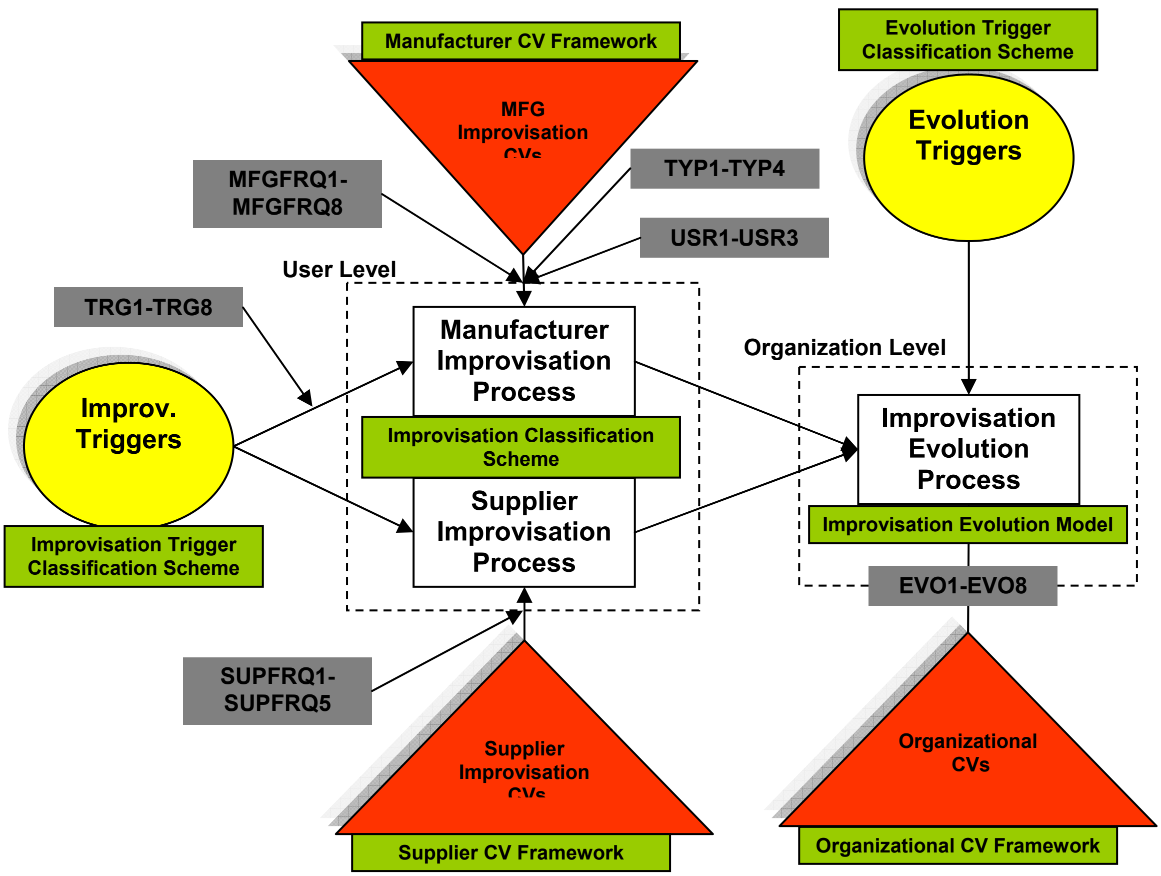


Figure 6a – Improvisation Dynamics Model

The Improvisation Evolution Model

Having established fundamental concepts and relationships of improvisation evolution, I will now move to explaining the process through the use of a refined version of the Improvisation Evolution Model (see figure 6b). This version was refined from the preliminary model developed in chapter 3 that guided my research. The model integrates all concepts discovered in the subsequent analysis process. The flow in this model, which aligns with that of the Improvisation Dynamics Model, is intended to show the punctuated movement of improvisations from temporary to permanent change, and the simultaneous hand off of change from a user to broader organization contexts as improvisations evolve from ad hoc adjustments to IT modifications and/or process embellishments, sometimes resulting in metamorphoses. The analysis that follows will present the core of my evolution theory on improvisation dynamics. Through this theoretical model, I will expand on different ways that my theoretical understanding of improvisations has evolved.

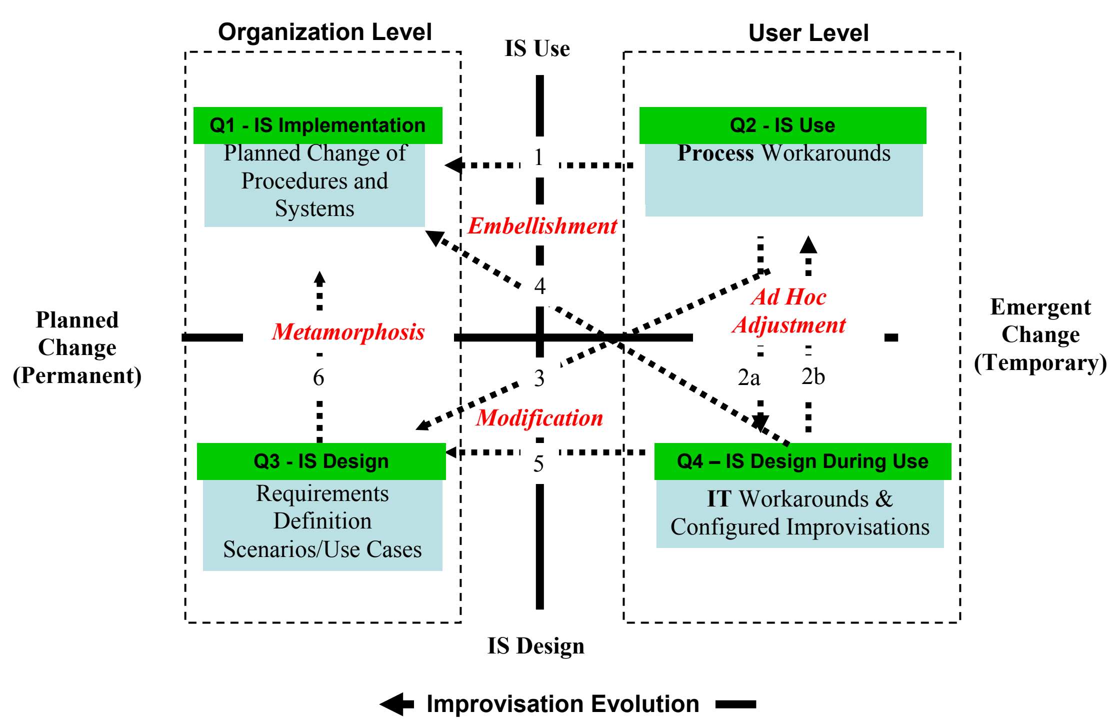


Figure 6b – Improvisation Evolution Model

The overall logic of the above model is the same as the preliminary version, except for the addition of new evolutionary paths and the division of the quadrants into the user and organizational contexts. Therefore, I focus the following description of the model on the possible paths that an improvisation can follow as it evolves.

Path 1 - Process Embellishment (evolving from a process workaround) – As a result of an improvisation trigger, a process workaround is improvised by a user, which begins its evolution process as an ad hoc adjustment in Q2. Triggered by a series of organizational actions called evolution triggers, ownership is transferred from the user who championed the evolution to the organizational design team which designs and implements a new process and institutionalizes it into organizational routines. At this point, the event is no longer an improvisation, as it has moved into Q1, a permanent/organization quadrant.
Example: A process was created by a BBC supplier to capture and report in-transit information for overseas orders. This was recognized and formalized by BBC management and is now used by other suppliers.

Path 2a - Ad Hoc IT Adjustment (resulting from a process workaround) – As a result of an improvisation trigger, a process workaround is created. This creates an IT requirement to match it. The change that results is a configurable improvisation or an IT workaround to satisfy the new requirement. This movement is from Q2 to Q4, which is located in the temporary/user quadrants. Hence, it is still an improvisation owned by the user who created it, and it has not been institutionalized.
Example: The initial inventory tracking process workaround at AIM drove a requirement for an IT workaround, which was a set of reports which were developed ad hoc, to support the process.

Path 2b - Ad Hoc Process Adjustment (resulting from an IT workaround) – As a result of an improvisation trigger, an IT workaround is created. This generates a process change requirement to match it. The improvisation outcome is a process workaround. This movement is from Q4 to Q2, which located in the temporary/user quadrants. This is still an improvisation owned by the user who created it, and it has not yet been institutionalized.

Example: In the early stages of the VMI process at BBC, a report was developed by one of the plants to capture all needed information. This resulted in a process workaround, which would utilize the information in the report.

Path 3 – IT Modification (evolving from a process workaround) – Resulting from an improvisation trigger, a process workaround is developed which in turn creates an IT requirement. Either there is no IT workaround to match this, a configuration change that can satisfy this new requirement is impossible, or the decision is made that it should be considered for IT modification. After a series of evolution triggers, an organizational decision is made to incorporate the improvisation into the permanent design of the system. A team designs and develops an IT modification to accomplish this. At this point, the event is no longer an improvisation and ownership has been transferred to management, as it has moved into Q3. This is an organizational/permanent quadrant.

Example: At AIM, A/P users improvised a process workaround to facilitate communication with suppliers about portal shipments and invoices. This led to an IT modification, which was the creation of an A/P messaging function that allowed users to attach messages to invoices, created a special message type for invoices and facilitated threaded discussion in the A/P invoice module.

Path 4 - Process Embellishment (evolving from an IT workaround or a configured improvisation) – As a result of an improvisation trigger, an IT workaround or reconfiguration of the system is created. This improvisation creates a requirement for a permanent change in organizational routines. After a series of organizational triggers, an organizational team designs and implements a new process. At the end of this path, the event is no longer an improvisation, as it has moved into Q1, a permanent change/organization quadrant.

Example: AIM A/P personnel had difficulties matching what raw materials they had been invoiced for in their ERP system with what had been shipped by the suppliers and received. As a result, a user created an IT workaround which was a custom report that pulled information from both systems to reconcile them. Seeing the magnitude of this issue, AIM management created a formalized process to specify the parameters for reconciling invoice discrepancies that required the use of this report by A/P clerks and suppliers.

Path 5 – IT Modification (evolving from an IT workaround) – Resulting from an improvisation trigger, an IT workaround or reconfiguration of the system is created. This is later recognized by the organization as a legitimate requirement. This trigger drives the need for modification of the software in order to permanently instantiate the change into the IT design. The improvisation is handed off from a user to an organizational IT development team, who develops and implements the change. At this point, it is no longer an improvisation and it is owned by the organization, as it has moved to Q3, which is a permanent/organization level quadrant.

Example: At BBC, there was a missed requirement, which was that part numbers needed to be displayed in both the manufacturer and supplier’s numbering scheme. It was only set up for manufacturer number. A user improvised an IT workaround, which was to use a comments field to hold this number. The organization recognized that this was a significant missed requirement and quickly modified XXX to capture and display both part numbering schemes.

Path 6 – Metamorphosis – The evolution trigger in this path is an organizational decision to effect a significant change. As a result, the process and IT teams collaborate to design necessary organizational changes and plan to integrate a set of related process embellishments and IT modifications. This typically results from: 1) a large scale IT modification which drives significant change in overall IS and 2) a related process embellishment, which has redefined organizational routines[38]. In the process, major procedure changes are made, job responsibilities are redefined and key performance indicators are modified.

Example: The Inventory control/receiving process at AIM is an example of how an IT workaround evolved into a process embellishment and an IT modification. The breadth of both evolutions caused a major organizational change, as an entirely new set of processes and a highly-functional software module were created. These led to a complete redefinition of the IT and processes that supported receiving, material control and customer shipping.

Improvisation Evolution Findings

Based on the analysis that I performed to construct the above model, I now offer the following propositions with regards to improvisation evolution:

Sequential connection between improvisation type and evolution

- IT workarounds will always evolve into IT modifications.
- Process workarounds can evolve into either process embellishments or IT modifications.

Sequential connection between evolutionary paths

Evolutionary Path to Metamorphosis - IT modification and process embellishment are the only stages that can occur concurrently. Therefore, the only possible evolutionary paths from ad hoc adjustment to metamorphosis are:

[38] Although the model seems to suggest that Metamorphosis requires an IT Mod only, as this stage positioned between Q3 and Q1, by definition, any movement into Q1 implies that an embellishment has occurred, or is occurring concurrently.

1. Ad Hoc Adjustment---IT Modification---Process Embellishment---Metamorphosis
2. Ad Hoc Adjustment---Process Embellishment--- IT Modification---Metamorphosis
3. Ad Hoc Adjustment---IT Modification/Process Embellishment---Metamorphosis

IT or Process Workaround improvisations that reach the metamorphosis stage will follow the same evolutionary path of Ad Hoc Adjustment---Embellishment---Modification---Metamorphosis, with the exception of those that result from significant gaps in requirements or urgent situations. IT or Process Workaround improvisations that are driven by a significant gap in requirements will have an evolutionary path where embellishment and modification occur simultaneously.

Initial Stage of Improvisation - Improvisations always start out in the ad hoc adjustment stage. If an approach to resolve a new requirement goes straight to IT modification, then no improvisation or evolution has occurred.

When an Improvisation Is No Longer an Improvisation - Once an improvisation evolves from an ad hoc adjustment to an IT modification or a process embellishment, it is by definition no longer an improvisation. It has evolved into a permanent part of the organizational routine or IT design.

Urgency of Requirements - Improvisations that are driven by urgent requirements (missed or evolving requirements) will move along the evolutionary paths faster than those that are not urgent.

Metamorphoses

- Metamorphoses require at least one associated IT modification and at least one associated process embellishment.
- All movement into Q1 implies that a process embellishment has taken place.

- Metamorphoses may evolve from IT modifications or process embellishments which took place in a previous phase.

Causal Models of Improvisation Dynamics

In this chapter, I have taken the complex network of relationships that were discovered in this study and developed a multifaceted theory, which encompasses them. In the final section of this chapter, I build a series of systemic models to first, summarize the complexity of the improvisation dynamics process that were discovered in this study and second, expose causal relationships that were not apparent otherwise. I accomplish this using a technique called causal mapping, which aligns well with these objectives. The literature indicates that causal mapping is designed to assist theory building studies such as this by: 1) making hypothesized relationships in a theory explicit, 2) adding precision to theory by clarifying all constructs and the relationships between them, 3) facilitating a more complete representation of complex theories and 4) providing a formal framework for theory testing (Bagozzi 1980). Up to this point in the study, analyses of each component of the improvisation process were conducted separately. This aspect of the research was useful in explaining the individual contexts (i.e. user and organization) and processes (i.e. improvisation and evolution) in the improvisation dynamics model. However, an integrated understanding of how all components interrelate is also necessary to complete this study. With clarity on these relationships provided by causal maps, more comprehensive theorizing on improvisation dynamics is possible.

The causal maps constructed are shown in figures 6c, 6d and 6e below. They are divided into three maps in accordance with the three contexts of the Improvisation Dynamics model: manufacturer user, supplier user and organization. Each map shows the appropriate causal relationships of the triggers, contextual variables and evolutionary stages as indicated by the propositions associated with that context. To construct causal maps, I took all concepts that I found to be related and used arrows to show causality[39].

Assembling them was an important part of the sense-making process, because through causal mapping, I learned the following: 1) improvisation from inception to institutionalization is a highly-complex process, 2) there are a large number of dependencies in the constructs of the improvisation dynamics model, which indicates a high degree of multi-collinearity among variables. This supports the selection of a qualitative approach for analysis that is as broad as this study. This is true because quantitative analysis would prove difficult until a more parsimonious approach to modeling these relationships is developed. 3) there are causal relationships between improvisation triggers and evolution stages (e.g. missed requirements and IT modifications), which I had not originally expected, 4) there are long loops of causality in the manufacturer user context, which were previously unrecognized (e.g. an increase in missed requirements causes support effectiveness to decrease. This in turn causes perceived usability to decrease, which inhibits users from creating workarounds, therefore causing evolving requirements to decrease.)

The myriad relationships in these models set the stage for a large number of potential future research opportunities. The key to this exercise was to show the possibilities for furthering improvisation dynamics research in order to accomplish what Bagozzi claims is one of the primary goals of causal mapping: "integrating the theory construction phase of research with empirical-hypothesis testing stages" (1984).

[39] Those arrows that have "-" signs indicate negative causality. Those with no sign indicate positive causality.

