DIFFUSION IN THE FACE OF FAILURE: THE EVOLUTION OF A MANAGEMENT INNOVATION

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Abstract

Recent work has questioned the institutional model of management innovation by highlighting interactions between the field-level actors engaged in diffusing innovations, and implementation of the innovation at organization level. Focussing on the adaptation of management innovations to their context, rather than their creation, we review this work and use it to analyse the global diffusion of Resource Planning (RP), counterposing this case with the widely studied example of TQM. Both of these innovations experienced a high level of failure when implemented by organizations. TQM's diffusion was characterised by a 'boom and bust' cycle. RP, however, has continued to spread globally in the form of its variants; MRP, MRPII and ERP. Our analysis seeks to account for the long run diffusion of RP through a processual model which highlights the interplay between RP's discursive framing at field-level, the affordances of the innovation itself, and its adaptation within organizations. This demonstrates how objectifying RP in software not only helped to spread the innovation, but also allowed field-level actors to differentiate its development as a successful innovation from the many failures experienced by organizations attempting to adapt it.

Keywords: management innovation, evolution, diffusion, institutional, ERP

Introduction

Management innovation is a term used to refer to the generation and implementation of new management practices, processes, structures and techniques that are intended to further organizational goals (Birkinshaw et al, 2008; Vaccaro et al, 2012). Innovation here means new to the organization, rather than new to the world (Birkinshaw et al., 2008). This paper considers how the spread of such innovations *across* organizations is influenced by the experience of implementing such innovations *within* organizations. This question is relevant to management innovations because they are characterized by high degrees of ambiguity, context dependency and 'interpretive flexibility' (Abrahamson, 1996). As such, they typically undergo significant adaptation when implemented and their 'success' is often difficult to assess (Ansari et al., 2010).

Institutional models of diffusion help to explain the spread of management innovations because they consider the ways in which social and institutional mechanisms drive diffusion and adoption (Strang and Meyer, 1993). While other work emphasizes technical or economic benefits as drivers of diffusion, the focus of institutional models is on the way in which certain innovations come to be seen as legitimate or even 'must-have' features of organizational life. At the extreme, as with the study of management fashions, the spread of new management practices may be seen as driven by 'bandwagons' and 'success stories' that have little to do with their performance benefits for organizations (Abrahamson, 1996; Scarbrough and Swan, 2001). Institutional models thus provide a complementary alternative to the view that innovations spread because of their comparative performance benefits (Kennedy and Fiss, 2009), and it is to this line of inquiry that we contribute here.

To date, however, institutional accounts have focussed mainly on field level processes (e.g. isomorphism), with insufficient consideration of how innovations are reinvented and evolve as they diffuse (cf. Rogers, 1995), or of managers' agency in adapting them as they implement and use them (Vaccaro et al., 2012; Ansari et al, 2014). Work on the implementation of management innovations, by contrast, has tended to focus on firm, or sector-level experience, rather than on wider processes of evolution (see Birkinshaw et al., 2008, for a critique). There is still relatively little understanding therefore of the *processes* through which field-level diffusion and organizational-level implementation interact and

how this drives the evolution of management innovation. In response, our study seeks to develop, as its principal theoretical contribution, a processual model of the evolution of management innovation that accounts for the interplay between diffusion and implementation.

To develop such a model requires a multi-level approach; one capable of relating the implementation of new practices within local settings to the emergence of field-level actors and their influences upon the spread of innovation. This, it has been argued, is especially the case with management innovations because their spread and adoption is highly influenced by both field and organization level influences (Birkinshaw et al., 2008). Such a multi-level analysis enables us to address a 'dearth of attempts to bridge inter-organizational mechanisms of diffusion with intra-organizational implementation and adaptation' (Ansari et al., 2010: 68).

In the next section, we review existing studies of the evolution of management innovations and use the particular example of TQM (Total Quality Management). From this we begin to draw out the elements of a provisional processual model and identify key research questions. We then develop our processual model through a theory development case study (Abrahamson and Eisenmann, 2008) centred on an historical analysis of the evolution of Resource Planning (RP). This innovation involves the use of cross-functional integrated systems to plan and control the flow of resources in organizations. It is considered to be one of the most important, and widely spread, management innovations of recent years (Mol and Birkinshaw, 2008). It involves a core of technical knowledge coupled with changes across management practices, processes and structures, thus blurring the conventional distinction between 'administrative' and 'technological' innovation (cf. Damanpour, 1987 and 2010). It therefore provides a good case from which to build theory by developing our processual model.

In the final section, we discuss the elements of this model, highlighting processes that appeared to drive the evolution of this innovation that have not previously been identified. In particular, a distinctive feature of this management innovation is its successful global diffusion in the face of widely reported, high levels of implementation failure, and associated detrimental effects on organizational performance. Our model provides

explanatory power for this phenomenon because it relates distinctive features of the innovation, and its adaptation by organizations, to the way success and failure were framed by its promoters.

The Evolution of Management Innovations: The Need for a Processual View

In discussing institutional influences on diffusion, it is important to distinguish between macro-level institutional factors, which help to explain the spread of innovations across *national contexts* (Guler at al., 2002), and the field-level factors which help to explain their spread across *organizations*. For the latter, the institutional model can be contrasted with 'classical' (Rogers, 1995) or 'rational' models of diffusion (Damanpour, 1987, 2010, Wischnevsky et al., 2011; Ansari et al., 2010). The institutional model suggests that, while early adopters may be motivated by performance benefits, as the innovation spreads, adopting organizations become more concerned with seeking legitimacy through a process of isomorphism (Meyer and Rowan, 1977; Tolbert and Zucker, 1983). Diffusion thus may, in some cases, be driven by fashion or social bandwagon effects (Strang and Meyer, 1993; Abrahamson, 1991).

However, recent work has begun to question some aspects of this model, with studies highlighting, both the agency of the groups involved (Lounsbury, 2002; Henfridsson and Yoo, 2013), and variations in the adoption of innovative practices at the organization-level. These studies have suggested that innovations may not only be more or less extensively implemented (Westphal and Zajac, 2001), but that they may also be more or less 'customized' to local contexts (Zilber, 2006; Lounsbury, 2007). This work questions an over-reliance on isomorphism as an explanation for the spread of innovation. Rather, it suggests that greater attention needs to be given to the role of both field-level *and* organizational actors in the spread of innovations.