Chapter 6 Summary

In this chapter, I have stepped through each of the findings in this study to expose salient relationships between contextual variables and improvisation frequency, types and evolution. The process produced 39 propositions, relating to all areas of the Improvisation Dynamics Model. This set of propositions explains the details of how and why improvisation and evolution occurs. These explanations form the basis for the proposed theory on improvisation dynamics. However, as has been noted by researchers conducting theory building research, the theory induced in this study is consistent with the data in these cases, but it does not necessarily completely and perfectly explain them (Eisenhardt 1989; Kirsch 1997). It serves as an initial conceptualization of improvisation dynamics, which will guide further research and theory building. Lack of complete clarity is appropriate at this early stage, as theorizing is always an approximation process that moves through a continuum of conceptual development (Weick 1995).

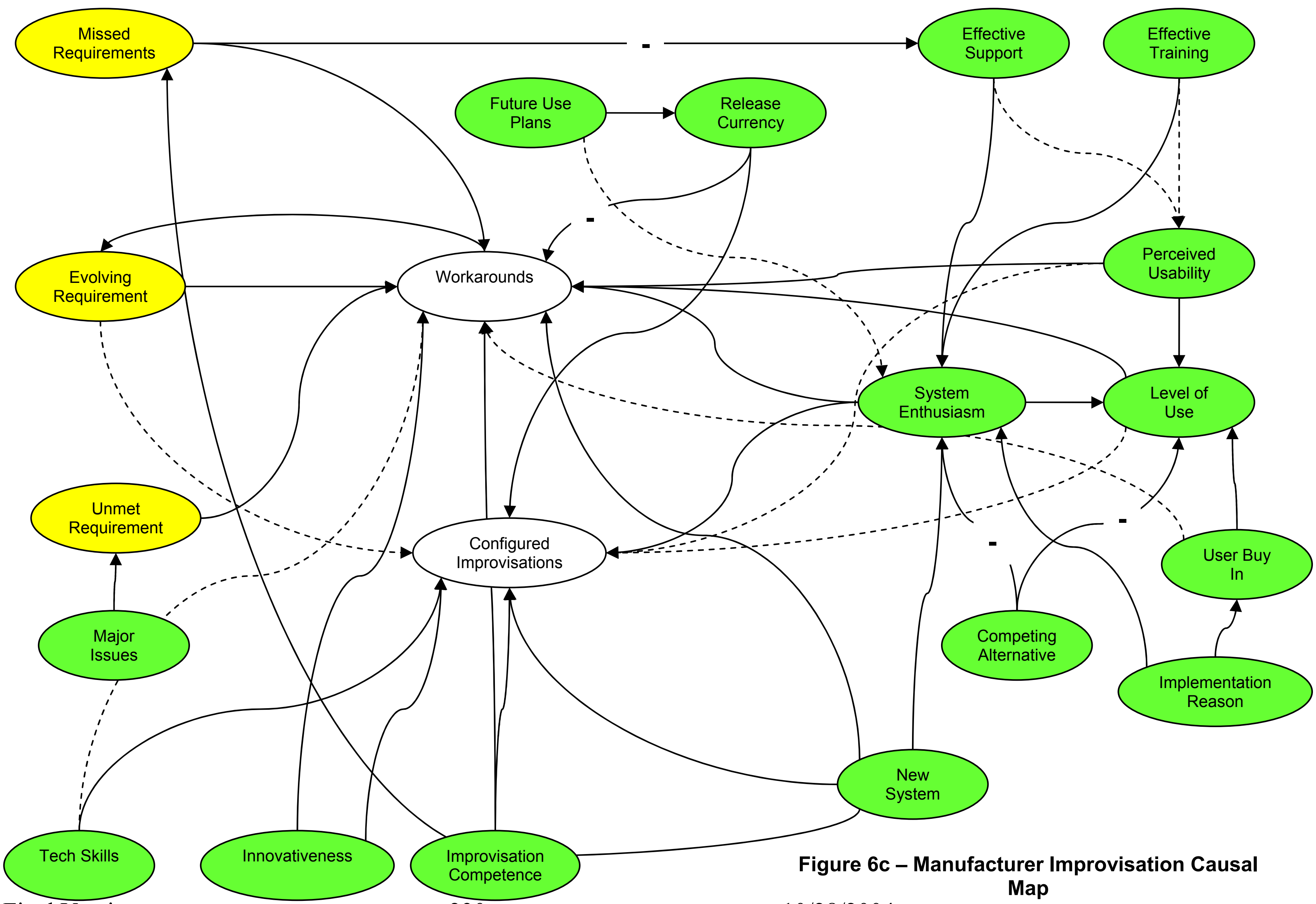


Figure 6c – Manufacturer Improvisation Causal Map

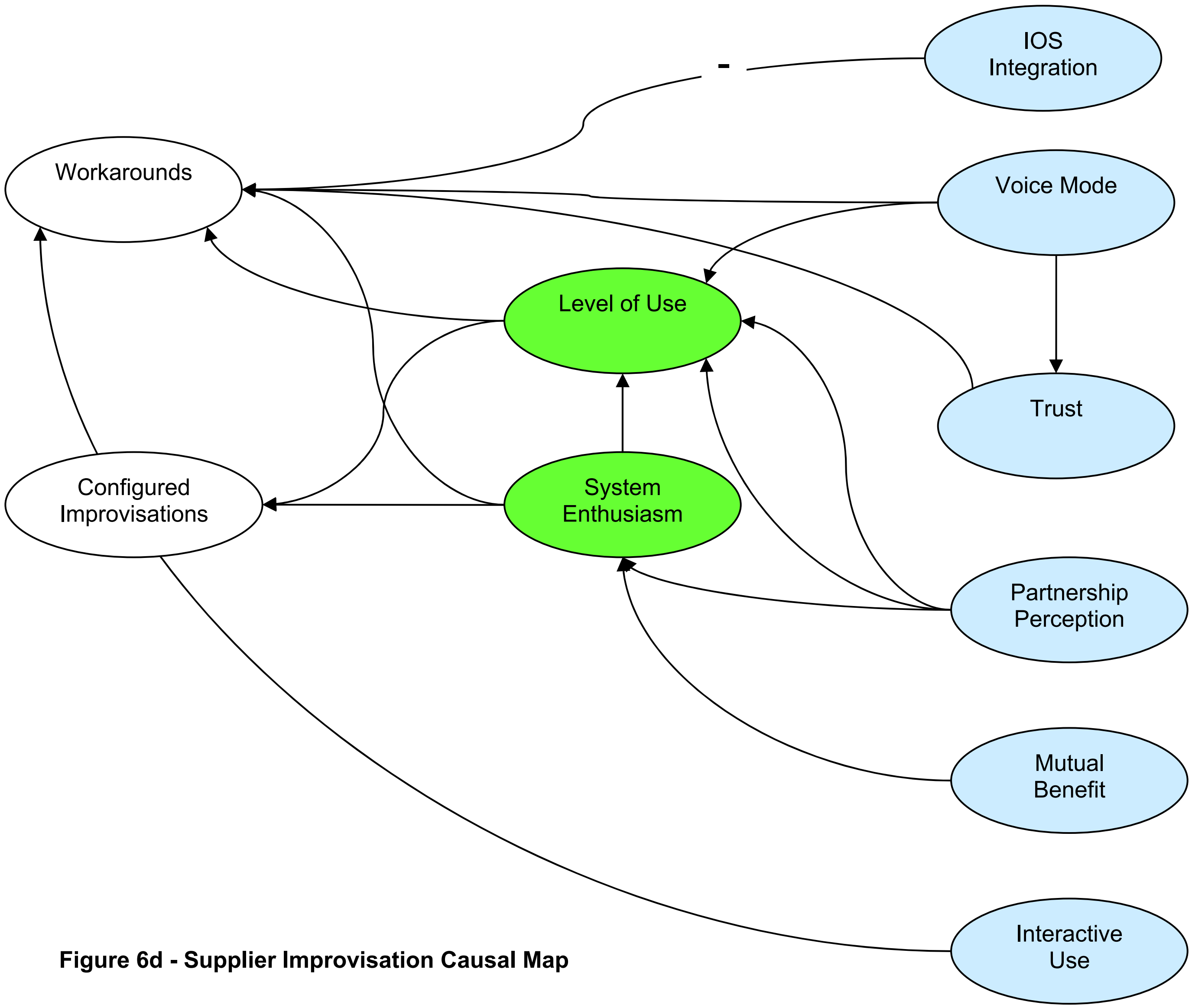


Figure 6d - Supplier Improvisation Causal Map

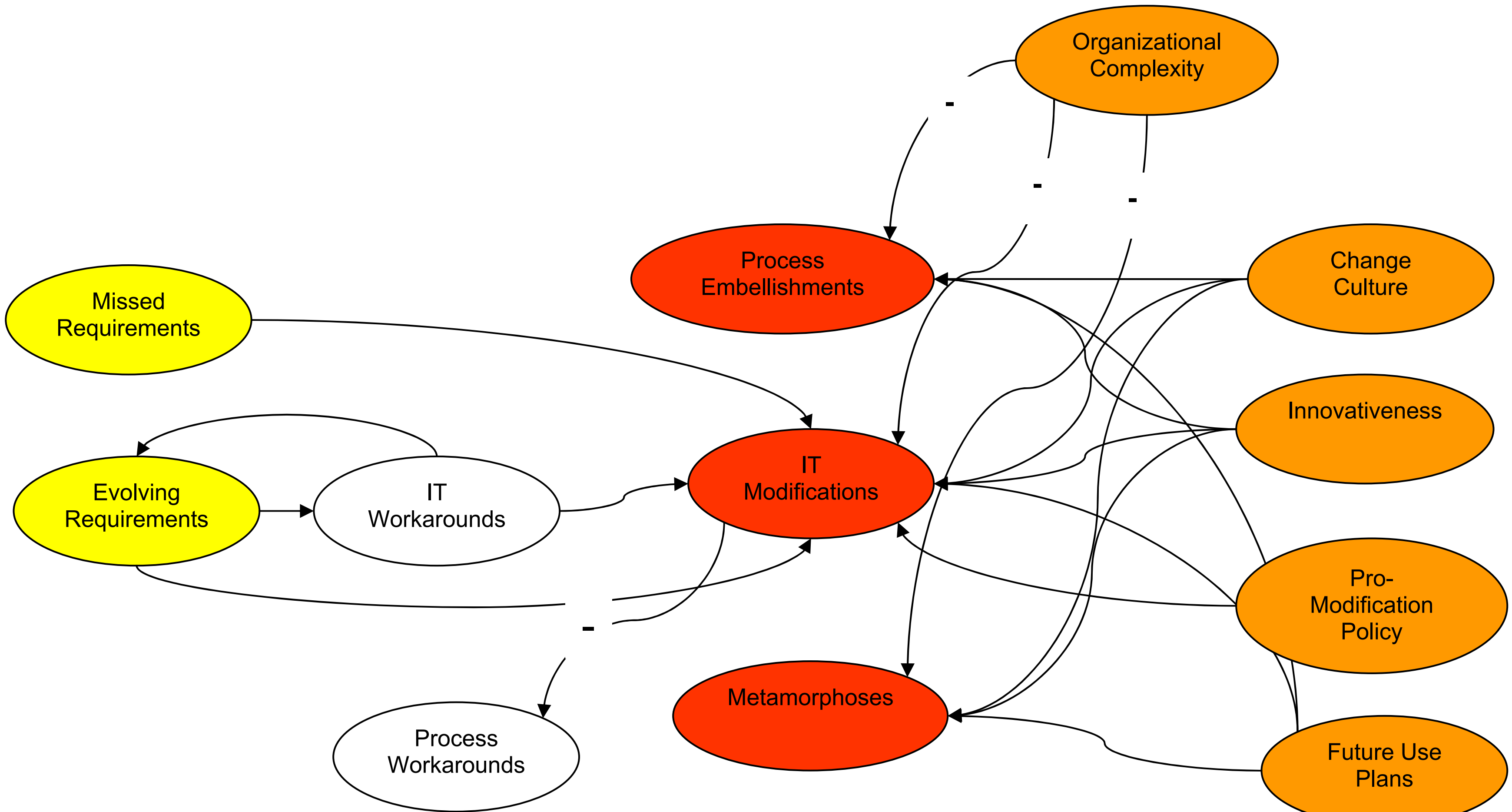


Figure 6e - Improvisation Evolution Causal Map

VII. Discussion/Conclusion

In this final chapter, I will outline my key findings and compare them with existing research in the literature streams discussed in the literature review in chapter 2. This final stage of the theory building process is intended to increase internal validity and generalizability of findings, by highlighting where key findings enhance, agree or conflict with previous studies (Eisenhardt 1989). The goal of this process is to first determine whether my findings are novel. If they are not, I will then examine whether they are similar to, or conflict with, previous findings. To accomplish this, I will outline what I observed to be the key findings in this study. I will then indicate whether each finding is a novel contribution, or if it has a comparable finding. If it has a comparable finding, I will juxtapose it with relevant research in the section that follows. I will then provide an overview of the limitations of this study, which may affect the validity of these findings. The dissertation will conclude with implications for practice and directions for future research.

Outline of Key Findings

Previous chapters yielded a large number of propositions, which are all findings of this study. In this chapter I chose to further analyze only what I determined to be the key findings. These findings were selected because they met one or more of the following criteria: 1) they made a novel contribution, 2) they were a significant enhancement to a similar finding 3) they were unexpected. Key findings that follow are divided into three categories: 1) General Improvisation Dynamics, pertaining to the overall theory and model that was created, 2) Improvisation Frequency, pertaining to specific relationships between contextual variables and improvisation frequency, and 3) Improvisation Evolution, pertaining to the relationships between organizational contextual variables and evolutionary paths of improvisations.

Key General Improvisation Dynamics Findings

The primary contribution of this research is to develop the improvisation dynamics model. Although many of the concepts such as contextual variables, improvisation types and evolution of improvisation have been discussed in previous research, this is the first theory building initiative which models and explains them in an integrated fashion. The process of developing this dynamics model produced a number of other key findings, which are novel. First, that improvisation from initial inception to evolution into organizational change is divided into two processes, and involves two separate groups of actors: 1) creation of the ad hoc improvisation by the user, and 2) evolution of the improvisation into organizational change by management. Second, these two processes are triggered by different sets of events and are influenced by different sets of contextual variables. Third, the evolution of improvisations can take a number of different paths as defined in the improvisation evolution model. This depends on the organizational triggers and the impact of contextual variables. Fourth, there are multiple levels of complexity in the improvisation processes, as CVs influence other CVs, improvisation types, frequency and evolution. Although the overall improvisation dynamics model is a new contribution, the relationships within it produced more specific findings, outlined below.

Key Improvisation Frequency Findings

1. **Influence of Competing Alternative System** (unexpected and novel) – An unexpected and novel finding was that a *competing alternative system* has a more significant impact on determining improvisation frequency among manufacturer users than most other variables. Despite factors that enable improvisation, such as a *usable*, *configurable* system, high levels of *user savvy* and *effective support*, I observed that the existence of an alternative system highly detracted from system use and improvisation.
2. **Importance of a Viable Reason for Implementation** (unexpected) – A second finding that was not expected was that, despite all of the factors described in the previous finding that

promote improvisation (i.e. system type, user savvy, and effective support), a high frequency of improvisation will not occur if the *reason for implementation* is not one that the users accept and support. This variable and the *competing alternative systems* variable are the two that superseded all others in this framework. My expectation was that they would be a factor, but not to the extent that they were in these implementations.

3. **Importance of the combination of Partnership Perception and showing Mutual Benefit in IOS Improvisation** (unexpected) - The next discussed finding is not novel, but was also unexpected. I found that despite an *exchange mode* that entails a strong voice relationship with high *levels of trust*, suppliers will not improvise frequently with an IOS if they do not perceive that the implementation is made in *partnership* and entails *mutual benefit*. The need for partnership and mutual benefit was not surprising. However, as with the previous two findings, it was not expected that these two CVs would supersede all other variables in determining the frequency of improvisation.
4. **IT Modification as an Alternative to Improvisation** (unexpected and novel) – The observation that improvisation frequency will be lower for organizations that chose IT modification as a strategy to meet new and evolving requirements than those that do not modify is unprecedented and one that I had not considered. My initial conception was that all IT modifications were the result of an improvisation. It did not occur to me that the improvisation process could be bypassed, and evolution of systems can occur without improvisation[40].

[40] Although I did not observe this, my speculation is that an organizational implementation strategy that involves a more proactive approach to process embellishment would also offer the opportunity to bypass improvisation.

5. **More User Experience Means More Missed Requirements** (unexpected and novel) – My initial inclination was to see users' *experience level* being correlated with fewer missed requirements, as they provide input into the design process. However, a new finding here was that as users gain experience with a system, they will find more missed requirements that designers had not considered and that they were previously not experienced enough to recognize. In response to the increased recognition of requirements, frequency of workarounds will also increase. The fact that more experience meant more missed requirements seemed counterintuitive, but my analysis has clarified this relationship.
6. **Reinforcing Loop Between Workarounds and Evolving Requirements** (unexpected and novel) **-** I found the process loop that existed between evolving requirements and workarounds to be of particular interest. As frequency of workarounds increased, more requirements were created. These new requirements generated more workarounds when the reinforcing cycle continued.

Key Evolution Findings

1. **Strategic Drivers of Metamorphosis** (novel) – The specific impetus behind metamorphosis resulting from improvisation has not been previously studied. My observation that improvisations will evolve to the metamorphosis stage only when motivated by a highly strategic and/or urgent requirement, and is reached most rarely of all the final stages, is thus a key finding.
2. **Speed of the IT Modification Process** (unexpected and novel) – Although speed of the evolution/IT modification process was not a study variable, I did obtain evidence to support the assertion that organizations that can develop and implement IT modifications quickly enough to satisfy user requirements will have fewer improvisations than those that have a slower IT modification processes. I observed that this speed is driven by the efficiency of the development process and the urgency of the requirements.

Comparison of Key Findings with Previous Research

My review of extant literature shows that this is the first such theory-building research on improvisation dynamics. Therefore, most of the specific findings from this study are novel. In fact, only two specific findings (key findings 2 and 3) were found to have viable extant findings for comparison. This fact makes direct comparison quite difficult. I also note that the concept of improvisation is extremely broad. Therefore, my findings could conceivably be indirectly linked and compared to any number studies in such areas as organizational change, innovation or improvisation in non-IS settings. It was my assessment that such a comparison would do little to further the theory building process. For these reasons, I chose to compare both general and specific findings with the previous research streams that were most influential to this research. These streams were chosen because they focus on such topics as improvisation with the IT artifact, the impact that improvisation in IS use has on organizational change, IS evolution and factors that influence IOS improvisation. The comparison that follows will review related literature in each of the following areas: 1) Improvisation in the IS/Management contexts, 2) IS Use and Exception Handling, 3) IS evolution, 4) IS Innovation, 5) Inter-organizational systems. For each stream, I will assimilate where appropriate, both my general findings regarding the various components of the improvisation dynamics model and specific findings pertaining to relationships between contextual variables and improvisation dynamics with existing research. In this process, I will point out similarities, differences and within them, points of agreement and conflict.

Improvisation in the IS/Management Context

As Orlikowski's (1996) research on the situated change perspective was the primary basis for this dissertation, our research shares a number important similarities. However, these similarities are primarily general in nature, pertaining to the overall structure of the improvisation evolution model. Her seminal work, which examined organizational change that was driven by users improvising with an information system, established a baseline for my theoretical framework. It defines improvisation in the context of IS use and identifies different phases of organizational transformation that take place as a result of this improvisation. She also describes the interplay that takes place between planned and emergent change as users improvise and institutionalize organizational process design changes as a result. This analysis provided the basis for my initial definition of improvisation, its evolutionary stages and the evolution model. Therefore, the basic idea and concepts behind the improvisation evolution process is not new. I was able to successfully replicate this idea in my study, as I followed organizational change through various evolution phases. In general, my findings concur with her study, as I concluded that improvisations do indeed undergo an evolution process that can have varying levels of impact on an organization. However, my theory is more specific, as it distinguishes between the different improvisation types. She explains IT and process improvisation as though they impact organizational change in tandem, and therefore do not need to be distinguished. Although I found that both of that IT and process evolution stages sometimes occur at the same time (e.g. the AIM Inventory Control/Receiving implementation when process embellishment and IT modifications occurred concurrently), my finding was that they must be considered separately. I found this to be true as process embellishments and IT modifications have different triggers and CVs that need to be considered regardless of their timing. She also does not distinguish between the IS design and IS use contexts, focusing primarily on process workarounds that occur in the use context. I draw this distinction with the addition of the design and use dimensions to my evolution model, and the identification of IT workarounds and configured improvisation in the design context. As her focus was on how IS improvisation impacts processes, she does not consider the organizational impacts of the evolution of the IT artifact, as major configuration changes and IT modification take place. Another key conflict with her study is that she considered only the user context, not focusing on the organizational role in the evolution process. Her evolution process seems to indicate that users drive the evolution of improvisations from inception to organizational change; not distinguishing between the improvisation and evolution processes, or the shifting ownership of improvisations between user and organization. In my Improvisation Dynamics Model, I draw a clear distinction between the user and the organization. Inherent in this boundary are two distinct processes on either side: improvisation and evolution. The transition between them implies movement from improvisation or emergent change and evolution to permanent change. I also show that there are different triggers and contextual variables associated with each of these processes. Further, her study is focused on only the evolution process. There is no analysis of the improvisation process beyond its initial inception, and she does not classify improvisation types or different organizational and IT conditions that influence improvisations. My addition of the contextual variable framework, improvisation and evolution triggers in the Improvisation Dynamics Model extend her study by creating a deeper understanding of the improvisation and evolution processes. Finally, the situated change perspective does not offer a theory on IS improvisation. My novel contribution is the execution of a formal theory building process to arrive at a detailed explanation of the IS improvisation process. In contrast to her study, this theory emphasizes the multitude of complex relationships in the improvisation process and sets the stage for future research by offering propositions that act as direct challenges to IS improvisation researchers.

IS Evolution

This study did not have any comparable findings to previous research in ISE, as past literature does not link improvisation with the ISE process. However, I was successful at confirming the importance of ISE, and some of its foundational concepts. Information systems evolution is defined in the literature as a process where systems "undergo continued progressive change in some of their attributes, which leads to improvement in some sense, often to the emergence of new properties" (Lehman 2003). At both BBC and AIM, I observed the characteristics described in the definition. First, I saw how continued progressive change (improvisation) led to changing IS features. I also saw how this process of evolution led to emergence of new properties in the form of additional IT features through the modification process. My research took this a step further by looking beyond software to organizational processes that emerge in ISE process.

Another area of ISE literature that was supported in this study was the drivers of new features and enhancements (Lehman 1980), which were similar to my improvisation triggers. Variables such as changing business rules (Wan Kadir 2004), environmental fluctuation and changing user preferences (Lientz and Swanson 1978) were said to drive these triggers. Adding trigger contextual variables such as these to the improvisation framework could be an area for future research. However, they fail to mention the contextual variables that enable or inhibit the evolution process. This is where my organizational CVs enhance this research.

ISE research is summarized into Lehman's theory of software evolution, which states: "long-term evolvability and evolution is likely to be heavily dependent on more global mechanisms…these include forward and feedback loops, and mechanisms that involve players such as business executives, stakeholders, organizational and individual users, governments and economies in the total evolution process"(2003). This theory begins to articulate the complexity of the causal relationships in the environment that surrounds ISE. Although this research is helpful in defining a high level process of ISE, providing some insight into types of factors that influence evolution, it does not address the specific contextual variables that are present in the user and organizational contexts. It also does not recognize the user and organizational contexts as separate, with the organization being the primary driver of the evolution process, having its own triggers and variables for evolution. Most importantly, it doesn't look at the role of improvisation in the evolution process. Therefore, this study of the impact of improvisation on ISE moves this research stream towards a deeper understanding of the specifics of the evolution process and its causes. It also adds a more practical aspect to ISE research by producing findings that promote understanding of the organizational and business issues involved.

The above ISE literature comparison was based on software engineering research, making comparison challenging. However, there are related streams such as adaptive structuration, that align more closely with ISE and IS improvisation. Similar to Orlikowski (1996), I am particularly interested in the evolution that occurs when users interact with information systems. This view emphasizes the iterative and recursive nature of the design and use process, as users improvise and thus function as designers. From this perspective, systems development is a continual process of users "designing and using technologies recursively" (Orlikowski 1992). In this vein, Adaptive Structuration Theory (AST) research (Desanctis and Poole 1994) draws two interesting parallels to the improvisation evolution process, and offers a means to further validate my process theory. The first parallel is between the AST and improvisation processes. In AST, the structuration process is described as a cycle in which, as users appropriate (use) technology, they enact structures and in turn create new ones. Technology structure is said to shape organizational structure and technology in turn is also shaped by them. This is similar to the improvisation evolution process, as improvisation in use (appropriation) causes new processes and IT modifications (new structures) to evolve in an iterative fashion. The second parallel is between AST's sources of structure and my contextual variables. In AST, sources of structure are shown in the AST model as variables that affect users' interaction with IT. These variables are quite similar to my contextual variables. Examples of structure sources given in this research that are similar to improvisation CVs are features (system type CVs), organizational environment (organizational environment CVs), knowledge and experience (user savvy CVs), faithfulness of appropriation (use as designed CV) and attitudes towards appropriation (user enthusiasm CV). These variables perform similar functions, in that they enable and inhibit the process of users interacting with IT as they shape the technology and its affects. Given these parallels, AST is an essential perspective to consider in understanding improvisation and its impact on ISE. In the process of analysis, it helped to clarify the evolution of the structures of systems and organizations as users improvise. It has also provided an additional source of validation for the evolution process and contextual variable components of my theory.

IS Innovation

As improvisation and innovation are closely related, I found the study by Nambisan et al (1999) on the impact of organizational mechanisms on user innovation in IT offered interesting comparisons on the impact of contextual variables. As in my study, the user is viewed as the primary creator of innovations. Innovation by users is described as being driven by a three variable areas: 1) **Technology Cognizance**, defined as user knowledge about the IT 2) **Ability to explore**, or user's ability to procure resources within the organizational context to explore available possibilities in solving business problems, and 3) **Intention to explore**, or user's willingness to explore the potential of a new technology. The connection between user and organization is made through a set of organizational mechanisms that are said to be positively connected with these variables. For example, their study found that: 1) organizational mechanisms such as use of IT journals, attending IT conferences and vendor demonstrations are positively correlated with technical cognizance, 2) IT steering committees, strategic IT planning groups and IT task groups were positively correlated with intention to explore and customer support, user groups, user labs and relationships managers are positively correlated with the ability explore[41]. My review shows that this research has a number of similarities and differences when considering the drivers of innovation and improvisation. Their innovation drivers and my contextual variables are compared in Table 7a:

Innovation Indicator	**Contextual Variable Factor**	**Organizational Mechanism**	**Contextual Variable**
Technical Cognizance	User Savvy	• IT Journals • IT Conferences • Vendor Demonstrations • Joint Ventures	• Experience Level • Technical Skills • Innovativeness
Intention to Explore	User Engagement	• IT Steering Committee • Strategic IT Planning • IT Task Group	• System Enthusiasm • Level of Empowerment • Level of Use
Ability to Explore	Support Factors	• Support Unit • User Groups • User Lab • Relationship Manager	• Effectiveness of Training • Support Effectiveness

Table 7a – Comparison of Innovation Drivers and CVs

My overall assessment of this comparison is that these studies complement each other. The three innovation indicators in this article are similar to the three contextual variable areas noted above, as *technical cognizance* and *user savvy* are both related to the impact of technical skills on ability to innovate, *intent to explore* and *user engagement* are both related to the impact of users'

[41] This review of the key areas of Nambisan et al (1999) was covered in the chapter 2 literature review. It is reinserted here as a reminder of the key points. Key points from other relevant literature on AST and IS Use and exception handling are also repeated in this section for the same purpose.

willingness to innovate and finally, *ability to explore* and *support factors* are both related to the impact of the available organizational resources available to support innovation. They are complementary in that their framework lists actual mechanisms that promote innovation, while mine lists variable names that could be measures of effective use of those mechanisms (e.g. use of support unit and user group mechanisms increase support effectiveness). As a result of this comparison, a possible next step for my research would be to explore which specific organizational mechanisms which promote improvisation in the context of IS use.

Comparison to Key Finding 2 - Looking at specific findings, Nambisan et al. (year) had particularly strong support for the *intention to explore* innovation indicator, with the *Strategic IT planning* mechanism aligning well with my finding on the importance of having users accept the *reason for implementation* improvisation CV. They define the purpose of strategic IT planning as "providing clear and specific business rationale and direction for technology deployment" and "they enable the users to internalize the technology vision that is being projected by top management" (Nambisan 1999). This mechanism describes the same type of dynamic as my *reason for implementation* CV, which focuses on having a strategic reason for the implementation and articulating it to the users to achieve support. Their study's strong support for the importance of this mechanism lends credence to my key finding in this area.

IS Use and Exception Handling

The research reviewed on IS use and exception handling did not have specific comparable findings, but served as an excellent means of validation for the primary concepts of this study. In alignment with one of my primary themes, previous research in this area emphasizes the importance of knowing how to "work around systems that are technically inadequate" (Gasser 1986). The two primary concepts that were used as a basis for the development of the improvisation research framework, were exception handling (Strong 1995), and workaround computing (Gasser 1986). Exception handling literature was instrumental in defining the triggers of improvisation, as they claim that exceptions cause exception handling, which is a process of improvisation (Strong 1995). The types of exceptions given, are “Operation Errors” (user error), “Design Errors” (design flaw or missed requirement), and “Dynamic Organization” (fluctuation of contextual variables that could not be anticipated) (Saastamoinen 1995). These types served as the basis for my triggers of improvisation. My research confirms that these triggers are indeed significant, I found that improvisation was triggered by missed requirements, which compares with their *design errors*, evolving requirements, which compares to their *dynamic organization*, and unmet requirements, which also compares to their *design errors*.

Another key topic area that was evaluated in this study was workaround computing (Gasser 1986), which defined the different workaround types as: 1) data adjustments (tricking the system through data entry that does not reflect the spirit of the design), 2) procedural adjustment (adjusting work routines to compensate for shortcomings in the system) and 3) backup systems (using alternative information systems to do processing that the primary system cannot handle). My research further validated these concepts, as I was able to find the following examples of each: 1) data adjustments – (similar to my IT workaround) users at BBC using a comments field for a supplier part number because the system would not accommodate it, 2) procedural adjustment (similar to my process workaround) – users at AIM improvising a process to track material that was consumed on the shop floor before it was received into the system, 3) backup systems (another example of an IT workaround) – BBC planners used a separate system to create reports that were not available in XXX. Although I use the term workaround in a similar fashion, I do not differentiate between workaround types at the same level. I argue that for analysis purposes in this framework, the process and IT categories are sufficient. Adding another level of detail within each of these categories may be an area of future research.

The Power of Partnerships in IOS Improvisation

From an IOS perspective, my key findings on the interaction between manufacturer and suppliers pertained primarily to the impact that the nature of relationships has on improvisation frequency. My first finding was that relationship variables such as trust and exchange mode are a prerequisite to improvisation. Suppliers in this study consistently cited the importance of long-term, interactive relationships based on trust as an incentive for them to contribute to IOS implementation success through use, enthusiasm and improvisation. Patterns of improvisation frequency in this study corroborated this finding. The second and perhaps most interesting finding was the discovery of the power of partnerships and the importance of establishing mutual benefit in IOS implementations. My observation was that relationship variables such as *exchange mode* and *level of trust*, are secondary to *partnership perception* and *mutual benefit* CVs in the context of IOS improvisation. The data suggests that regardless of how strong the relationship is, improvisation will not occur frequently by suppliers unless they feel that IOS is will further partnership and that the system has sufficient benefit to them.

Comparison to Key Finding 3 - As there are no studies of improvisation in the IOS context, I compare the above findings to a number of studies that examine the effect of comparable variables on IOS implementation success such as (Johnston 1988), who found that in order to be successful, IOS implementations must provide incentives for use to all intended participants, and must consider the payoffs for all organizations involved. This supports my finding with regard to the mutual benefit CV**.** With regards to my *partnership perception* finding, I compare to (Williams 1997), who concluded that IOS implemented by “Fiat” (decree or mandate) are problematic as they will often result in decreased levels of buy in, satisfaction and overall use. This is referred to as “asymmetry” or “hierarchical relationships”, which involve “domination and subordination”. This finding aligns with the views expressed by supplier study participants, who agreed that partnerships were keys to success in this IOS implementation.