Work on institutional entrepreneurship has attempted to better account for agency in the institutional model (Maguire et al. 2004; Dorado, 2005; Munir and Phillips, 2005; Greenwood and Suddaby 2006; Battilana et al, 2009; Henfridsson and Yoo, 2013). This work has connected field-level shifts in institutional arrangements to the micro-level actions of

individual agents who are effectively able to 'leverage resources to create new institutions or to transform existing ones' (Maguire et al., 2004: 657). Institutional entrepreneurs (Garud et al, 2002) are thus found to play an important role in 'igniting' organizational changes that may eventually lead to changes in the trajectory of innovations (Henfridsson and Yoo, 2013). Such actors 'skilfully draw on established practices as they envision alternative futures…providing the basis for field-level changes when they are successful' (Henfridsson and Yoo, 2013: 944). This work is important in showing how actors' discursive strategies play an important role in framing alternative possibilities (Munir and Phillips, 2005; Maguire et al., 2004). More broadly, it emphasises the need for multi-level, processual theories that can better account for how embedded actors shape field-level change (Battilana et al, 2009). However, it is relatively silent on the innovation itself and, in particular, on how the experiences of implementation and adaptation shape wider diffusion processes.

Recent contributions are thus advocating a perspective on the evolution of innovations that takes account of the 'emergent, processual, and recursive character of implementation and diffusion' (Ansari et al., 2010: 84). The need for such a view is reinforced by work on one of the most widely studied management innovations, namely TQM[i]. This research has been used previously to highlight the influence of social bandwagon effects upon the spread of innovations. David and Strang (2006), for example, describe how the spread of TQM underwent three phases of a 'boom and bust' cycle. First, there was a 'pre-boom' period, when TQM emerged from a mix of corporate quality programs, quality gurus and professional experts. This was followed by a 'boom period', marked by high levels of media attention and widespread, but 'superficial', implementation, aided by large numbers of generalist consulting firms. Finally, a 'post-boom' period was characterised by rational and technical interests, where 'exchanges of information and analysis…replaced celebratory success stories' (David and Strang, 2006: 230).

Unpacking the 'boom and bust' cycle of TQM reveals the importance of the interplay between field-level activities promoting diffusion and firm-level implementations of the innovation. First, in common with the work on institutional entrepreneurship noted above, this study highlights the importance of the 'discursive framing' of an innovation by field-level actors (Hargadon and Douglas, 2001; Nicolini, 2010; Maguire et al., 2004). Thus, in the

pre-boom period, specialist consultants framed TQM as a 'solution' to the professional management of quality issues. The boom period was characterised by the framing of TQM as a 'success story' fuelled by generalist management consultancies and widespread media attention. This was followed by the downswing phase which saw a shake-out in the consultancy providers, and the development of a more technically-oriented discourse.

Second, we can identify a relationship between field-level framing and organizational implementation. The rhetoric of the boom period helped to promote the spread of the innovation, but was also seen as encouraging 'superficial' rather than 'deep' implementation. Cole notes, for instance; 'Because of the vagueness of the concept (TQM) ….firms and industries were free within a certain range to interpret it, position it and adopt those practices that fit particular corporate traditions and industry imperatives.' (Cole, 1999: 11). In other words, the meaning of the innovation was enacted and adapted to particular organizational contexts, leading to variations in practice (cf. Zbaracki, 1998; Kennedy and Fiss, 2009; Purdy and Gray, 2009).

As Ansari et al. (2010) observe, such 'adaptations' raise the question of whether certain innovations lend themselves to different interpretations and enactments. For example, the flexible interpretations of TQM can be contrasted with the more constrained interpretations which apply to ISO 9000 as a management practice which is embodied in industry standards more or less independent from field level actors and adopting organizations (Guler et al., 2002). The contrast between these two management practices thus highlights how innovations may be more, or less, amenable to flexible interpretation by organizations, thus enabling, or constraining, the possibility for local adaptation. It also highlights the role of field–level actors, including consultants, in simplifying the ambiguous ideas (that they have vested interests in promoting) so as to encourage their adoption by organizations (Clark et al, 1992).

Ansari et al. (2010) identify interpretive flexibility as one of the 'affordances' of an innovation, which is mediated by, but transcends, perceptions (other affordances that they identify include 'divisibility' and 'complexity'). Affordances are described as characteristics that can offer opportunities for action but also, potentially, place constraints upon action, making it more or less likely that a practice will be adopted (Hutchby, 2001). Aside from the

work on TQM, we know relatively little about how such affordances operate upon the adopters of management innovations, particularly where their effect is to constrain, rather than enable, adaptation.

Over time, variety in the enactment and outcomes of implemented innovations helps to increase the knowledge and experience available to potential adopters (Strang and Macy, 2001; David and Strang, 2006). In the case of TQM, such vicarious experience seems to have contributed to this innovation's boom and bust cycle, with 'success stories' helping to drive its spread, and 'failure stories' contributing to the downswing in the cycle. This highlights how the experience gleaned from previous adopters, as well as the number of such adopters, can play a role in driving or dampening the spread of an innovation (Abrahamson, 1991). What is less understood, however, is how this vicarious experience is filtered and framed, and what role is played by adopting organizations, as well as by field-level actors, in acting as the 'sensegivers'(as well as sense-takers) of the meaning of a diffusing practice (Fiss and Zajac, 2006). As Strang and Macy (2001) note 'while much work emphasizes the impact of adoptions elsewhere, there is little attention to how actors respond to the results experienced by others' (p. 151).

Wider work on the diffusion of innovations in health and public policy provides some clues, however, as to how vicarious experience may be conveyed to organizational actors. This highlights, in particular, the important mediating role of professionals in promoting or inhibiting the spread of innovations through their adoption of particular forms of innovation (Ferlie et al., 2005). Experience conveyed through professional networks plays a persuasive role in communicating vicarious experience because it is seen to have high legitimacy among potential recipients (Swan et al., 1999a). Research on policy implementation shows, further, how entrepreneurial actors, who have detailed local knowledge of their own organization and pan-organizational contexts, are adept in both adapting innovations for use locally *and also* in proactively shaping and contributing to policy mandates (Fitzgerald et al., 2002; McDermott et al., 2013). Thus 'first-order change recipients' can act as 'second-order change agents' by using their local and contextualised experience to tailor, adapt and change policy mandates (McDermott et al., 2013). This research highlights the importance of considering vested interests of different groups (e.g. professionals, commercial suppliers) in the spread of management innovation. It also shows the blurred distinctions between 'users'

or 'adopters' of innovation at the organizational level and 'producers' or 'suppliers' (policy makers, in this case) at the field level. However, this work is silent on how particular ways of framing vicarious experience (e.g. as 'success' or 'failure') encourage or discourage the evolution and spread of innovation over time.