The final article reviewed that supports the above findings is Bensaou's (1997) study of inter-organizational behaviors between suppliers and manufacturers in US and Japanese supply chains. In this research, he focuses on similar relationship variables as mine, using the notion of inter-organizational cooperation (i.e. "the degree to which focal activities to the relationship are carried out jointly") to explain partnership behaviors in achieving success in IOS implementations. Similar to my finding on partnerships, he determined that cooperation in situations such as an IOS implementation was driven by a construct called "Partnership Uncertainty" (i.e. "uncertainty a focal firm perceives about a relationship with a business partner"). One of the primary sources of this uncertainty is theorized to be the climate of the relationship as determined by trust, goal compatibility and perception of fairness variables. His finding was that these factors are significant in determining the level of cooperation that takes place in IOS implementations. Assuming cooperation is a determinant of improvisation in this case, I concur with his findings that these variables are indeed significant. However, he does not make a distinction between the extent of the effect of these individual variables, and implies that that their effect on inter-organizational cooperation is equal. Further, the above studies by Johnston (Johnston 1988) and Williams (Williams 1997) state that the trust variable is a primary determinant of success in the IOS context. My data challenges these findings by arguing that, in the context of IOS improvisation, trust is secondary to goal compatibility (mutual benefit CV) and perception of fairness (partnership CV). I found that in both cases, the longer term investments in trust and the relationship were less important than the immediate dynamic that was created by the IOS implementation. For example, most AIM supplier users seemed to lose sight of that fact that they had an excellent relationship with AIM due to the fact that they felt the XXX had been forced on them and they saw no mutual benefit.

Therefore, it is my position that the above perspectives on the nature of partnerships and cooperation within them can be effectively used to explain the behavior of improvisers in the IOS context, with some slight modifications. I agree that significant improvisation between organizations must be preceded by a high level of cooperation, a relationship climate that is based on trust and a system that is mutually beneficial to suppliers in the IOS network. However, my data suggests that these variables must be considered hierarchically as follows: 1) Mutual Benefit Perception, 2) Partnership Perception, 3) Perception of Trust 4) Exchange Mode.

Limitations

This study has a number of limitations that may affect the validity of its findings. First, I found that studying improvisation, especially using inquiry to identify improvisation events, is an imprecise process. I was forced to rely on users' accounts of their improvisations and their ability to assist me in identifying them. I also found that in general, users do not understand improvisation. Therefore, getting them to describe these events proved challenging. Discoveries of improvisations often took place through indirect questioning designed to expose improvisations, my interpretation of events as improvisations, or by accident during the course of conversation or participant observation. I do feel that the sample of improvisations that was discovered provided an effective basis for my theory. However, it is apparent that the imprecise nature of the process may have limited the number of improvisations that were exposed. More research is needed, which adds precision to this process. I propose the need for research designs which enable the researcher to take a more active role in identifying improvisations though other means than inquiry. This could be accomplished through more active participant observation, where the researcher relies less on the user to identify improvisations, and actually observes them happening. Use of experimental settings could also remedy this problem, as users could be put in a controlled setting and improvisation behavior could be observed. However, at this early stage of the theory building process, it is my opinion that despite its limitations, inquiry is still the best way to expose the basic concepts behind improvisation. These concepts will serve as a basis for more precise research methods in the future.

Second, the findings of this study are based on one researcher's interpretation of the data that was collected. Therefore, I was forced to make a number of subjective judgments about improvisations and the events that surround them. The reliability of these findings could have been increased through the use of other researchers in the interpretation process.

Third, with regards to the research design, although two cases, through theoretical sampling, were incorporated to increase internal validity and reliability, there were two key differences between them that made direct comparison more challenging. The first difference is the fact that BBC first implemented what was referred to as a "preliminary version" of XXX, and built new functionality through IT modifications as each phase progressed. AIM, on the other hand, implemented XXX after BBC and used a more mature, feature-rich version. This difference affected both improvisation frequency and evolution. As a result, new CVs such as release currency and modification policy were added to account for this variation. Future IS improvisation research should attempt to control system functionality and feature sets. The second difference between the AIM and BBC cases was the data collection process. At BBC, I was able to collect data through all four phases of the implementation, spanning two years. At AIM, I was limited to the first two phases. Further, in their first two phases, BBC used the preliminary version of the software, while at AIM their first two phases were on the later version. Therefore, a direct phase-by-phase comparison in improvisation and evolution patterns was difficult. Although I was able to make time-phased comparisons by aggregating the phases into groupings called "initial" and "latter" phases, it seems that following implementations over similar timeframes with more closely matched software would produce more reliable findings. However, these limitations are inevitable in the study of XXX, as BBC and AIM were the only implementations at the time of this dissertation, and they began one year apart.

Finally, with regards to the assessment of improvisation environments using contextual variables, parameters were defined in a binary fashion (e.g. low/high, yes/no). I found that this was an effective means for establishing relationships of CVs with improvisation dynamics and assessing whether or not an environment was conducive to improvisation. However, the limitation is that these variable parameters do not capture the degree of impact that the CVs have. Further research needs to take place to properly operationalize these variables so that the different levels of variance of improvisation dynamics can be better understood.

Conclusion

In this study, I have addressed the research questions offered in Chapter 1 through a combination of literature review and field research, in the process I have made a number of substantive contributions to improvisation research. The research questions and the resulting contributions are as follows:

Research Question 1 – *What types of improvisations occur in the use of IS?* – As shown in chapter 3, I have developed a classification scheme for improvisation types, which are IT and process workarounds and configured improvisations. I was also able to classify types of triggers as evolving requirements, missed requirements and unmet requirements.

Research Question 2 – *What are the contextual variables that enable or inhibit the improvisation process in IS environments?* I contribute the framework of contextual variables in chapter 3, which was refined throughout the study. It was used to establish many of the causal relationships in the propositions, and can now act as a tool to assess the IS improvisational environments in organizations.

Research Question 3 – *How do the contextual variables impact the dynamics (frequency, type and evolution) of improvisation?* The contextual variable framework was applied to two case studies to assess CV impact on IS improvisation. In that process, 39 propositions were formulated to show the salient impacts of contextual variables on improvisation dynamics. These relationships were summarized in a series of causal maps, which show the complexity of these CV impacts.

Research Question 4 – *How do improvisations evolve into organizational change?* I contribute the Improvisation Dynamics Model in chapter 6, which shows the evolution of improvisations from initial trigger to its final evolutionary stage. I also use the developed Improvisation Evolution Model to show the specific paths that improvisations can take as they evolve from temporary to permanent organizational change in different stages. Further, a separate set of improvisation evolution contextual variables were identified and used to show how the various organizational enablers and inhibitors impact this evolution process. Finally, a set of triggers were identified to clarify what actually initiates movement through the evolution process. These models and constructs were applied to develop 8 propositions related to improvisation evolution.

Research Question 5 – *How do improvisation dynamics differ in the IOS context?* I contribute an approach to studying improvisation in the IOS context. This is accomplished through the IOS components of the dynamics model, a separate set of contextual variables and the Interaction Zone Model. These concepts were applied to develop a set of 5 propositions in chapter 6, which describe the unique characteristics of the IOS improvisation environment.

The above contributions combine to form a theory of improvisation dynamics, articulated through the improvisation dynamics model, which explains improvisation from initial trigger to its final stage of evolution into permanent organizational process and IT change. This process model considers all triggers and contextual variables that drive improvisation frequency, type and evolution. It furthers understanding of the various components of the improvisation process, the complexity of the relationships between these components and their impact on information systems evolution.

Implications for Practice

Previous research has shown the importance to practitioners of promoting continuous evolution of information systems in order to meet the changing requirements of the business environment (Lehman 2003). This study has shown improvisation to be a significant source of information systems evolution, and accordingly it has a number of implications for practitioners. First, managers need to accept the fact that information systems are going to evolve, no matter what. If they do not evolve, they will become increasingly useless and will have an adverse affect on businesses' ability to survive. However, there is a high cost associated with this evolution, as IT designers struggle to keep up with the new requirements within a volatile business environment. Therefore, my contention is that managers can no longer ignore the fact that improvisation is often the only means to keep up with these evolving requirements. They must also be cognizant of the potential cost savings and organizational benefits of shifting a portion of the responsibility for keeping pace with ISE to the users. However, my research shows that improvisation is often perceived negatively by users and managers, as deviation from norms is often deemed inappropriate. My advice to managers is that this paradigm must change. I argue that improvisation needs to become a key part of their IS strategy and organizations need to take action to establish a "culture of improvisation", which encourages and/or mandates innovation and creativity in the use of IS. Action steps that managers may take in order to accomplish this are as follows: 1) incorporate more flexible, configurable technologies into their IT mix; 2) educate users on the importance of the improvisation process and techniques for effective improvisation; 3) encourage the use of configurable technologies, and also the development of IT and process workarounds when appropriate. Users need to know that improvisation of this nature is not an exception, but a necessary part of their responsibility, and 4) back this approach with an organizational culture that promotes innovation and improvisation by defining it in the performance measure and compensation structures accordingly. I found AIM to be an excellent example of a firm that had adopted such a culture of improvisation. My analysis showed this to be true for a number of key reasons. First, I found that there was a high level of emphasis on the use of cutting-edge IT to develop and implement business solutions. As a result, managers and users were highly skilled in the use of IT. Second, I found innovation and creativity to be a core value that was shared by all associates. From the executive level down to the core users, each expressed an appreciation of the importance of innovation in promoting continuous IT and process improvement. Third, users felt empowered to make ad hoc changes to IT and processes in their areas. They also felt that it was a key part of their responsibility to look for opportunities to do so. Fourth, the functional liaison was an effective support person and was highly skilled at IS improvisation. As part of the ongoing support process, he trained users on the importance of workarounds and how to create them on their own. Finally, management backed the core value of innovation by recognizing this skill through contests and increased compensation for it. AIM is an organization that exemplifies the culture of improvisation, and offers a useful organizational model for managers to consider when promoting such a culture in their own firms.

Another implication for managers is to consider that, with this shift towards a culture of improvisation comes a need to find effective ways to manage this emerging process. This has inherent difficulties, as improvisation is difficult to predict, recognize and control. As a result, problems may occur as more users begin to develop their own way of using an IS through IT and process workarounds. Further, configurable systems with many options may threaten the standardization of system parameters and use. This can create difficulty in transaction-heavy environments, especially in the case of an IOS where the scope of system use increases dramatically. Therefore, there is a risk that with hundreds of users' improvising, there could be a multitude of variations of organizational processes and IT configurations. This variation may be acceptable in some areas, where such creativity does not endanger the business. However, in more sensitive and critical areas, improvisation will need to be more tightly controlled. Practicioners will need to carefully establish a set of "creative constraints" (Weick 1998) to allow improvisation within certain parameters, and only in those functional areas where it will be deemed beneficial. They will also need to find a way to identify, track, and document it so that it becomes part of the knowledge base of an organization. This will assure that users can be rewarded for doing it, and that it is appropriately controlled.

The final implication for practice is the observation that improvisation may not always have a positive impact on organizations. With the "culture of improvisation" comes the risk that users are distracted from their primary job responsibilities because they are improvising excessively and/or in areas where it may not be necessary. There is also the risk that users will frequently second guess design decisions, working around them at will. This could put an inordinate amount of pressure on support personnel and IS designers to assess whether these improvisations should evolve. Finally, there is the risk that if too many users are given too much creative latitude with key system areas, system failures may result due to unnecessary "tinkering". In response, managers need to carefully define the differences between favorable and unfavorable improvisation.

Future Research

Because of the early stage of theory development in this area, and the broad nature of the theoretical framework that was produced, there are a multitude of directions that could be pursued. In this section, I will prioritize and elaborate those areas that I think should take be receive primary consideration. As the goal of theory development progress along the continuum that "begins with guesses and approximations and ends with explanations and models" (Weick 1995), future research needs to focus on adding more precision to improvisation research models. In order to accomplish this, I see the following as potential next steps: 1) additional studies using the same research design on a number of other cases. These cases should consist of organizations from other industries outside of automotive, of different sizes, and of alternative organizational structures. The goal of this step would be to refine the improvisation research framework. 2) Validation of constructs through quantitative analysis, by developing instruments such as questionnaires to operationalize and analyze causal relationships of CVs with improvisation frequency, type and evolution. This process will refine the levels of causality and help determine which variables are significant. 3) Using this refined understanding of the improvisation process to conduct more precise longitudinal research to further explain the dynamics of improvisation. This could involve the use of experimental designs to test specific hypotheses while varying system types, user types, and other environmental conditions in the research framework. 4) Once a higher level of precision is established, researchers need to take a look at specific portions of the improvisation dynamics model, to establish a better understanding of the constructs and the complex relationships of the CVs within each. This will lead to a more detailed set of hypotheses and a deeper understanding of specific areas of improvisation dynamics.

Perhaps the most interesting area for future improvisation research is to more closely examine the relationship between improvisation and information systems evolution. In this study, I looked at the evolution of an observed improvisation that began with its initial trigger and ended in its final stage (e.g. metamorphosis). However, as shown in the simplified version of the design and use model below (see figure 7a), ISE is an iterative process. Therefore, new features or releases that result from the evolution process act as inputs to the next iteration of the improvisation process. The next level of this research will be reached when a study can follow an improvisation or a group of related improvisations through a number of cycles of this evolution process to show the larger and longer-term impacts of the improvisation process on the evolution of IT systems and organizations. Such research has the potential to subject traditional information systems development approaches to a higher level of scrutiny. The "improvisational model"[42] moves away from the traditional process of continual requirements gathering and development by development teams (Truex 2000) to assure systems evolve as needed. The emphasis is instead on empowering users to handle their own requirements through improvisation, which has the potential to change ISD research significantly. Studies of this nature could compare cases that use traditional ISD models to those that use the improvisational model (or assess sites that have changed to the improvisational model) to determine if there are indeed tangible benefits. Potential study variables could include software maintenance costs, software development time, unmet and missed requirements. If successful, this research stream would be an effective means to further assess the importance of improvisation in promoting ISE.

The final area for future research to consider is improvisation by designers and the impact this has on user improvisation dynamics and ISE. As figure 7a below shows, this dissertation looked at the evolution process primarily from the perspective of a user, examining how their improvisation impacts ISE. By incorporating designer improvisation, research could examine the dynamics that take place as control of improvisations shift between the design and use contexts. In this process, new CVs such as time and space difference between the designers and users (Orlikowski 1992)

[42] I define the "improvisational model" as a paradigm of system development that emphasizes the role of user improvisation in meeting requirements, in order to better facilitate ISE.

could be considered. This would promote a more complete understanding of the improvisation dynamics and ISE processes.

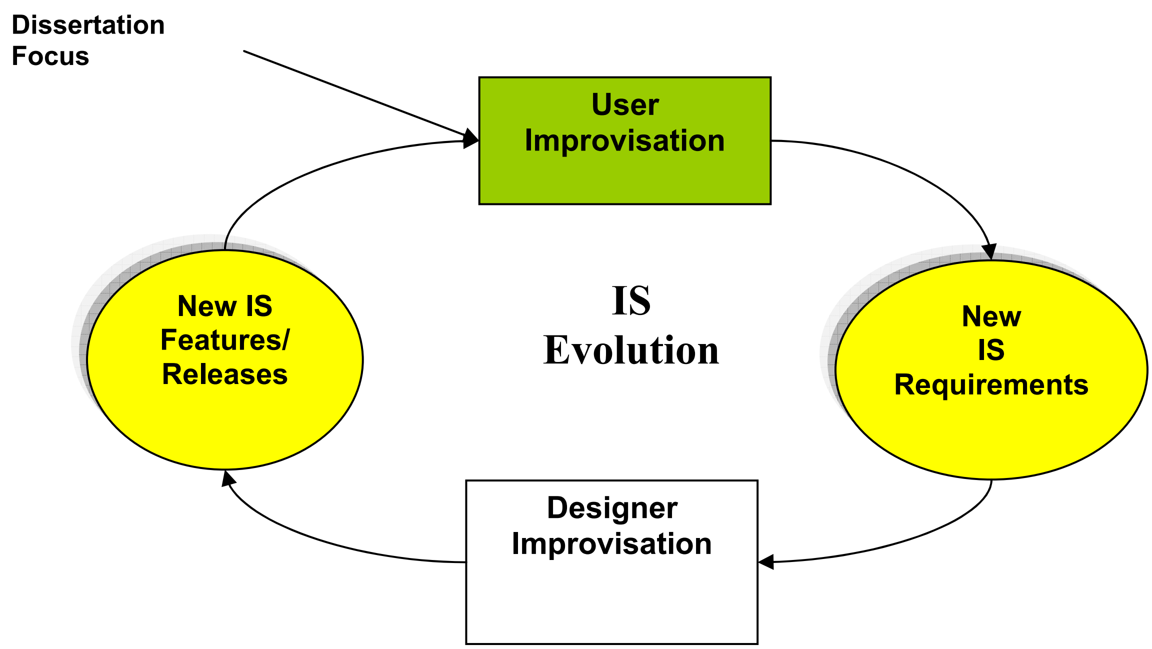


Figure 7a – Summary ISE Model

In conclusion, this dissertation has set the stage for research on IS improvisation in relation to information systems evolution, organizational change and inter-organizational systems. I offer a theory of improvisation dynamics, develop a rich theoretical framework and propose a number of propositions to serve as a basis for future research. The theory developed through this process represents an initial understanding of improvisation dynamics. I now call on researchers to validate, enhance and/or challenge it.