In summary, the variation in the framing, interpretation and enactment of new management practices seen, for example, with TQM, brings into question an established institutional model of diffusion (Lounsbury, 2002). Diffusion of management innovations is seen to be a complex process in which the interpretation of the innovation is more or less flexible and is influenced, not only by the framing of field-level actors and entrepreneurs, but also, in a cyclical fashion, by the vicarious experience that accumulates from organization-level adaptations. In our analysis, from which we develop our processual model of management innovation, we seek to contribute to this emerging perspective in the literature. We focus our empirical study around the following questions which are crucial to developing the more processual model of the spread of innovations called for by Ansari et al. (2010).

1. How do the affordances of the innovation influence its interpretation, enactment and adaptation within adopting organizations?

2. How does the emerging vicarious experience of an innovation's adaptation within organizations, including accounts of 'failure' and 'success', come to influence its framing by field-level actors and onward spread amongst other organizations?

3. What are the implications of this recursive relationship between field-level framing and firm-level adaptation for an innovation's development and diffusion over time?

Research Methods and Context

In explaining the evolution of RP, a longitudinal, multi-level and diachronic study was needed in which the interaction of field-level and firm-level phenomena over significant time spans could be analysed. This involves a process-oriented, historical perspective capable of grasping interactions across levels of analysis (c.f. Lawrence, 1984; Pettigrew et al. 2001; Van De Ven and Huber, 1990; Mol and Birkinshaw, 2014). An historical perspective differs from an historical analysis in that history provides the raw materials, rather than the

object of analysis, and is used to make sense of the present rather than the past (e.g. Leblebici et al., 1991). As Lawrence notes; 'It pushes thinking about alternative explanations for phenomena…..controlling for longitudinal, cohort, and period effects' (1984: 311). By relying solely on secondary sources, such accounts may neglect the 'concrete details that shape and constitute actions' and impose a 'retrospective gloss' on events (Hargadon and Douglas, 2001: 478). To address this, we were able to draw upon a range of primary sources – some derived from our own empirical work - in combination with secondary sources. This allowed us to triangulate, and as far as possible verify, assertions and identify the dynamics occurring at different times in the past.

Historical accounts are particularly amenable to multi-level analysis, since this allows the complex interplay of causal relationships to become more fully apparent (Barley and Tolbert, 1997). Hargadon and Douglas (2001) note that 'historical case studies also provide a perspective that covers the decades often necessary to observe an innovation's emergence and stabilization' (p. 485). Hence the multi-level, historical design enabled an analysis of the recursive patterns of development of RP innovation. Few empirical studies of RP (or indeed of any management innovation) have adopted such a multi-level approach.

The evolutionary path of RP innovation that we trace began with the ideas/actions of a small group of individuals in the 1960s in developing a computerised approach to plan the materials required for production. This became known as Material Requirements Planning (MRP). It evolved into a subsequent variant - Manufacturing Resources Planning (MRPII) - that incorporated financial management and accounting, before eventually evolving into the Enterprise Resource Planning (ERP) systems that have diffused worldwide today (Umble, 2003; Shaul and Tauber, 2013; Schonsleben, 2000). Nowadays ERP systems, although variously interpreted (see Hald and Mouritsen, 2013), are broadly defined as 'integrated cross-functional systems' that integrate all of the data and related processes of an organization across functions into a unified system to support management and information processing (Robey et al, 2002; Grabski et al, 2011).

The first stage of data collection involved amassing secondary data of accounts of the evolution of RP at the field level, including studies of the role of the American Production and Control Society (APICS) in the diffusion of MRP and MRPII (Lummus, 2007) and other

studies of the role of European professional associations (APICS affiliated) for operations management in the diffusion of MRPII (Swan et al., 1999a; Swan et al, 1999b). We combined these data with empirical studies that considered diffusion and organizational RP implementation issues more generally. We also conducted a 'meta-review' of peer-reviewed papers - identified via the comprehensive list of journals on Business Source Premier (N=41) - that aimed to present systematic reviews of RP implementation and/or surveys of implementation and/or multiple case studies (see Appendix A). This included three papers which, together, provided 21 detailed case studies of MRP, MRPII or ERP implementation in organizations (Wilson et al. 1994; Robertson et al. 1996; Robey et al, 2002). By combining these sources on field level evolution and local level implementation we were able to satisfactorily corroborate field level and organizational events.

A number of primary textual sources were also identified for analysis, which included texts written by those who were the original 'designers' of MRP and MRPII, i.e. Oliver Wight, Joe Orlicky and George Plossl (including Plossl and Wight, 1971; Wight, 1974; Wight 1982;1983; Orlicky 1975 and Plossl, 1985). These were supplemented with analysis of APICS annual conference proceedings from the early 1960s through to the end of the 1990s. As Maguire and Hardy (2009) note 'discourses are changed through the production, distribution, and consumption of texts' (p. 151). These primary sources were valuable in making sense of the evolution of RP, because they included claims, arguments, statistics etc., that over the time period discursively (re)framed each RP variant, heralding each new variant.

In order to ascertain convergence, we constructed a discursive event history database (Van de Ven and Poole, 1990, Maguire et al., 2004), chronologically ordering descriptions of the actions and process contributing to the evolution of RP. This analysis (see Table 1) captured the key actors involved in the evolution and diffusion of RP, locating their actions in time and space. In Table 2 we also offer an indicative overview of approximate diffusion and implementation failure rates across the decades which, combined with our event based narrative analysis, form the basis of our case study description presented next.

The Case of RP Innovation

RP is an innovation in management practice as it involves changing practices by systematically integrating the information flows of different business processes so as to improve planning and control[1]. Originally, this integration took place within a manufacturing environment and focused on integrating information about purchasing, inventory and production schedules (Wight, 1987). Subsequently, the focus of RP's integrating effect shifted to wider cross-functional and multi-site organizational processes (Wilson et al, 1994) and, later, enterprise-wide (Robey et al, 2002).

As outlined in Table 1, RP originated with a small group of US manufacturing firms in the post WWII period as an innovation that challenged traditional Economic Order Quantity approaches. Managers worked independently to develop MRP with support from three consultants (Wight, Plossl or Orlicky). Wight was responsible for naming this approach 'Materials Requirements Planning (MRP)'. From 1967, this group, who were closely linked to IBM, and to the newly formed professional association for production control – APICS – began to work together developing MRP reports and a certification programme for APICS. They also supported the development of IBM software to standardise, computerised approaches to MRP (Lummus, 2007).

INSERT TABLE 1 HERE

MRP offered benefits over a manual approach, but still struggled to establish itself, largely as a result of dissatisfaction with the accuracy of the production schedules it generated. Problems were attributed to the 'sensitivities' of the technical system to outside influences (Fortuin, 1977). MRP systems were only as good as the data submitted by production controllers who often input data based more on their own heuristics rather than actual sales forecasts (Swan and Clark, 1992).

[1] MRP – "provides a *logical* approach to planning and scheduling" The objectives are to reduce inventory costs, improve customer service and maximise efficiency (Wilson et al., 1994, Wight, 1987).

MRPII – " a company – wide closed loop manufacturing control system which *integrates* all aspects of manufacturing…. It is designed to help managers *control* complex manufacturing and business environments ….when companies are able to exercise effective systems management , substantial benefits of integration are claimed " (Wilson et al, 1994)

ERP " A framework for organizing, and *standardizing* business processes necessary to effectively *plan and control* an organization so the organization can use its internal knowledge to seek external adavantge"p.34 (APICS dictionary – Blackstone and Cox, 2005)

A watershed in MRP diffusion, however, came with APICS endorsement, which was the outcome of a stormy meeting of the annual conference in 1971 (Orlicky and Burlinghame, 1971), whereby the professional body was practically mobilized in support of the MRP concept. Plossl stated; 'In the early 1970s we organized the APICS MRP Crusade, using the resources of the Society and the knowledge of a few 'Crusaders' to spread the word on MRP among APICS members and others interested.' (Plossl, 1989: ii). Following the launch, adoption rates soared during the 1970s, but so too did accounts of implementation failures, as shown in Table 2. Here we should note that 'failure', like 'success', in the context of an innovation is a very broad term, open to a range of interpretations and attributions (a point to which we return later). But, even as a simple description of implementation outcomes, it stands out as an important strand in contemporary accounts of RP's spread.

It is difficult to quantify the level of implementation failure (reports vary), but it was clearly high across the whole cycle of RP's evolution (see Appendix A). While early MRP systems were seen as providing important new capabilities, by the mid-1970s implementation experience was already mixed, with some success rates put as low as 5% (Belt, 1979; Wight, 1974).

INSERT TABLE 2 HERE

Wight, now considered a world expert in manufacturing management (Ralston, 1996), endorsed the need to integrate production with the planning and control of other resources such as finance and distribution (Lilly and Smith, 2001). Wight referred to this expanded approach as 'Manufacturing Resource Planning' and 'MRP II' (Wight, 1982; Mabert, 2007). MRPII was based on the same 'push' philosophy as MRP, but it also enabled other capacity constraints to be taken into account. Because this approach demanded even greater integration across functions, it encouraged software vendors to develop applications and specialist consultants to support implementation. These suppliers promoted the benefits of MRPII in relation to strategic business concerns, particularly in light of what was seen as the emerging 'threat' of competition from Japanese manufacturers (Wight, 1982, 1983). By the mid-1980s, several thousand large US firms were using MRPII systems.

Again, experience of implementation was mixed and many companies felt they were not getting the expected benefits (Miller, 1981, Table 2, Appendix A). MRPII suppliers had

claimed that the MRP 'problems' that organizations had experienced could be solved by computerizing and integrating the planning of financial and human resources with materials and production. However, because of its increased scope and greater level of organizational integration, MRPII actually generated further problems. By the 1980s, problems around the technical aspects of the system and the accuracy of sales forecasts were largely resolved. Continued implementation failures were therefore attributed to poor implementation methods and management of change. Managers struggled to integrate the output from MRP systems with other organizational information, which was often still maintained manually (Wilson et. al, 1994). Implementation, it was argued, required a better 'fit' between the technology and the organization, which could be accomplished by adapting the system locally to match business requirements (Schroeder et al, 1981 – see Appendix A). Problems were thus attributed to management's failure to implement effectively.

To address these problems, consultants began to develop implementation methodologies, the archetype of which was the 'Proven Path', developed by the Wight Consultancy. Training courses were offered to help adopters implement this methodology and a Class 'A' to 'D' checklist was developed, against which adopters could be audited. This made a virtue out of the challenges of RP implementation by celebrating the 'world class' minority who achieved full, Class 'A', implementation status. These efforts were accompanied by intense professional support, with APICS promoting a certification programme that emphasised MRPII as *the* best practice (Swan et al, 1999a). Yet, user experience across the US and Europe continued to be mixed, with reported success rates in achieving full integration varying from around 50% to as low as 8-12% (Brauch, 1988; Wilson et al, 1994; Appendix A).

During the 1990s, these ongoing implementation problems, together with further developments in RP knowledge and hardware led a number of software vendors to undertake what was termed a 'structural migration' of the MRPII approach into systems which were no longer confined to manufacturing applications, but that could also be used in the service sector and across a broader range of business functions (Kalakota and Robinson, 2001; Schonsleben, 2000). In 1990, the Gartner Group coined the term 'Enterprise Resource Planning' (ERP) to denote the new, enterprise-wide scope of the RP innovation, providing adopters with the means to business plan across their entire supply chains (Wylie, 1990). Software vendors and management consultancies presented these systems as '*complete*

business solutions'. This broadening of scope meant that the RP innovation was capable of planning and scheduling both internal and external resources (within the supply chain) according to dynamic customer demands (Shaul and Tauber, 2013). High failure rates continued to be attributed to problems of implementation (such as political factors, 'user resistance' etc. – see Appendix A) but, because ERP was a complex 'whole system approach', users were advised to select the most appropriate software vendor for their industry sector and, with the support of specialist consultants, make their organization *fit* in terms of changes to internal processes, rather than take a 'piecemeal' approach to implementation. Work turned to the improvement of a comprehensive set of 'critical success factors' required to manage the organizational transformation more effectively (Appendix A).