Appendix 1 – Glossary of Terms[43]

Improvisation - The creative practice of adaptation in the design and use of IS, employed within the confines of existing system (technical and organizational) parameters, as actors react to technical opportunities, unanticipated problems, emerging requirements, and external environment fluctuations, which result in temporary adjustments of systems and processes through workarounds or configuration changes (Orlikowski 1996; Weick 1998; Moorman and Miner 2001).

Improvisation Dynamics*- the frequency, type and evolution of improvisation

Improvisation Trigger – An event encountered in IS use where information cannot be properly processed through existing IT functionality or process design, thus triggering improvisation (Strong 1995). The types of triggers are defined as missed requirements, evolving requirements and unmet requirements.

Missed Requirements* – those that result from an error in the design process, where the IT design team misses an essential system requirement. Therefore, needed functionality is missing from the system.

Evolving Requirements* – new requirements that were not needed in a previous software release, but surface after a period of time due to changing business needs.

Unmet Requirements* – requirements that were properly designed into the system, but due to a software error (e.g. software bug), they are not met.

Improvisation Contextual Variables – conditions in the IS design and use environment that enable or inhibit improvisation (Orlikowski 1996; Weick 1998).

Contextual Variable Area* (lowest level of detail) – These are the overall categories of the individual variables. This level allows for summary level CV analysis of a group of variables and/or factors.

Contextual Variable Factors* (second highest level of detail) – This is a sub-category of the Contextual Variable Area. This level allows for more parsimonious analysis of variables that logically group together.

Improvisation Evolution* - The shift of improvisations from the user context to the organizational context and their subsequent movement towards institutionalization into organizational routines and IT design.

Improvisation Evolution Trigger* - Events that initiate the movement of improvisations between the various stages of evolution.

Improvisation Evolutionary Paths* – paths that improvisations follow as they transition from emergent to permanent change and ownership changes from the user to the organization.

[43] Terms marked with an asterisk were defined based on data analysis. Remaining terms have associated references that were used to develop definitions.

Information System (IS) - refers to systems within and across organizational boundaries.

Information Systems Evolution (ISE) - a process where systems "undergo continued progressive change in some of their attributes, which leads to improvement in some sense, often to the emergence of new properties" (Lehman 2003).

Software Maintenance - development designed to meet new requirements and removing or changing existing ones in the interest of promoting ISE (Lientz and Swanson 1978; Wan Kadir 2004).

IS Use - An IS user's interpretation, appropriation and manipulation of information systems tasks during the implementation and utilization of an IS to accomplish coordinated tasks in various intra-organizational and inter-organizational contexts (Orlikowski 1992).

IS Design - Dynamically fashioning and constructing information systems to realize organizational goals and opportunities in a fluctuating environment that is separated in time and space from IS use (Orlikowski 1992).

Exception - Exceptions are defined in the literature as cases that information systems cannot process correctly without manual intervention (Strong 1995); as an event for which no applicable rule or procedure exists (Saastamoinen 1995).

Exception Handling - the identification of an event and the selection of pertinent action in order to set the system back to coherent state (Saastamoinen 1995)

Inter-organizational System (IOS) - Systems crossing organizational boundaries designed to reduce transaction cost, while facilitating efficiency, accuracy, and competitive advantage through interactive sharing of supply, demand, quality, design and other collaborative information (Johnston 1988; Bensaou 1997).

IOS Improvisation - The creative practice of design adaptation in the use of IOS, enabled by inter-organizational cooperation, as actors react to technical opportunities, unanticipated problems, emerging inter-organizational requirements, and external environment fluctuations, which result in joint adjustments of systems and processes (Johnston 1988; Orlikowski 1996; Weick 1998).

Interaction* - the exchange of information, business transactions or materials in the context of the IOS environment.

Interaction Zone* - a point in the supply chain where the exchange of information, business transactions, and materials takes place between businesses in the IOS environment.

Configured Improvisation – a dynamic modification of IT that is facilitated by existing system design functionality, which promotes agile responses to IT requirements and creatively expands system use (Morch 1995; Strong 1995; Mehandjiev 2000).

Workaround - intentionally using computing in ways for which it was not designed, or avoiding its use and relying on an alternative means of accomplishing work (Gasser 1986)

IT Workaround* – an adjustment in the use of an IT, which involves intentionally using it in ways it was not designed, to handle IT requirements.

Process Workaround* – the creation of temporary organizational processes to meet an IT requirement.

Improvisation Evolution* – the transition of improvisations from temporary solutions to permanent organizational change.

Ad Hoc Adjustment (IT or Process)* – This is the initial stage in the evolution process for all improvisations. In this stage, a user creates a solution to a new requirement using an IT or process workaround, or a configured improvisation. However, the improvisation remains localized to that user, and results in no modifications of IT or organizational processes. Often these improvisations do not drive such modifications due to the sporadic nature of unmet need that drove it.

Process Embellishment* – This stage results from an ad hoc process improvisation, which has been adopted into organizational procedures. The magnitude of the organizational impact of an individual embellishment is not highly significant.

IT Modification* – This stage results from an ad hoc IT improvisation, which has been permanently designed into IT functionality.

Metamorphosis* – This is the final stage of evolution, which results from one or more significant modifications of the IT and one or more process embellishments. The overall impact is highly significant as organizational procedures, IT and policies are changed as a result.

eCollaboration - a web-based environment, which uses extranet portal technology, allowing manufacturers and suppliers to collaborate through the supply chain over the web (Rosario 2001). For a full description of eCollaboration systems, see appendix 5.

Portal – a website that offers a broad array of resources and services (webopedia.com 2003).

Issue* - a system problem that is reported by a user to support personnel for resolution

Tailorability/Tailoring - the dynamic modification and adaptation of applications in the context of their design and use (Mehandjiev 2000)

Functional Liaison* – an individual, who serves as the "gatekeeper" for screening and resolving requirements. He is part of the manufacturing organization and is the intermediary between the users, management and the designers. His task is to design workarounds and resolve issues locally or communicate the new requirements to the designers at the software company, so that they can modify the IS.

Vendor Managed Inventory – a means of optimizing Supply Chain performance in which the manufacturer is responsible for maintaining the distributors inventory levels. The manufacturer has access to the distributors inventory data and is responsible for generating purchase orders (vendormanagedinventory.com 2003).

KanBan – A Japanese term meaning "signal". It is one of the primary tools of JIT system. It signals a cycle of replenishment for production and materials. It maintains an orderly and efficient flow of materials throughout the entire manufacturing process. It is usually a printed card that contains specific information such as part name, description, quantity, etc (isixsigma.com 2003).

Appendix 2 – Contextual Variable Descriptions

General System Area

1. **System Type Factor**
   a. **Usability** - the level of ease of use that a system has. I observed that the users who found the system easy to use were more apt to experiment with and configure it. Therefore, this variable drove the configured improvisation type (McGann/AIM FN #1, 2003 #4; McGann/BBC FN #1, 2003 #1).
   b. **Configurability** – the ability a system has to be configured by using options designed to promote flexible design (Morch 1995). With configurable systems, there is an open architecture and therefore functionality can be configured to meet organization needs. Systems that are highly configurable allow for more requirements to be met with configured improvisations. However, in the case of non-configurable systems, functionality is largely predetermined. In these cases, workarounds are more frequent, as existing processes must be adapted to the set system (McGann/BBC FN #2, 2003 #2; McGann/AIM FN #2, 2004 #5).
   c. **Formality** – the level of control and formality surrounding the use of a system (Williams 1997). This variable impacts the latitude users are given to improvise. From this perspective, there are two system types, structured systems with a high level of formality and control, and unstructured systems with less formality and more creative latitude. My observation through a comparison of EDI (formal) to eCollaboration (informal) was that the former inhibits improvisation, while the latter promotes it (McGann/BBC FN #1, 2003 #1). This observation is supported in (Williams 1997), where it was found that "formal systems" such as EDI tend to promote asymmetry in the relationship of trading partners, thus inhibiting creative use.
   d. **Interactivity** – the ability that a system gives users to openly interact. Examples of functionality that promotes this is chat, bulletin boards, messaging, e-mail and broadcast messages. I found that the improvisation process is one that often requires interaction, especially in an IOS environment (McGann/AIM Part Obs 2004). This is because users often collaborate on creating solutions and need to discuss mutual impacts of these changes. The ability to interact is cited throughout the literature as a key to effective improvisation (Mirvis 1998; Weick 1998). Interactivity was also indicated by users as a key difference from the previous IOS, which was EDI. Therefore higher levels of interactivity can lead to increased improvisation.

System Environment Area

1. New System Factor

a. **Reason for Implementation** – reason that is understood by the user base as the primary driver for an IS implementation. Examples of these reasons found in the study were cost cutting, increasing efficiency and building a new strategy. My finding was that reasons which provide some benefit to the users and/or are accepted by users will result on a higher level of support for the implementation. This support will ultimately increase user's tendency to improvise, as they will have more of a desire for continuous improvement that improvisation entails (McGann/AIM FN #2, 2004 #5; McGann/BBC FN #3, 2004 #3). This finding on support of a system due to provision of "clear and specific business rationale" resulting in increased levels of innovation is supported by Nambisan et al (1999).

b. **Fit** – how well a system meets organizational requirements. Systems that fit well meet organizational requirements and minimize integration issues; those that do not create more requirements and therefore drive the need for alternative solutions. My assertion is that if a system fits, the need to improvise decreases. If technology and processes integrate well into organizations, the need to workaround deficiencies is not present. However, a system that fits poorly will have the opposite effect, making improvisation more of a necessity (McGann/BBC FN #1, 2003 #1; McGann/AIM Part Obs 2004).

c. **Modification Policy -** policy of the organization stating whether or not it uses IT modifications to permanently instantiate improvisations into the design of their software systems. Regardless of fit, if an organization is willing to invest the time and resources to modify their system to meet requirements, improvisation will be less frequent. Instead of changing existing technology use and processes by creating workarounds, implementers improve system fit by changing the technology to integrate more effectively (Suchman 1983).

2. Alternative System Factor

a. **Competing Alternative System? -** the level to which an alternative system competes with the new system (assuming it is still online and offers similar functionality). If there is a similar system online that users have been using for an extended period of time, I found that they are usually more comfortable with it. Therefore, they will often continue to use it or revert back to it after a period of time. This detracts from the focus on the new system, which decreases enthusiasm, use and ultimately improvisation (McGann/BBC FN #3, 2004 #3).

b. **Legacy Integration w/New IS?** – the level of integration achieved between the existing and new systems. Integration is a key to minimizing issues related to transferring information between new and legacy systems. However, if integration is not achieved, there will be more unmet requirements (e.g. software bugs and data transfer problems), which will trigger related improvisations. I found that when organizations did not effectively integrate with the new system, they were forced to create workarounds (e.g. downloads to Excel files, changing to proper format, then re-keying into the legacy system) (McGann/BBC FN #2, 2003 #2). On the other hand, if there are too many issues, user confidence can diminish, which will inhibit improvisation (McGann/AIM FN #2, 2004 #5).

Manufacturer User Type Area

1. **User Savvy Factor**
   a. **Experience Level (New) -** amount and quality of experience with the new system, that the manufacturer user exhibits. This correlates with user's ability to improvise, as my research showed that more experienced users were more skilled both with creating configured improvisations because they knew the system options better, and workarounds because they knew the limits of the system and how to "MacGyver it" or workaround it (McGann/AIM FN #1, 2003 #4; McGann/BBC FN #1, 2003 #1). This is confirmed by Gasser (1986) who cites experience as a key factor in creating workarounds and also by Swanson, (1978) who argues that lack of knowledge of a specific system accounts for the majority of the problems in the maintenance of software.
   b. **Tech Skills** – level of general technical skills that a user has. As some users are more comfortable and work better with technology than others, they will tendency to explore the improvisation of new and better ways to accomplish tasks with the technology at hand. Those that are not technically savvy will tend to stay within the confines of existing functionality and therefore will improvise less. This finding is supported in part by Cavaye and Cragg (1995), who argue that user "technological awareness" is a key determinant of adoption rate and use, which is tied to improvisation frequency.
   c. **Innovativeness –** user trait which drives them towards innovation in response to new requirements. Regardless of experience and technical skills, without an innovative spirit improvisation will not occur (Tushman 1986). This is supported in (Nambisan 1999), where it is argued that the innovative nature of users fosters a high degree of knowledge creation. My observation was that those users who had an aptitude to think freely and innovate improvised more (McGann/BBC FN #2, 2003 #2; McGann/AIM FN #2, 2004 #5).
   d. **Improvisation Competence –** ability to understand and apply the concepts of IS improvisation (e.g. knowing what a workaround is and why it is important). One of my first findings was that the first prerequisite for effective improvisation is the ability to understand what it is, its purpose, benefits and how to do it. Many users did not have a grasp of these concepts and therefore did not improvise frequently. However, there were a handful of users that understood them well, and they were the ones that improvised most (McGann/AIM FN #2, 2004 #5; McGann/AIM Part Obs 2004; McGann/BBC FN #3, 2004 #3).

2. **User Engagement Factor**
   a. **System Enthusiasm** – level of enthusiasm for the implementation of the new system. I found Enthusiasm to be a key predictor of improvisation, as those users who were excited about the system and the possibilities it entailed, improvised more. These users typically had the desire to go beyond normal expectations and modes of thinking to create solutions themselves (McGann/BBC FN #1, 2003 #1).
   b. **Level of Empowerment** – perception of empowerment that users felt with respect to creating solutions. Some users felt that they were responsible for dealing with new requirements themselves, while others relied on the functional liaison. Those that assumed this responsibility felt that they were empowered by the organization to make changes through workarounds, and therefore improvised more (McGann/AIM FN #1, 2003 #4).
   c. **Level of Use** – frequency of use of the system. I found a correlation between and frequency of system use and frequency of improvisation. As system use increased, so

did level of comfort with it, enthusiasm as they saw more benefits and ultimately this led to more improvisation (McGann/AIM FN #1, 2003 #4; McGann/BBC FN #1, 2003 #1).

Implementation Effectiveness Area

1. **Support Factor**
    a. **Effectiveness of Training** – ability to effectively use the system as a result of knowledge gained from training. My finding was that users with more competence with the system used it more and were able to perform more configured improvisations as a result. They also understood the shortcomings of the system, so they knew where workarounds would be necessary (McGann/BBC FN #1, 2003 #1). This is supported by Lientz and Swanson (1978), who found that inadequate user training suggests and estrangement from the system, thus resulting in less use and enthusiasm.
    b. **Support Effectiveness** – ability of the support team to deal with and other issues. The support team can enable improvisation because they keep the system running smoothly, help users understand the system and teach them how to create workarounds (McGann/AIM FN #2, 2004 #5). It can also inhibit it in some cases where the support people create the workarounds themselves (McGann/BBC FN #2, 2003 #2). The importance of support effectiveness is outlined in Nambisan et al (1999), as they emphasized the importance of support groups in promoting improvisation.

2. **Use Factors**
    a. **User Buy In** – dynamic occurring when users accept the system and its purpose. Users who had bought in to the project were usually the ones that wanted to improve their situation by improvising. Previous research shows that user buy in is a key to IS/IOS implementation success, is a direct indicator of IS/IOS use and often results from a successful "marketing effort", designed to get the users to support the implementation (Cavaye 1995).
    b. **Actual vs. Designed Use –** when the system is actually being used as it was designed. In the implementation process, a design was created for the use of the system and the processes surrounding it. Problems occurred when, only parts of the system were being used (e.g. suppliers performing shipping transactions only and neglecting to send promises), or the system was not used as designed (e.g. data being manually keyed instead of using auto-download capabilities). When users deviated from the design, the effectiveness of the implementation was diminished, therefore they improvised less (McGann/AIM FN #1, 2003 #4).

3. **Post Conversion Factor**
    a. **Quantity of Issues –** quantity of critical requirements that were not met by the implementation team. Per the Improvisation Dynamics Model, as these types of triggers occur, improvisation frequency increases.
    b. **Number of Issues** – quantity of issues that are presented to the support team. In this study, issues were defined as improvisation triggers that are driven by system problems. They consisted of system and data problems, administrative issues and training issues. My research showed that issues often resulted in improvisation as temporary solutions, to these unmet user needs that were unfulfilled. (McGann/AIM FN #2, 2004 #5).

c. **Severity of Issues** – severity of issues reported, categorized as major or minor. Both sites categorized issues this way. This study showed that major issues (such as design flaws, missed requirements and critical system failure) are linked to the level of improvisation that occurs (McGann/AIM FN #2, 2004 #5; McGann/BBC FN #3, 2004 #3).