A small group of RP vendors led by SAP now began to dominate. Because ERP required the implementation of one standardised enterprise-wide suite of applications, these vendors were able to argue that it made a virtue out of the replacement of *all* legacy systems within firms. As Umble et al (2003) noted; 'For managers who have struggled…with incompatible information systems and inconsistent operating practices, the promise of a quasi 'off-the-shelf' solution to the problem of business integration is enticing' (p243). This was further reinforced by the global spread of the 'millennium bug' discourse (Themistocleous et al, 2001), with vendors stressing that it was imperative that firms invest in ERP before the year 2000 (Scott and Kaindl, 2000, Adam and Sammon, 2004; Jacobs and Weston, 2007). As a Deloitte (2012) report notes: 'Organizations were forced to invest in ERP solutions that could cater for eight-digit dates, because of the threat that their existing solutions would fall apart at midnight on 31st December 1999 and that their business would be left in total disarray'. These factors helped prompt a major increase in revenues and adopters. By 2006, SAP alone had 96,400 installations across 25 industry sectors, and 12 million users (Jacobs and Weston, 2007).

However, the continuing challenges of implementing ERP prompted vendors to make major investments in on-line communities that could link developers with users and business experts. Even so, the ERP period saw some very high profile and costly implementation failures, including Fox Meyer and Dell Computers, (Adam and Sammon, 2004). Recent surveys and reviews (see Appendix A) continue to highlight high levels of dissatisfaction

with ERP, with a 2014 report based on 192 respondents finding that 66 per cent of organizations believed that they had received less than 50 per cent of the benefits they anticipated from ERP (Panorama, 2014). It is worth noting, however, that organizational issues, rather than software continue to be seen as the major cause of implementation problems.

Analysis: Explaining the Evolution of RP Innovation

The evolution of RP innovation and its widespread, global diffusion described above was clearly the result of multiple factors including the complex interactions between field-level actors and the organizations implementing this innovation. In this section, our analysis is structured according to the key processes enabling such interactions, as indicated by our earlier review of the literature.

Discursive (re)framing of the innovation

The discursive framing of the RP innovation involved a shifting array of organizational and field-level actors. Initially, in the MRP era, the audience for this discursive framing was production and inventory control managers. Through the involvement of a nascent APICS, working closely with the 'Group of 3' consultants (Lummus, 2007), MRP was more fully theorized and legitimized (c.f. Greenwood et al., 2002). This not only served to justify its adoption in preference to traditional methods (Mabert, 2007), but also served the interests of the professional group who were seeking to 'colonize' this emerging field (Abbott, 1988; Swan et al, 1999a). The importance of this link between the innovation and the interests of field-level actors is made clear by the impact of the 'coup' at the 1971 conference. As a result of APICS' commitment to the 'MRP Crusade', both MRP's spread and APICS membership increased dramatically (Greene 1987).

The RP innovation's subsequent development was characterized by successive *re-framings* in which new labels were applied to variants that demanded progressively greater organizational integration. Thus, MRP was initially modified to incorporate feedback loops which it allowed it to be framed as a 'closed loop' system, rather than as an 'open loop' system that could spiral out of control. The subsequent development and increased functionality of MRPII, led by Oliver Wight (with IBM) advocated the integration of

production and inventory control with the planning and control of other internal resources such as finance, accounting and human resources.

A further progression in scope and functionality accompanied the development of ERP, which extended the innovation's reach and market potential across a range of sectors, national contexts and different-sized firms (Shaul and Tauber, 2013). Each re-framing was triggered by further objectification – via software and implementation methods - of RP knowledge, aiding both its cross-functional and industry sector spread. In each case, field-level groups, such as management gurus, professional bodies and software vendors, sought to justify the expanded scope (and costs) of the RP innovation by highlighting its substantial benefits to a widening audience of senior managers. The innovation was also linked to high level business concerns; MRPII was linked to the 'Japanese threat' to US manufacturing (Newell et al, 1993), while ERP was considered to be the answer to the problems of business integration and the 'millennium bug' (e.g. Scott and Kaindl, 2000). Importantly, however, these re-framings by field-level actors, not only emphasized the performance benefits of each new variant, but also directly engaged with the problematic vicarious experience of its predecessor. In effect, the framing of each succeeding variant provided a narrative to distance it from failed implementations in the past. Moreover, as can be seen in Appendix A, the on-going and high failure rates with *all* variants of this RP innovation were framed as problems of management that could be resolved by attending to well-defined critical success factors, and not as failures of the innovation itself. This continued to be portrayed by field-level actors (who had a vested interest in downplaying the problems of implementation) as promising substantial business benefits.

Organizational enactment and adaptation

In the MRP period, manufacturing managers used their in-house expertise to tailor RP systems to meet their own organizational problems. The increased involvement of field-level actors - professional associations, consultancies and software vendors - however, led to the progressive codification and 'blackboxing' of RP knowledge as standardised software and methods. This helped promote RP's diffusion by enabling market-based relationships between vendors and users. Thus, the advent of MRPII saw a new group of software

suppliers enter this market, followed, in the ERP era by consolidation and domination of a small group of suppliers led by SAP.

While these developments enabled much wider diffusion, the need to objectify RP knowledge into more generic forms also created a greater challenge for its adaptation to specific organizational contexts. Effective implementation thus required significant adaptation efforts to integrate distributed organizational practices and the software itself (Waterlow and Monniot, 1986; Wilson et al, 1994). While such adaptation efforts initially entailed in-house customisation of the systems (Swan et al, 1999c), with the ever expanding scope and complexity of the software, it increasingly entailed significant organizational change to accommodate complex software packages. Implementing organizations relied increasingly on the skills of consultants and software suppliers, with an associated reduction in their in-house RP systems expertise (Wilson et al, 1994).

Affordances of the RP innovation

Our analysis above shows that, with successive variants of RP, the interpretive flexibility of the innovation was progressively reduced. Increasingly over time, organizations had to 'work around' the standardised software packages, thereby demanding investments in software, implementation methodologies, consultancy support and training that far exceeded software costs (Benders et al, 2006; Dechow and Mouritsen, 2005). There was a shift between adapting the innovation to suit the context and then, later, occasioned by more complex systems, adapting the organization to suit the innovation. This was supported by vendors' claims that 'vanilla' implementations – that is, minimizing changes to the software and adapting organizational practices instead – would secure 'world class' performance (Wagner and Newell, 2004). The Year 2K 'problem', and software offerings tailored to very specific sectors exerted further pressure not to 'drift' from the standard ERP solutions on offer.