Supplier User CVs

Inter-Organizational Environment Area

1. Relationship Factor

a. **Exchange Mode** – overall nature of relationship between manufacturer and supplier. I characterize this dynamic using Helper and MacDuffie's "Exit and Voice Modes of Exchange" (Helper 2002). This research describes these relationships as being either in "Voice" mode (which means that the actors have open communication on issues, speaking freely and secure that the relationship will remain intact on a long-term basis) or Exit mode (which means that the relationship is not considered to be long term, and the threat of exit is a key incentive for negotiation). The effect that these modes have on the tendency to improvise is as follows: a more secure, interactive relationship (voice mode) will provide the needed trust and security to improvise more freely, while exit mode firms will not feel as free to experiment and will likely have less incentive to invest the resources and energy to do so (McGann/BBC FN #2, 2003 #2).

b. **Partnership Perception** – degree to which a supplier perceives a manufacturer as partner. Perception as a partner means the supplier feels they share in decisions such as systems implementations and design. Non-partner perception means the supplier feels that such decisions are usually mandated. My finding was that those that did not see the manufacturer as making decisions that reflected partnership resented the decision that was imposed upon them. This resentment diminished enthusiasm making them less likely to improvise (McGann/AIM FN #2, 2004 #5). This agrees with Williams (1997) who found that IOS implemented by "Fiat" (decree or mandate) are problematic as they will often result in decreased levels of buy in and satisfaction and overall use. This is referred to as "asymmetry" or "hierarchical relationships", which involve "domination and subordination" (Williams 1997).

c. **Level of Trust** – amount of trust between organizations. Higher levels of trust are shown to cause increased cooperation (Bensaou 1997), which were found to increase improvisation in IOS settings. This was confirmed in my research, as those suppliers that expressed trust felt more comfortable improvising with the manufacturer's system (McGann/AIM FN #2, 2004 #5).

d. **Cultural Differences** – differences in organizational culture between manufacturer and supplier. Differences in culture (e.g. Japanese vs. US) can cause difficulties with communication and collaboration. As these are keys to effective improvisation, they can significantly affect the level it that takes place (McGann/AIM FN #2, 2004 #5). Prior research supports my assertion that positive interaction promoted by similar mindset promotes improvisation (Weick 1998; Kamoche 2001; Miner 2001).

e. **Mutual Benefit Perception** – perception that a system is providing benefits to both manufacturer and supplier equally. Although the benefits to the manufacturer were readily apparent, benefits to suppliers were not. I found that those supplier users who perceive that they are benefiting from the system are more likely to improvise with it (McGann/BBC FN #2, 2003 #2), while those that perceive the system as solely for the benefit of their customer, are less likely (McGann/AIM FN #2, 2004 #5). This is corroborated by Johnston and Vitale (1988), who specified that IOS must provide incentives for use to all participants in order to be successful.

2. **Supplier Factors**
    a. **Supplier Size** – size of supplier with respect to number of personnel, sites, products and annual revenues. Supplier size is a factor that could either help or hinder the improvisation process. As smaller suppliers have simpler processes and systems, they may tend to integrate more readily with manufacturer systems, requiring less improvisation. Smaller suppliers may also lack the depth in systems knowledge to improvise effectively. However, in the case of larger suppliers with more complex systems, the level of improvisation will likely be higher as they are forced to find alternative ways to integrate systems and processes. Larger suppliers are also more likely to have IS resources and experience, thus promoting improvisation (McGann/BBC FN #1, 2003 #1).This variable is also based on the finding by Williams, who emphasized that larger manufacturers like Ford had more resources to innovate in the use of IOS (Williams 1997).
    b. **Location** – location of supplier with respect to manufacturer. In the current environment of global sourcing, most larger manufacturers are working with a supply base that is a mix of local and overseas suppliers. In the case of local suppliers, the logistics and processes are less complex and therefore require less improvisation to interact. However, global suppliers have to deal with long lead times, language barriers, time zone problems and more complex logistics. Research at BBC confirms that they as they globalize, they will have to improvise more in order to effectively move material though the supply chain (McGann/BBC FN #2, 2003 #2).

3. **Systems Factor**
    a. **Legacy IS Integration w/IOS** – same as corresponding manufacturer CV.
    b. **Interactive Use** – use of the systems features which promote interaction across organizational boundaries. Examples are messaging, chat, and attachments to transactions and broadcast announcements. My observation was that users who leveraged these features were able to create more IOS improvisations by collaborating across organizational boundaries (McGann/BBC FN #2, 2003 #2).

General System Area – same as corresponding manufacturer CVs

1. System Type Factor
a. System Type Factor
b. Usability
c. Configurability
d. Formality
e. Interactivity

Supplier User Type Area - same as corresponding manufacturer CVs

1. User Savvy Factor
    a. Experience Level (New)
    b. Tech Skills

    c. Innovativeness
    d. Improvisation Competence
    e. IS Integration Knowledge

2. User Engagement Factor
    a. System Enthusiasm
    b. Level of Empowerment
    c. Level of Use

Implementation Effectiveness Area - same as corresponding manufacturer CVs

1. Support Factor
    a. Effectiveness of Training
    b. Support Effectiveness
2. Use Factor
    a. User Buy In
    b. Actual vs. Designed Use
3. Post Conversion Factor
    a. Missed Requirements
    b. Number of Issues
    c. Types of Issues

Organizational CVs

Organizational Environment Area

1. **General Organizational Factor**
    a. **Organization Size** – size of the firm with respect to number of personnel, sites, products and annual revenues. I found that this variable can either enable or inhibit evolution. In some cases, a larger organization may improvise more effectively because it has the resources and the diversity of skills to do so. However large organizations may also have inertia and bureaucratic problems, which will inhibit the creative process. There is also the possibility that the smaller organization is forced into improvisation as it has limited resources, and therefore must workaround its shortcomings. Also, smaller organizations are more nimble, and can therefore implement improvisational change quickly (Van de Ven 1996).
    b. **Complexity** – complexity of the structure of the organization with respect to hierarchy, number of processes, products, personnel and globally dispersed locations. If an organization is more complex the evolution process is more likely to become slowed by the bureaucracy and number of approval channels that is must go through. More streamlined organizations will process the improvisation more efficiently, so that the IT modification or process formalization will evolve quickly (Van de Ven 1996).
    c. **Change Culture** – organizational culture that is adept at handling change, usually through past experience with it, or instilling it into organizational values. As improvisation evolution implies change, an openness to change is a prerequisite characteristic of an organization that will promote the evolution of situated changes into organizational changes (Orlikowski 1996). Conversely, organizations that are not

open to embracing change will lack the requisite skills and mindset to improvise (Weick 1998).

d. **Internal Job Movement** – moving personnel between positions within the organization. My finding was that this interrupts continuity in the evolution process, as a champion of an improvisation that is driving its evolution may be replaced someone who does not support it (McGann/AIM FN #2, 2004 #5).

e. **Culture of Innovativeness** – a culture that encourages and teaches innovation as a core value and skill. An organization that promotes innovation and creativity see improvisation as a continuous improvement process. They are therefore more willing to accept improvisations as opportunities for positive change, and will thus seek to incorporate them permanently into organizational IT and processes (Nambisan 1999; Moorman and Miner 2001).

System Environment Area

1. New System Factor

a. **Modification Policy** – policy of the organization stating whether or not it uses IT modifications to permanently instantiate improvisations into the design of their software systems. Organizations that promote this practice will cause more improvisations to evolve, as they will be incorporated into their systems (McGann/BBC FN #2, 2003 #2; McGann/AIM FN #2, 2004 #5).

b. **Future Use Plans** – strategic plans that the organization has for future use of the studied system. If an organization has long-term strategic plans for the system, they will be more prone to invest resources into IT modification and process re-engineering as a result of improvisation, in order to take advantage of these continuous improvement opportunities to better position them for future use of the system and the benefits that it will offer the organization (McGann/AIM FN #2, 2004 #5). If the organization sees the system as a temporary solution, and is uncertain of long-term plans for it, they will tend to divest, thus stopping the evolution process (e.g. not allocating funds for IT modifications as a new solution is being considered) (McGann/BBC FN #2, 2003 #2).

Appendix 3 – Detailed CV Assessments

BBC Manufacturer User CVs Assessment

Contextual Variable Area	Contextual Variable Factors	Contextual Variables Items	CV Rating	Overall Assessment
General System	1. System Type Factor	a) Configurability (1) b) Formality (1) c) Interactivity (1)	a) High (+) b) Low (+) c) High (+)	1. +
System Environment	1. New System Factor 2. Legacy System Factor	a) Reason for Implementation (1) b) Modification Policy (1) c) Release Currency (1) d) Competing Alternative Syst? (2) e) Legacy Integration w/new IS (2)	a) Not Accepted (-) b) No-Mod (+) c) Not Current (-) d) Yes (-) e) High (-)	1. – 2. -
Manufacturer User Type	1. User Savvy 2. User Engagement	a) Experience Level (New) (1) b) Tech Skills (1) c) Innovativeness (1) d) Improvisation Competence (1) e) System Enthusiasm (2) f) Level of Use (2)	a) High (+) b) Low (-) c) Low (-) d) Low (-) e) Low (-) f) Low (-)	1. – 2. –
Implementation Effectiveness	1. Support Factor 2. Use Factor 3. Post Conversion Factor	a) Effectiveness of Training (1) b) Support Effectiveness (1) c) User Buy In (2) d) Actual vs. Designed Use (2) e) Missed Requirements (3) f) Number of Issues (3) g) Types of Issues (3)	a) High (+) b) High (+) c) Low (+) d) NE Designed (-) e) Low (-) f) Low (-) g) Minor (-)	1. + 2. - 3. -

BBC Supplier CVs Assessment

Contextual Variable Area	Contextual Variable Factors	Contextual Variables Items	CV Rating	Overall Assessment
Inter-organizational Environment	1. Relationship Factor 2. Supplier Factor 3. Systems Factor	a) Exchange Mode (1) b) Partnership Perception (1) c) Level of Trust (1) d) Cultural Differences (1) e) Location (2) f) Legacy IS Integration w/IOS (3)	a) Voice (+) b) Low (-) c) High Trust (+) d) Low Differences (+) e) Regional/International (+) f) Low (+)	1. + 2. + 3. +
General System	1. System Type Factor	a) Configurability (1) b) Formality (1) c) Interactivity (1)	a) High (+) b) Low (+) c) High (+)	1. +
Supplier User Type	1. User Savvy 2. User Engagement	a) Experience Level (New) (1) b) Tech Skills (1) c) Improvisation Competence (1) d) System Enthusiasm (2) e) Level of Use (2)	a) Low (-) b) Low (-) c) Low (-) d) High (+) e) High (+)	1. – 2. +
Implementation Effectiveness	1. Support Factor 2. Use Factor 3. Post Conversion Factor	a) Effectiveness of Training (1) b) Support Effectiveness (1) c) User Buy In (2) d) Actual vs. Designed Use (2) e) Number of Issues (3) f) Types of Issues (3)	a) High (+) b) High (+) c) High (+) d) As Designed (+) e) Low (-) f) Minor (-)	1. + 2. + 3. -

BBC Organizational CVs Assessment

Contextual Variable Area	Contextual Variable Factors	Contextual Variables Items	CV Rating	Overall Assessment
Organizational Environment	1. General Organizational Factor	a) Complexity (1) b) Change Culture (1) c) Innovativeness (1)	a) Low (+) b) Adept (+) c) Low (-)	1. +
System Environment	1. New System Factor	a) Modification Policy (1) b) Future Use Plans (1)	a) No-Mod (+) b) Low Use (-)	1. –

AIM Manufacturer User CVs Assessment

Contextual Variable Area	Contextual Variable Factors	Contextual Variables Items	CV Rating	Overall Assessment
General System	1. System Type Factor	a) Usability (1) b) Configurability (1) c) Interactivity (1)	a) High (+) b) High (+) c) High (+)	1. +
System Environment	1. New System Factor 2. Legacy System Factor	a) Reason for Implementation (1) b) Fit (1) c) Modification Policy (1) d) Level of Use (1) e) Competing Alternative Syst.? (2) f) Legacy Integration w/new IS (2)	a) Users Accept (+) b) Good (-) c) No Mod (+) d) High (+) e) No (+) f) Low (-)	1. + 2. +
Manufacturer User Type	1. User Savvy 2. User Engagement	a) Experience Level (New) (1) b) Tech Skills (1) c) Innovativeness (1) d) Improvisation Competence (1) e) System Enthusiasm (2) f) Level of Empowerment (2)	a) High (+) b) High (+) c) High (+) d) High (+) e) High (+) f) High (+)	1. + 2. +
Implementation Effectiveness	1. Support Factor 2. Use Factor 3. Post Conversion Factor	a) Effectiveness of Training (1) b) Support Effectiveness (1) c) User Buy In (2) d) Missed Requirements (3) e) Number of Issues (3) f) Types of Issues (3)	a) High (+) b) High (+) c) High (+) d) Low (-) e) Low (-) f) Minor (-)	1. + 2. + 3. -

AIM Supplier User CVs Assessment

Contextual Variable Area	Contextual Variable Factors	Contextual Variables Items	CV Rating	Overall Assessment
Inter-organizational Factors	1. Relationship Factor	a) Exchange Mode (1) b) Partnership Perception (1) c) Level of Trust (1) d) Mutual Benefit Perception (1)	a) Voice (+) b) Low (-) c) High (+) d) Low (-)	1. -
General System	2. System Type Factor	a) Usability (1) b) Configurability (1) c) Interactivity (1)	a) Low (-) b) Low (-) c) Low (-)	1. -
Supplier User Type	1. User Savvy 2. User Engagement	a) Experience Level (New) (1) b) Tech Skills (1) c) Improvisation Competence (1) d) System Enthusiasm (2)	a) Low (-) b) High (+) c) Low (-) d) Low (-)	1. - 2. -
Implementation Effectiveness	1. Support Factor 2. Use Factor 3. Post Conversion Factor	a) Effectiveness of Training (1) b) Support Effectiveness (1) c) User Buy In (2) d) Number of Issues (3) e) Types of Issues (3)	a) Low (-) b) High (-) c) Low (-) d) Low (-) e) Minor (-)	1. - 2. - 3. -

AIM Organizational CVs Assessment

Contextual Variable Area	Contextual Variable Factors	Contextual Variables Items	CV Rating	Overall Assessment
Organizational Environment	1. General Organizational Factor	a) Complexity (1) b) Change Culture (1) c) Internal Job Movement (1) d) Innovativeness (1)	a) Low (+) b) Adept (+) c) Often (-) d) High (+)	1. +
System Environment	1. New System Factor	a) Modification Policy (1) b) Future Use Plans (1)	a) No Mod (+) b) High Use (+)	1. +

Appendix 4 - Master Improvisation Listing

Master Improvisation List

Phase I - BBC

Improvisation Trigger	Improvisation	Type	Improvisation Creator	Final Evolutionary Stage
Missed Requirement	**Message Alert.** Calling or e-mailing supplier/planner manually when there is a message on the portal that needs to be addressed.	Process Workaround	MFG Users	**Modification** - Creation of mailbox icon on each order to show that an associated message is attached to an individual order.
Missed Requirement	**ASN for UOM.** Use of the ASN screen by suppliers to enter in standard shipping information like units of measurement (e.g. inches or pounds)	IT Workaround	Functional Liaison	**Modification** - Creation of drop down boxes to automatically fill in the standard fields.
Missed Requirement	**Supplier Part Number Display.** Use of messaging fields to display supplier part numbers.	IT Workaround	Functional Liaison	**Modification** - Created a “Supplier Part Number” field
Unmet Requirement	**Demand Mailing.** .Planners printed out and mailed demand to suppliers that were not adopting or having system problems	Process Workaround	MFG Users	**Embellishment** – This process was created to aid suppliers in receiving demand during initial phases of implementation when issues were present. Still used as needed.
Missed Requirement	**ASN Number Display.** Use of messaging field for ASN #	IT Workaround	Functional Liaison	**Modification** - Added these fields to software in later release

Phase II – BBC

Improvisation Trigger	Improvisation	Type	Improvisation Creator	Final Evolutionary Stage
Missed Requirement	**Ship To/Ship From Filtering**. Use of "Ship to" and "Ship from" filters in reports created by the supplier and planners	IT Workaround	Functional Liaison	**Modification** - Functionality added which allowed defaults to all "ship from" and "ship to" locations, Create option in Releases screen to pick individual plant or ship from location. This made it so users didn't have to create the ship to or ship from filter to use the site.
Evolving Requirement	**Ship To Select All.** In the process of creating a "ship to" filter, if the user wanted to select all suppliers, they figured out that they could select the first item, hold down shift, then select the bottom supplier to select all.	IT Workaround	MFG Users	**Modification** - A "select all" option was implemented so that the users wouldn't have to go through this process. This also fixed the issue when a new supplier was added. This way the new supplier was automatically included without manually selecting them.
Evolving Requirement	**Reporting Improvisation.** Creative use of online reporting capabilities	Configured IT Improvisation	MFG Users Supplier Users	Ad hoc adjustment **– Continue to use array of reporting tools for ad hoc queries and reports as designed.**
Evolving Requirement	**Data Download for Reports.** Improvised uses of download capabilities for creating custom reports in Excel and other tools (e.g. "in transit report" and "supply/demand report" by brake part supplier agent)	Configured IT Improvisation	Supplier Users	**Embellishment** - Used XXX functionality to create a side process for reporting due to special in-transit requirements.
Evolving Requirement	**Data Download for Systems Integration.** Improvised uses of download capabilities to integrate data with legacy systems	Configured IT Improvisation	Supplier Users	**Modification** – Used XXX functionality to bridge systems by importing transactions in different formats
Unmet Requirement	**Reverting to Back to Mainframe.** Using mainframe system for ad hoc queries because of portal performance issues, the fact that they had to log on each time, or better query and info capabilities.	IT Workaround	MFG Users	**Embellishment** - Still have not resolved performance issues, but know it is a problem with BBC database. In the meantime, process has been institutionalized to use the mainframe for all reports.
Missed Requirement	**Messaging for Ad Hoc Storage.** Use of messaging as a "workaround mechanism" for ad hoc information storage needs such as vendor part number and in-transit information.	IT Workaround	MFG Users	**Modification** – Added vendor part number to software, still no in-transit fields.

Evolving Requirement	**VMI Process.** Use of messaging fields to communicate vendor managed inventory information (VMI).	Process/IT Workaround	Functional Liaison	**Modification –** Changes were made to XXX, which added a new software module and a number of associated reports. **Embellishment** – A new set of processes to support the new module were developed and implemented. **Metamorphosis –** The VMI processes and modifications were vital enough to warrant changes to policy and procedure, as well as a significant implementation effort to roll it out to the user community.

Phase III - BBC

Improvisation Trigger	Improvisation	Type	Improvisation Creator	Final Evolutionary Stage
Evolving Requirement	**Use Monitoring.** There was a problem with knowing whether some suppliers were using the system. Some said they were, but BBC suspected this was not the case. A process was put in place to monitor whether changes were made in the supplier database to indicate use.	IT/Process Workaround	Functional Liaison	**Modification** – a function was added that gave the administrator the ability to query the database with a standard report to see who had logged on, when and for how long.
Evolving Requirement	**Auto E-mail for Low Volume Suppliers.** A problem evolved with low volume suppliers forgetting to use the site. The improvisation was to e-mail them as needed as a reminder.	Process Workaround	Functional Liaison	**Modification** - Functionality added which Use the automatic e-mail program to send e-mails to suppliers that forget to use the web site. The site was set up to send reminder e-mails to the low volume suppliers when ever a schedule has been changed on the site. This way a supplier usually gets an e-mail once a week telling them to view the site.
Evolving Requirement	**Consignment Parameter Settings.** Certain high volume consignment suppliers have their minimum inv. and max inv. Set to 10/20 DOS instead of the standard 20/40 DOS. This is an improvisation using standard	Configured IT Improvisation	Supplier Users	**Embellishment** - This forces both the supplier and planner to keep closer watch of the forecast and inventories.

Improvisation Trigger	Improvisation	Type	Improvisation Creator	Final Evolutionary Stage
	functionality.			
Evolving Requirement	**Supplier Scorecard Process.** BBC needed a way to communicate key metrics to supply chain. A manual report was created from mainframe data.	IT Workaround	Strategic/Management Users	**Modification -** An entirely new software module called the "Supplier Scorecard" was developed to meet this requirement. **Embellishment** - associated processes were also created and implemented **Metamorphosis -** This completely changed the dynamic between BBC and its suppliers as it increased communication levels, accountability levels and in turn has improved overall delivery performance levels throughout the supply base.
Evolving Requirement	**Scorecard for Receipts Info.** As there were often discrepancies between actual receipt dates and dates on the system, suppliers were inquiring often about these issues. Planners were manually looking up this information and e-mailing it to suppliers.	Process Workaround	Supplier Users	**Embellishment** - Suppliers have been trained to use the new Supplier Scorecard Module to pull this information from the portal. The suppliers were shown how to use the "receipts function" to find which orders were late or early according to the system.
Evolving Requirement	**Supplier Scorecard Adjustments.** The BBC planning/purchasing department has analyzed supplier metrics using a 3 month average. This has given them limited analytical ability.	Process Workaround	Strategic/Management Users MFG Users Supplier Users	**Embellishment -** BBC has made a major adjustment to their Score Card metrics as a result of the portal 's ability to provide a 12-month rolling average. This has provided them with expanded analytical abilities, and could result in further evolution of the buyer/supplier process in the future.
Evolving Requirement	**Scorecard Data for Targeting**. An improvisation was created to use portal data to target suppliers in need of corrective action.	Process Workaround	MFG Users Supplier Users	**Embellishment -** One plants is using the score card metrics to target suppliers for 8D corrective action programs.
Missed Requirement	**Last Order Change Date.** Planners were having a problem with suppliers shipping against cancelled orders, claiming that had been not cancelled. The ability to verify this is not available in legacy system. The need first arose when a supplier built very expensive tooling against a cancelled	Process Workaround	Functional Liaison	**Modification.** "Last change Date" has been added to orders and reports so that planners can see when an order was canceled or added.

Improvisation Trigger	Improvisation	Type	Improvisation Creator	Final Evolutionary Stage
	order. With some digging in the portal database, they were able to prove the orders were cancelled.			
Missed Requirement	**Schedule Change Tracking.** Initially there was no means of tracking schedule change dates. This was a problem as planners were going in and canceling schedules. They were working around this with phone calls to determine these dates, and entering them into spreadsheets.	Process Workaround	Functional Liaison	**Modification** – The system has been modified to include the "Schedule Change Date" in reports and queries.
Evolving Requirement	**830 Download by Suppliers.** Suppliers were using the 830 download to integrate with their EDI systems.	IT Workaround	Supplier Users	**Modification** – This led to the modification of the data download module to perform this automatically.
Missed Requirement	**Supplier Cumulative Information.** Visibility of cumulative transaction information was not part of the original design of XXX. These were being calculated on spreadsheet systems offline.	IT Workaround	Functional Liaison Supplier Users	**Modification** - XXX now has the ability to give suppliers cumulative information. (This was a metamorphosis per Joe)
Evolving Requirement	**Event Triggered Messaging.** Separate reports were being used to identify exceptions in XXX from ERP system.	IT Workaround	Functional Liaison	**Modification** – Added the "Event triggers/exception-based" module thus bridging between legacy systems and messaging capabilities in XXX.
Evolving Requirement	**VMI Module to Track In transit Shipments**. There is a need for certain overseas suppliers to have visibility of in-transit orders, due to long lead times and intermediate operations (metacote). This was being tracked manually through spreadsheets of extracted data.	IT Workaround	Supplier (Power) User	**Embellishment** – Supplier user discovered that the VMI module could be used for this type of in-transit requirement. Now it is being used by other suppliers in this situation.
Evolving Requirement	**Proof of Release.** Planner was having a problem with a supplier who refused to ship product because they could not find it on the portal. Planner found the release, faxed it to the supplier who then agreed to ship it.	Process Workaround	MFG User	**Ad Hoc Adjustment** – This situation happens infrequently, but the advantage of the portal's ability to create mutual communication to resolve such issues is obvious in this case.
Evolving Requirement	**Use of Consignment Module for Overseas Suppliers.** Unique requirements for overseas suppliers with long lead times and sporadic requirements. In the past they were shipping once a month and also	Process Workaround	Functional Liaison	**Embellishment** – Certain vendors are now piloting the use of the Consignment Module to assist in this process.

Improvisation Trigger	Improvisation	Type	Improvisation Creator	Final Evolutionary Stage
	expediting.			
Evolving Requirement	**Mexico Planner Training Issues.** Due to training issues associated with Mexico Plant, the planner downloads most schedules for her suppliers and sends them by e-mail.	Process Workaround	MFG User	**Ad Hoc Adjustment** – This will be done on an as needed basis, but will likely subside as users become more experienced.

Phase IV - BBC

Improvisation Driver	Improvisation	Type	Improvisation Creator	Final Evolutionary Stage
Evolving Requirement	**VMI Module as a Kan Ban System.** Selected overseas suppliers have a need to replenish inventory using a KanBan type system. This was being done manually through spreadsheets. (This is a continuation of the metamorphosis that started in Phase II).	Process/IT Workaround	Functional Liaison Supplier (Power) User	**Modification –** a number of fields were added to meet the design. **Embellishment –** an extensive set of processes were developed and implemented to facilitate Kan Ban. **Metamorphosis** – Through a collaborative effort between the BBC functional liaison and a supplier power user with a special set of requirements, it was discovered that the VMI module could be used to create a KanBan type system. Based on this discover, this system is now being implemented at other overseas suppliers.
Evolving Requirement	**"Schedule Drop In" process**. Due to the new more real time visibility of data, BBC has started to "drop in" schedules at the last minute (inside of normal two-week window). Suppliers were not seeing or responding to them. This has caused the necessity for an improvised process (follow up phone call), to notify suppliers when this happens in order to assure that the order can be filled, and that the supplier is not upset when this takes place.	Process Workaround	MFG User	**Modification** – This process spawned a modification where an auto-e-mail message was sent when net change picked up on the changed quantities. (permanent process workaround and permanent IT workaround)
Unmet Requirement	**Mainframe Specialized Reporting Process.** To satisfy the need for specialized reports, planners used to	Process Workaround	MFG User	**Embellishment** – Planners created a mainframe "Db Query" because it is faster (15 mins in Mx and only 1 min

Improvisation Driver	Improvisation	Type	Improvisation Creator	Final Evolutionary Stage
	improvise use the download capabilities from Mx to Excel. However, due to performance issues, this needed an alternative solution.			from mainframe). This is a highly specialized report that is sent to vendors that need information on schedules and are unable or unwilling to get it from the portal.
Missed Requirement	**Trigger Message Workaround**. When an e-mail message notification is received, planners used to go to the messaging module to investigate. This was taking too much time, so many of them were communicating outside of the messaging module.	Process Workaround	MFG User	**Embellishment** - Now planners do not check messages, since they are not integrated with Outlook. Instead, this is seen as a trigger for an immediate phone call or e-mail. This saves the step of going to the portal to view the message.
Evolving Requirement	**Consignment for In-transit.** Used to use a complex system of spreadsheets for calculating In-transit and for sending materials out to be coated at an alternate operation.	Process Workaround	Supplier (Power) User	**Embellishment** – She now uses the consignment module for tracking split sourcing operations.
Evolving Requirement	**Conflict in Min/Max**. Conflict arises with demand reports as min/max and consignment is not split out by supplier in reports, but is split out in portal. Workaround is for the planner at the plant to e-mail inv report to Sue with these split out manually.	Process Workaround	Supplier (Power) User	**Embellishment** – This process will likely not evolve past an embellishment as it is a highly specialized requirement.
Missed Requirement	**Consigned "On Hand" No Future Demand.** Consigned parts with no demand in the future do not show "On Hand" inventories. Workaround is to track manually by downloading receipts and comparing to the pulls to calculate "On Hand" manually.	Process Workaround	Supplier (Power) User	**Embellishment** – This manual process is being used indefinitely, but this issue is being considered for modification as it is a basic piece of functionality that was missed.
Missed Requirement	**Invoice Number on Pull Report**. Need to match invoice number with inventory pulls on the pull report. Was creating a manual report to match these numbers.	IS Workaround	Supplier (Power) User	**Modification** – Pull report was modified to include invoice number.
Missed Requirement	**Partial Shipments Not Showing Late**. As partial shipments don't show remaining quantity late, supplier has to print out transaction reports and calculate them manually.	IT Workaround	Supplier User	Embellishment **– This manual process is being used indefinitely, but this issue is being considered for modification as it is a basic piece of functionality that was missed.**
Evolving Requirement	**E-mail Schedule to Holdouts Using Portal**. There are about 20 suppliers that are not using the portal. As EDI	Process Workaround	MFG User	**Ad Hoc Process Adjustment** – This will continue until these suppliers convert or are dropped.

Improvisation Driver	Improvisation	Type	Improvisation Creator	Final Evolutionary Stage
	was recently cut off, the only way for them to get schedules for orders was to institute an workaround where they are e-mailed.			
Missed Requirement	**Drawing Number/Part Number Conflict**. No way to match drawing/rev number with part numbers. Disconnect between engineering and mainframe and portal. Workaround is to track these manually and look up/explain as needed. This is resulting errors and inefficiencies.	IT Workaround	Functional Liaison	**Modification** – this is being considered for modification in the next release.
Missed Requirement	**Quality Metric Rollup (Rhonda Laux)**. Metrics in supplier scorecard only roll up o the supplier. Need this in more detail by breaking down by part number. Workaround is to calculate manually using spreadsheets.	IT Workaround	Strategic/Managerial User	**Modification** – this is being considered for modification in the next release.

Phase I - AIM

Improvisation Trigger	Improvisation	Type	Improvisation Creator	Final Evolutionary Stage
Evolving Requirement	**Receiving Module/Process.** Raw material was being lost or not accounted for properly due a disjointed receiving and tracking process. This was resulting in hundreds of “material discrepancies”. The workaround for this was for management to track these issues on a spreadsheet and assign resolution of them to material handlers, receiving clerks and A/P personnel.	IT/Process Workaround	Strategic/Management User	**Modification –** An entirely new software module was created, and others, such as inventory control were modified to meet these requirements. **Embellishment –** A new set of material tracking and accounting processes resulted. **Metamorphosis –** This major change involved all members of the supply chain, changing policies and performance measures.
Evolving Requirement	**“Receive All” Process.** When the receiving module was first developed, users had to receive POs one line at a time. This was taking up approximately 3-4 hours of each day for the receiving clerk	IT Workaround	MFG User	**Modification –** This led to the addition of a “Receive All” function, which allowed for the receipt of all lines of a PO at once.
Missed Requirement	**Customer Controlled Parts.** For “Honda Controlled” parts (Demand received from Honda by supplier, then shipped to AIM.), The improvisation is	Process Workaround	Functional Liaison MFG User	**Embellishment** – This process happens relatively infrequently and therefore has not warranted a modification yet.

Improvisation Trigger	Improvisation	Type	Improvisation Creator	Final Evolutionary Stage
	for receiving to create an ASN when the material arrives, ship it and receive it all in one process.			
Evolving Requirement	**Missing Paperwork on Receipts.** When paperwork (MPL) is missing when material arrives, there is a need to use it before it has been received. A Process Workaround was created to track these on a spreadsheet, and then receive them on the system at a later time, after this discrepancy has been resolved.	Process Workaround	Functional Liaison MFG User	**Embellishment** – This process is working well, and therefore has not warranted a modification yet.
Evolving Requirement	**Material Use Before System Receipt.** When materials are needed immediately on the shop floor, before they have been received into XXX, a Process Workaround was created to track these on a spreadsheet, and then receive them on the system at a later time.	Process Workaround	Functional Liaison MFG User	**Embellishment** – This process is working well, and therefore has not warranted a modification yet.
Evolving Requirement	**Master Packing List Reprint.** If packing slip is missing on the receiving dock, a process workaround was created to search in XXX by ASN number and print it for receiving to scan and for A/P to do matching.	Process Workaround	Functional Liaison MFG User	**Embellishment** – This process is working well, and therefore has not warranted a modification yet.
Missed Requirement	**Multiple "Ship Froms".** System will not accommodate multiple "ship froms" from a single company. Have to workaround by setting up multiple companies and doing all transactions separately.	IT Workaround	Functional Liaison	**Modification** - Functionality added which allowed defaults to all "ship from" and "ship to" locations, Create option in Releases screen to pick individual plant or ship from location. This made it so users didn't have to create the ship to or ship from filter to use the site.
Missed Requirement	**Shipment "Undo".** Unable to undo a shipment that is confirmed by mistake in XXX. Have to receive it in XXX and then go to the ERP system (which has the 'undo' functionality) and undo the receipt in order to clear it.	IT Workaround	Functional Liaison	**Modification** – This has been submitted for possible modification in the future.
Unmet Requirement	**Deleting User Profiles**. Users were being deleted from the system, but could still log in. It was discovered that there was a software flaw causing	IT Workaround	Functional Liaison	**Modification** – This "bug" was fixed quickly due to the security risks that it posed.