As it became more difficult to adapt the software, there was a greater impetus to adapt and standardize organizational practices (Benders et al., 2006), with work now focussing on the systematic identification of 'Critical Success Factors' – centred on management and organization – required to implement ERP (see Appendix A). Coupled with the increasing

cross-functional scope of the innovation, however, the reduction in interpretive flexibility greatly increased the risks of implementation, because organizations continued to focus on software costs and to allocate insufficient budget to organizational change management, both of which are required to fully realise the business benefits of highly tailored ERP solutions (Panorama, 2014).

Vicarious experience of the RP innovation

As a result of these high levels of implementation failure, vicarious experience of the RP innovation was mixed. As outlined in Table 2 and in Appendix A, at each stage in its evolution there were numerous academic and practitioner reports of failure or disappointing outcomes. As RP evolved, access to this vicarious experience became possible, through practitioner media, professional association events, and user groups. As noted, this accumulation of vicarious experience helped to trigger and promote the discursive re-framing of the innovation at field level. Here, as with the 'Proven Path' methodology for MRPII, the experience of previous failure was reconciled with claims for success of the new variant through an underlying narrative that attributed implementation 'failure' to failures of management, allowing the 'success' of the RP innovation, in terms of its technical core and potential business benefits, to remain intact. The emphasis on 'Critical *Success* Factors' is indicative of this underlying narrative that, if the management of change were properly supported, then the RP innovation would be successful.

In summary, by adopting a multi-level analysis we have been able to explore the complex inter-relationship between the field-level diffusion of the innovation, and its adaptation at organization level. Our analysis suggests a novel model of the evolution of this management innovation which builds on, and extends previous theory. This is depicted in Figure 1 which relates our conceptual analysis to the RP variants and their diffusion over time.

INSERT FIGURE 1 HERE

This model responds to our third research question by conceptualizing the spread of innovations in terms of a recursive relationship between the field-level discursive (re)framing of the RP innovation and its adaptation within particular organizational settings. It develops the processual view by depicting diffusion as the product of a temporally situated interplay between discursive framing, innovation affordances, organizational adaptation and vicarious experience.

Concluding Discussion

Our analysis of RP's spread represents a theory development case study and as such we need to be cautious about over-generalizing (cf. Abrahamson and Eisenman, 2008). However, it is clear that our case reinforces questioning of the institutional model of diffusion (Lounsbury, 2002) by showing, not only the critical importance of agency in the spread of a management innovation, but also the variability of what was spread. The role of agency is seen with field-level groups who are engaged in a continuing quest to (re)frame the innovation discursively, and with organization-level actors who are interpretively enacting and adapting the innovation to organizational contexts. Our analysis therefore provides a processual perspective in which 'carriers and hosts co-construct management practices diffusing into new settings' (Ansari et al., 2010: 86). Thus, the initial development of the innovation is closely intertwined with the growth of professional groups who were able to anchor and legitimize RP practice (Perkmann and Spicer, 2008; Nicolini, 2010). Over time, as RP knowledge became further elaborated and objectified, the legitimizing role of the profession was superseded by the marketing efforts of software vendors and consultancy groups, promoting particular variants.

Our findings complement existing work on institutional entrepreneurship by highlighting both the embedded agency of particular actors (e.g. the 'Group of 3' who aligned their work closely with that of APICS) but also the important role of field configuring events, such as the APICs conference, in mobilizing commitment (cf. Oliver and Montgomery, 2008; Hardy and Maguire, 2010). In addition, our processual model pays close attention to the innovation itself and its adaptation in context, thereby responding to calls for institutional entrepreneurship scholars to 'gain greater insight by considering the role of technology and

its materiality in shaping the innovation trajectory in organizations' (Henfridsson and Yoo, 2013: 948).

Here, the comparison between TQM and RP is instructive. Both management innovations experienced high levels of failure, but RP achieved enduring global diffusion, while TQM succumbed to the boom and bust cycle of management fashions. Our study suggests that this contrast can be explained by considering, firstly, the effect of an innovation's affordances on its enactment and adaptation, and secondly, the role of vicarious experience in the discursive framing and spread of an innovation (i.e. our first two research questions).

In terms of affordances, as TQM was largely grounded in rhetorical, symbolic practices (Zbaracki, 1998), it offered far greater interpretive flexibility than RP (Ansari et al., 2010). This supported diffusion by enabling a wider range of non-specialist suppliers to claim relevant TQM competence and to spread it through a 'superficial' implementation approach that could secure 'ceremonial' benefits for adopting organizations (David and Strang, 2006). This resulted in both large scale adoption of TQM, and wide variability in the adaptation of the concept. The tendency towards superficial implementation of TQM, however simultaneously contributed to high levels of failure. Subsequently, the vicarious experience of 'failure' rather than 'success' stories fed through into a negative discursive framing by field-level actors, and this contributed to the downswing in the TQM diffusion cycle (Strang and Macy, 2001).

In contrast, the RP innovation was developed by a small circle of professional groups, specialist consultants and software vendors. This limited its interpretive flexibility from the outset, and even more so when RP knowledge became increasingly objectified as software and methods in subsequent variants. Moreover, the RP innovation, unlike TQM, was materialized in a technical core, amid on-going pressures on organizations to better manage their resources. It was possible, then, for field level actors to highlight the proven success of the technical artefact – i.e. the RP knowledge embodied in operating rules, and later software – in handling the computational aspects of RP. Success here could thus be differentiated as a performance outcome from the many, frequently unsuccessful, efforts to adapt the innovation to particular organizational contexts.

This interpretive distinction between the innovation and its organizational adaptation is a recurrent theme in RP's evolution. It can be seen as helping to sustain the relations between the field level actors - who have a vested interest in 'selling' the RP concept - and the managers who are faced with the challenge of enacting the innovation within their own organizational context. Importantly, the distinction enabled field-level actors, such as professional groups and consultants, to re-cast adaptation problems as partial implementations on a 'proven path' to success; an overarching discourse of 'progress' which distanced the potential of the new from the failures of the old (Abrahamson, 1991). This field-level framing thus served to insulate RP innovation from the growing vicarious experience of widespread adaptation failures. At the same time, and reinforcing the narrative of progress, the innovation was successively re-labelled; from MRP to MRPII to ERP. This re-labelling was not cosmetic, but helped to renew legitimacy by elaborating the original concept (Lawrence and Suddaby, 2006). RP was thus able escape the boom and bust cycle which has affected other management innovations such as TQM.

Relating these insights to our first research question highlights our study's contribution to theory regarding the impact of affordances on innovation diffusion. Here our study has reinforced previous work by highlighting the influence of interpretive flexibility on an innovation's enactment and adaptation within adopting organizations. In addition, our work suggests that this affordance may influence the interpretation of performance outcomes from such adaptations, and particularly the causal attribution of success and failure. As we found that these attributions often distinguished between RP's technical core and its local implementation, we can link them to the widespread societal tendency towards viewing technology as a progressive force (Winner, 1977) and a tendency for managers, in particular, to justify change as technologically-based (Markus, 2004; Leonardi, 2008). In essence, our study suggests that where the implementation of innovation encounters problems, these may often be attributed to the innovation's social and organizational aspects, rather than to its technical features. This 'partitioning of the blame' in actors' accounts is afforded by the innovation (in this case, that it has a technical core), and provides one explanation as to why an innovation can continue to diffuse even in the face of ongoing problems with implementation. We should note that we see this explanation as complementary to, and not replacing, arguments as to the 'actual' technical efficiency of an

innovation, which was not the theoretical focus of our study. However, it does suggest a need for further work to consider how attributions of success and failure to different aspects of the same management innovation can shape its propensity to diffuse or die.

By relating the interpretive efforts of organization-level managers to the framing of an innovation by field-level actors, our study highlights the need to address sense-making at multiple levels of analysis in accounting for the spread of innovations. This might encompass, for example, the importance of the labels supplied by field-level actors in guiding sense-making at the organization level (Weick, 1995), and the role of adopting organizations in acting as exemplars or 'sense-givers' for other organizations (Fiss and Zajac, 2006; Swanson and Ramiller, 1997).

A further and related contribution centres on our second research question and our finding that vicarious experience may not operate as an objective force upon diffusion but may be re-framed discursively by field-level actors. This suggests that the distinction made in previous literature between 'success' and 'failure' in adoption outcomes is too broadly defined. Future research could usefully focus on how these notions are discursively constructed even for more technologically-based innovations. For example, a recent study highlights the importance of rhetorical tropes in the diffusion of new IT-based innovations (Barrett at al., 2013). Further work on this question could deepen our understanding of the role of 'success' and 'failure' in the sense-making and sense-giving of different groups, which, as Fincham highlights, stand as 'conjoined narratives…implicated in forms of change and innovation' (2002, p.1).

Finally, our study also adds to the processual perspective by demonstrating how the above questions need to be considered within the context of the wider evolution of an innovation. The construction of success/failure reflects, not only the discursive framing of field-level actors, but also the degree of interpretive flexibility pertaining to an innovation and its organizational adaptation. It follows that greater explanatory power for diffusion cycles and levels of diffusion might be achieved by considering the evolving inter-relationship between the affordances of the innovation, its adaptation by organizations, and its framing by field-level actors.

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Table 1: Chronology of RP events

Year	Event (plus selected references)
1957	27 production controllers who had set up local associations create a national society known as APICS - The American Inventory and Production Control Society (Plossl, 1985)
1969	Consultant – George Plossl - Chairs the APICS Curricula and Certification Council to develop a professional certification programme.
	IBM begins to develop an integrated set of applications around their Bill of Materials processor to computerise MRP. The IBM development team is supported by consultants Oliver Wight and Joe Orlicky (Ralston, 1996). The initial 'open loop' MRP system is modified with feedback loops and capacity planning to develop 'closed loop' MRP, which prevents system from spiraling out of control.
	There are 47 APICS chapters across the US with 1500 members (Mabert, 2007)
1970	APICS expands geographical reach and membership to 114 chapters across the US (Lummus, 2007).
1971	At the 14th APICS conference a heated debate occurs around the benefits of a traditional EOQ approach compared to the use of MRP . APICS launches the 'MRP Crusade' (Orlicky, 1971, Mabert, 2007).
1972	IBM launches a standardized manufacturing software application –COPICS - to support computerized MRP (Plossl, 1985)

1973	First APICS certification exams grounded in MRP approach are taken by 335 members (Lummus, 2007)
1975	APICS expands to 14177 members in the US (Lummus, 2007).
	IBM sponsor academic seminar which Orlicky organizes involving academics from leading US universities (Mabert, 2007)
1977	The Proven Path implementation methodology is published (Goddard, 1990)
	APICS set up Academic Liaison Committee with American Institute of Decision Sciences (Lumnus, 2007)
1979	7300 APICS members are now certified production 'professionals' (Plossl, 1985)
1980	APICS has 41, 085 members in the US (Greene, 1987)
1981	Wight defines the MRPII philosophy as an extended closed-loop manufacturing system based on a push philosophy aimed at enabling organizational integration (Wight, 1981, Lilly and Smith, 2001)
1983	Wight dies of cancer (Mabert, 2007)
1985	Baan (Netherlands), SAP (Germany), PeopleSoft and JD Edwards (US) have all entered the market with MRPII software applications
1987	APICS certification expands to include the Certificate in Integrated Resource Management (CIRM) to support MRPII philosophy (Lummus, 2007). JIT (promoted by the Institute of Purchasing and Supply) seen as 'incompatible' with MRPII
1988	The ABCD checklist is published for classification of user's MRPII implementation (Wight, 1988)