Improvisation Trigger	Improvisation	Type	Improvisation Creator	Final Evolutionary Stage
	this. To correct this, an IT workaround was designed where the DBA would use a query to "hard delete" records from the database.			
Evolving Requirement	**Supplier "Pass Through Parts" Process.** A few suppliers send parts directly to Honda instead of shipping to AIM. A workaround was created so that each supplier has the ability to ship normally, or pass through.	Configured IT Improvisation	Functional Liaison	**Embellishment** – This is an ongoing use of the improvisation, which has become institutionalized.
Evolving Requirement	**User Support Lookup**. Users call and leave a support message with no contact information. The Dba wrote a query to extract contact information from the support Db.	IT/Process Workaround	Functional Liaison	**Embellishment** – There is an ongoing use of this improvisation, which was institutionalized into organizational procedures. It was also followed up with training to reduce the occurrence of this issue.
Evolving Requirement	**ASN Search**. Material that was shipped on the portal was not found in inventory after shipping lead-time had expired. A/P improvised a process to track shipments that are confirmed but not received. If a week passes, vendor is contacted to inquire about the status. Result was the discovery that many vendors were shipping material in the portal before physically shipping it.	Process Workaround	MFG User	**Embellishment** – This is an ongoing use of the improvisation, which has become institutionalized. It has been used to increase accountability in the A/P process
Evolving Requirement	**A/P Invoice Search.** ERP system and XXX shipments did not match up. A/P improvised this custom report to verify that what they had been invoiced for (in Glovia) matched up with what was actually shipped and received in XXX.	IT Workaround	MFG User	**Embellishment –** This report is used on an ongoing basis to resolve these discrepancies. Therefore, a new process has been created for resolving these discrepancies. They have also added a process of contacting vendors to reconcile these differences.
Evolving Requirement	**No Release to Ship Against.** Vendor can't ship because there is no release on the portal to ship against. A process was improvised to instruct the vendor to call the planners, who manually create a release. This problem stems from the fact that the planners are not using the portal as their primary planning tool. They are using spreadsheets instead. This results in release information in Mx being out of	Process Workaround	Supplier User MFG User	**Embellishment** – This is an ongoing use of the improvisation, which has become institutionalized. This will continue to be necessary until the planners use XXX as their primary planning tool.

Improvisation Trigger	Improvisation	Type	Improvisation Creator	Final Evolutionary Stage
	synch with actual orders.			
Evolving Requirement	**DTR Process/Attachments.** In the case where more pieces are shipped than were called for on the portal release an issuance of a Domestic Trouble Report, ensues. This lowers the supplier's rating. The improvisation was to use the portal's attachment capabilities at the PO line level to attach a DTR by line.	Process Workaround	MFG User	**Embellishment** – This is an ongoing use of the improvisation, which has become institutionalized.
Evolving Requirement	**Wrong MPL Number.** Another common problem that required some improvisation was when the packing list number is wrong (due to user error). The workaround In this case is to cross reference it to the invoice in Glovia (ERP) and hand write it in before being able to do the receipt.	Process Workaround	MFG User	**Embellishment** – This is an ongoing use of the improvisation, which has become institutionalized.
Evolving Requirement	**Actual Shipment More than PO.** If a purchase order is fully received, but the actual shipment includes more material than is indicated on the PO, they have to manually create a new PO line in the ERP and receive there.	Process Workaround	MFG User	**Embellishment –** This is an ongoing use of the improvisation, which has become institutionalized.
Evolving Requirement	**ASN After Shipment.** Suppliers don't keep up with shipments on portal and then try to ship POs all at once (after material was already shipped). The workaround was manual correction of POs through the use of a mass SQL program.	IT Workaround	Functional Liaison	**Ad Hoc Adjustment –** This SQL program is run as needed, but training has resolved the need for frequent use or an organizational process change.
Evolving Requirement	**ERP/XXX PO Delete Discrepancy.** PO is deleted in the ERP, but then not updated in portal. The vendor then ships against a deleted PO. The improvisation in this case was to build a temporary interface that assures the two systems were in synch.	IT Workaround	Functional Liaison	**Modification** - There is an ongoing use of this program, which has become institutionalized.
Evolving Requirement	**A/P Messaging.** A/P was spending an inordinate amount of time contact suppliers about material and invoice issues. They were using e-mail and attaching invoices, etc. as the initial improvisation.	Process Workaround	MFG User	**Modification** - The A/P messaging module is a modification that resulted from the need to communicate with vendors with regards to invoices. This allows for A/P specific messaging, threaded discussion and also coding of

Improvisation Trigger	Improvisation	Type	Improvisation Creator	Final Evolutionary Stage
				message type.

Phase II – AIM

Improvisation Trigger	Improvisation	Type	Improvisation Creator	Final Evolutionary Stage
Evolving Requirement	**Material Discrepancy Process.** In response to lost material issues being so great in number, management improvised an approach to locating in-transit material using the portal. Phone calls were made to locate materials that were reported as shipped or received.	IT/Process Workaround	Management/Strategic Users	**Modification –** A new report was created to track in-transit material, but was created in phase I as part of a different improvisation. **Embellishment –** From the report, a new set of processes designed to more closely track in-transit material were designed and implemented. **Metamorphosis** – This simple report spawned a key strategic material tracking process which involves all personnel from top management down on a daily basis. It has evolved as a key strategic tool and now serves as the focal point for all planners, receiving and A/P personnel. This process has redefined the material management is handled at AIM.
Missed Requirement	**No Decimals (Functional Liaison).** Mx won't do decimal (fractional) numbers, and some fabric is sold in meters and must be converted, resulting in fractions. These types of fractional items cannot be processed in Mx, so had to create a workaround to identify these items and go through the ordering, ASN and receiving processes in the ERP.	Process Workaround	Functional Liaison	**Modification –** Ability to handle decimal places has been added to the next software release.
Evolving Requirement	**Proactive Message Viewing.** A/P developed a process to view messages attached to POs, in order to give him insight into where issues will be later on in the A/P process. (e.g. if there is a PO line missing for some material that was physically received, he knows that	Process Workaround	MFG User	**Embellishment** – This improvisation has been institutionalized as standard process at the local level.

Improvisation Trigger	Improvisation	Type	Improvisation Creator	Final Evolutionary Stage
	he will need to communicate with that supplier soon and can plan accordingly).			
Unmet Requirement	**Mx-ERP Interface PO/Receipts Not Matching.** An interface issue pertaining to a program that moves Mx receipts into the ERP to match against POs created to the need for a workaround. The example given was that receipts in Mx were being matched with the wrong POs in Glovia. The workaround was to backdoor the Mx database to reverse the receipts.	IT Workaround	Functional Liaison	**Ad Hoc Adjustment** – The interface issue was resolved, but still surfaces intermittently. The SQL program is still used as needed.
Evolving Requirement	**Shipping Before PO Created (MFG User, Planning).** Big issue with shipping materials by vendors without a PO to ship against. They contact the planner as the material is on its way out the door. At that point, even if he manually creates the PO in the ERP right then, the interface will not create a release to ship against until the interface runs (every four hours). Therefore, shipments often arrive without an MPL. In these cases, the workaround used to be to create an MPL and receive against it right away. This was deemed inefficient, and now the material in these cases is being received directly into Glovia to save steps.	Process Workaround	MFG User	**Ad Hoc Adjustment**. This issue has been alleviated somewhat through training and advising, but is still used as needed.
Missed Requirement	**Suppliers Splitting Shipments or Changing Qty on Release.** Suppliers cannot change the qty of a release or split a shipment. The workaround was to call or e-mail when they are shipping a different qty. and the planner can create a different release.	Process Workaround	MFG User Supplier Users	**Modification** - This issue resulted in a modification of the software to allow changing and splitting quantities at the PO level, but only by the buyer/planner.
Evolving Requirement	**Alert of Over or Under Qty. After Shipped**. If the release that is shipped against is over or under the qty of the release, supplier uses a special message to alert them of this.	Process Workaround	Supplier Users	**Embellishment** – This improvisation has been institutionalized as standard process at the local level.

Appendix 5 - eCollaboration System Overview

The XXX Supplier Collaboration Tool

The XXX Supplier Collaboration supply chain solution, developed by the Express Corporation, is designed to leverage the ubiquitous nature of the Internet to allow seamless interaction between manufacturers and suppliers, in the exchange of supply chain information. The purposes of this tool according to its creator are:

"To extend capabilities of ERP systems, using extranet and web technologies to encourage collaboration in the supply chain", " facilitating collaborative planning, forecasting and replenishment (CPFR)", " allowing geographically dispersed firms to operate as a virtual corporation", "facilitate integration of information with back-end systems", and "provide planners and suppliers with business intelligence that allows them to manage by exception".

Proposed benefits of eCollaboration systems are:

"Reduction in procurement costs, improvement and simplification of communication along the supply chain, decreased cycle times, maximized planner, analyst and buyer efficiency, and increased likelihood that the right product will be delivered in the right place at the right time".

Technical architects at Express created a secure application using portal technology as the primary interface. The tool consists of a supplier portal and a planner portal, with administrative control over what information can be viewed and manipulated. Within these interfaces, order release data (similar to an EDI 830), advanced shipping notices (similar to an EDI 856) and order promises, are exchanged in procurement transaction process. This collaborative environment also allows planners to track shipments in real time, use interactive messaging to communicate about supply chain issues and effectively deal with exceptions as demand changes, using net change alerts, which automatically e-mail planners and suppliers as fluctuations occur. The system also provides targeted visibility to all types of supply chain information through various ad hoc and standardized reporting tools.

In comparison to EDI, BBC quickly saw that an eCollaboration tool such as XXX has obvious advantages. Most appealing is the reduction in overall cost. Use of such tools eliminates EDI expense, as all transactional information is now transmitted over the Internet. Another key factor is the availability of real-time information. In the case of BBC, EDI transactions were only updated once a week. Daily exceptions were not visible on any information system, and as such had to be dealt with via e-mail or phone. This proved especially difficult and inefficient in the case of global suppliers in vastly different time zones such as Asia. Often supply problems from the previous week were not visible until the following week's EDI was run. XXX solved this, as net change information was available on a real-time basis. Further, proactive e-mail alerts are sent out in response to supply and demand changes. The third advantage over EDI is the interactive nature of the tool. EDI creates a unidirectional flow of information in the supply chain, in a rigid, standardized fashion. This makes interaction between actors difficult, as they are forced to use a different medium (e-mail or phone) to exchange information as day-to-day exceptions occur.

The development partnership between BBC and Express yielded a solution to this as stated by the Express president:

"When we showed them the first version, they thought the functionality and the capability and the concept were very leading edge and very much oriented toward what they needed. However, they were looking for a holistic solution, something we had planned in version two. When we say from a holistic viewpoint that is tying in releasing, shipping, messaging, and portal technology to allow really a two-way communication level between the manufacturers and the suppliers, thereby allowing a more real time environment to be reflected on both ends".

The final key advantage of eCollaboration tools over EDI is the flexibility that they provide in the use of information. Through ad hoc query tools, standardized reports with various filtering capabilities, and the ability to download supply chain information in various formats, planners and suppliers have the ability to improvise uses for information. Inherently, the system gives them ability to view only the information that they want, use the data in other reporting tools such as Excel, or integrate it with their legacy systems in formats such as XML. This type of flexibility is unique to the eCollaboration environment, and was a key part of the decision to adopt it at BBC.

Appendix 6a – Manufacturer Interview Script

General Information
- Name and description of company position?
- Role in implementation of MX?
- Amount of time working with MX?
- What need did MX fill in your area?
- How long ago did your area go live with MX?
- How much do you depend on it on a daily basis?

MX Implementation Process
- Describe what the MX systems does.
- Has the MX system been easy for you to learn?
- Discuss the training process.
- Has the implementation been successful? Please explain.
- Are most of the features of MX used frequently?
- Has use of the MX system changed since it was implemented? Have these changes involved modification to the software or the processes supporting it?

Supply Chain Systems
- What are the types and nature of the legacy systems that existed before the MX implementation for managing customer/supplier relationships and interactions in your area?
- How has the information available to you changed as a result of the MX implementation? (e.g. types of information before and after, quality, accuracy, timeliness, etc)
- How has the change in information impacted you (e.g. ability to make decisions, change in information process efficiency, etc)
- How is it integrated with other applications within and outside of BBC?
- How has the initial implementation changed the overall technological landscape of the BBC Supply Chain? (e.g. more Internet savvy, etc)

Functional Processes
- How have the types and nature of the functional supply chain processes in your area changed as a result of the MX implementation? (e.g. new processes, elimination of processes, refining of processes, etc.)
- How has MX changed the nature of your interaction with suppliers? (e.g. more or less, different media used before and after, more or less automated, etc.)
- How has your relationship with suppliers changed as a result of MX?
- How has MX changed the overall collaborative environment of the BBC Supply Chain from your perspective?
- What are the main impacts of these changes in performance indicators of the business processes e.g. cycle times, error rates, scope of information accessibility, customer satisfaction, quality etc?

Improvisation

- How are ad hoc exceptions handled with regards to collaboration with MX in your area of the supply chain?
- What new, 'improvised' uses and processes have evolved over time as users in your area have become savvy in their use of MX?
- How have these improvisations impacted the evolution of BBC and organizations in the BBC supply chain?
- How have these improvisations changed the use of MX and the system itself?
- Is your organizational environment conducive to improvisation in system use in a collaborative eBusiness environment? Why/Why not?
- What is the impact of these improvisations in the implementation of MX and the evolution of its use?

Appendix 6b – Supplier Interview Script

General Information

- Name and description of company position?
- How long ago did your company go live with MX?
- Describe what the MX system does.
- To what extent do you use it on a daily basis?
- Has the implementation been successful? Please explain.

MX Implementation Process

- Has the MX system been easy for you to learn?
- Discuss the training process.
- Has use of the MX system changed since it was implemented?

Interorganizational Relationships

- What is your opinion of MX?
- Is it mutually beneficial? (or something you feel was imposed on you)
- How has MX changed the nature of your interaction with BBC? (e.g. more or less, different media used before and after, more or less automated, etc.)
- How has MX affected your overall relationship with BBC?

Supply Chain Systems

- How has the information available to you changed as a result of the MX implementation? (e.g. types of information before and after, quality, accuracy, timeliness, etc)
- How has the change in information impacted you (e.g. ability to make decisions, change in information process efficiency, etc)

Functional Processes

- How have the types and nature of the functional supply chain processes in your area changed as a result of the MX implementation? (e.g. new processes, elimination of processes, refining of processes, etc.)

Improvisation

- What new, 'improvised' uses and processes have evolved over time as users in your area have become savvy in their use of MX?
- What is the impact of these improvisations in the implementation of MX and the evolution of its use?

Appendix 6c – Express Interview Script

General Information

- Name and description of company position?
- Describe the history of e-Ventus
- Describe the strategy for the development of eCollaboration solutions
- Describe MX?
- Discuss the key differences that you see between eCollaboration and EDI systems
- What are the key advantages/disadvantages of ecollaboration/EDI?
- Do you see eCollaboration solutions like MX replacing EDI?

BBC Implementation Process

- Discuss how the BBC project came to fruition
- What was the initial strategy for development/co-creation of MX?
- How did MX evolve over the course of the implementation?
- How were changes back into the development process?
- Has use of the MX system changed since it was implemented?

Interorganizational Relationships

- What impact do you see MX having on relationships between suppliers and customers?
- Is it mutually beneficial?
- Do have any impressions on how it is perceived by suppliers and BBC?

Information Changes

- How has the information available changed in the case of BBC? (e.g. types of information before and after, quality, accuracy, timeliness, etc)
- How has the change in information impacted them? (e.g. ability to make decisions, change in information process efficiency, etc)

Functional Process Changes

- How have the types and nature of the functional supply chain processes changed as a result of the MX implementation? (e.g. new processes, elimination of processes, refining of processes, etc.)

Improvisation

- What new, 'improvised' uses and processes have evolved over time as users have become savvy in their use of MX?
- What is the impact of these improvisations in the implementation of MX and the evolution of its use?

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