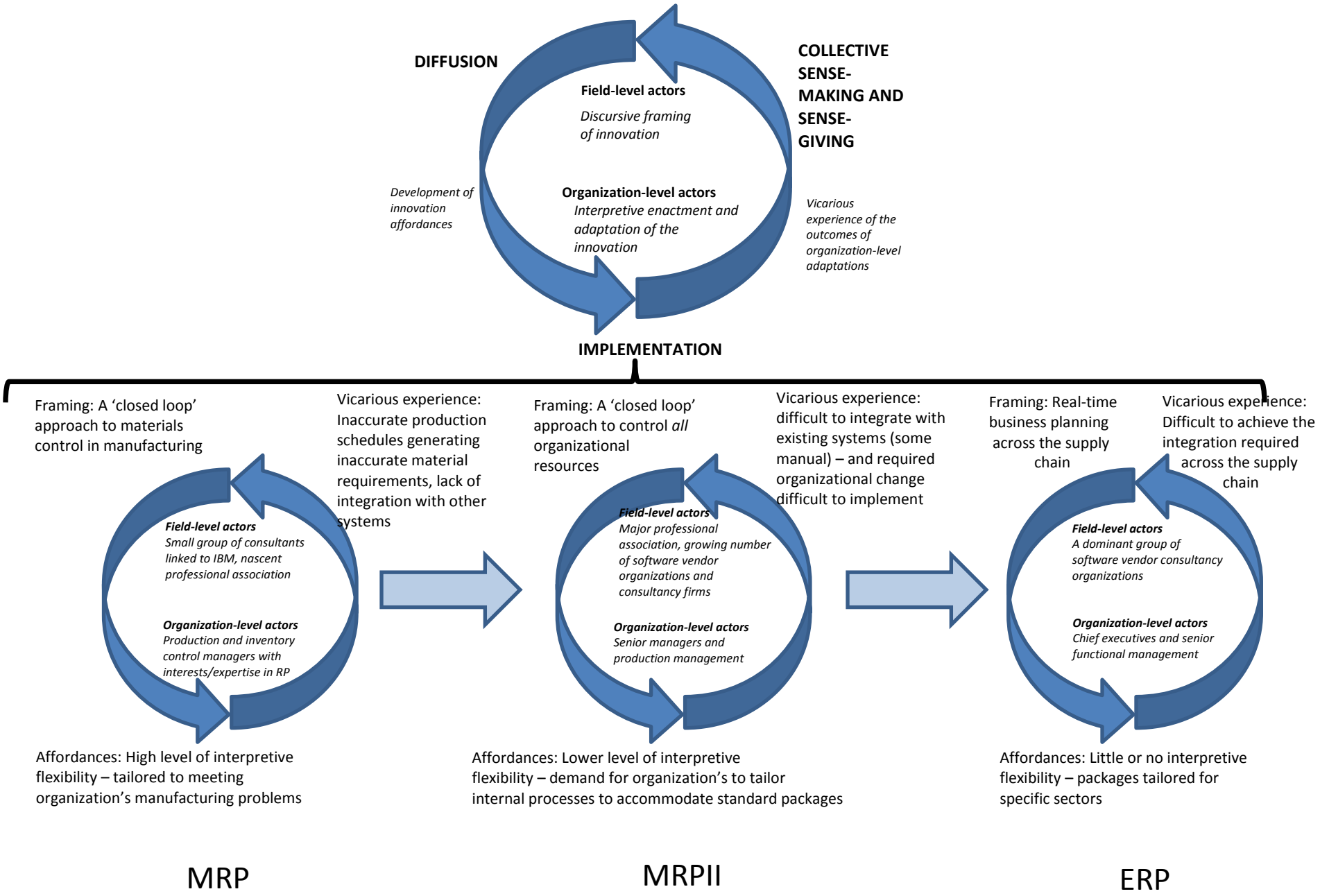
1989	APICS endorse the use of both MRPII and JIT in organizations (Plossl, APICS Conference Proceedings 1989). ABCD checklist is changed accordingly.
1990	Gartner coin the term 'enterprise resource planning' (ERP) expanding the scope of resource planning to the entire supply chain (Wylie, 1990).
1992	SAP drive a technological shift from mainframe computing to 'distributed computing' using client server architecture (SAP R/3) and develop an ERP software application that it supports
1992-7	Baan, Peoplesoft, Oracle and JD Edwards all develop ERP applications which run on SAP hardware, IBM leaves the market
1997	ERP is widely discussed as a means of achieving 'Year 2K' compliance and overcoming the 'millennium bug' (Manufacturing Computing Solutions, 2000, Jacobs and Weston, 2007).
2002	Significant consolidation in ERP vendor sector (PeopleSoft and JD Edwards merge and are taken over by Oracle, Baan leaves the market) as significant pressure to downsize following their growth in the late 1990s and poor economic climate. Only SAP and Oracle remain in the market (Jacobs and Weston, 2007)
2005	SAP and Oracle have 62% of the global market share of ERP installations in large firms (Jacobs and Weston, 2007)
2006	APICS has 260 US chapters and around 50,000 (Lummus, 2007)
2012	SAP has 25% ERP market share and revenues of $6 Billion (Panorama consulting, 2013)

Table 2: Adoption and RP Failure Rates from the 1960s to 2013

Decade	Adoption	References	Reported failed or incomplete implementation	References
1960s	20% of US firms attempting to use computers to plan material resources	Plossl, 1975	The computerised approach is considered cumbersome. A UK survey found that heuristics were still largely relied upon	Factory Magazine 1961
1970s	150 organizations using MRP in the US by 1971 A survey of 1846 APICS members in 1975 highlights that 47% of APICS members' firms are using MRP	Orlicky, 1975; Davis, 1975	50-80% MRP failure rates reported in US and UK by mid to late 1970s.	Hoyt, 1977; Davis, 1978: White et al, 1982; Oakland and Sohal, 1987; Wilson et al, 1994; Ralston, 1996.
1980s	By 1985 between 2000-5000 large US firms are using MRP/MRPII systems 65% of all manufacturing installations are using IBM software based MRPII systems	Aggarwal, 1985 Jacobs and Weston, 2007	Survey of 433 US firms showed that 33 % believed that their MRPII systems were a failure and 26% believed the system fell short of expectations Implementation of MRPII referred to as a '$100 billion mistake'	Cheveny and Scott, 1989 Goodridge, 1988 Little and Johnson,1990
1990s	Baan has 1800 MRPII customers worldwide by 1998 75% of large UK manufacturers have implemented MRPII but facing difficulties in achieving full functionality 20,000 firms worldwide implement ERP applications in 1997 By 1999 J.D. Edwards has more than 4700 ERP	Jacobs and Weston, 2007 Manufacturing Computer solutions, 1998 Markus and Tanis	Continuing high MRPII implementation failure rates estimated between 40-70% reported, leading in some cases to corporate bankruptcy. ¾ of ERP projects found to be unsuccessful	Jones, 1994; Maskell, 1993; Wilson et al, 1994; Luscombe, 1994 Griffith et al, 1999

	customers in over 100 countries Oracle has 41,000 ERP customers worldwide, with 16,000in the United States. PeopleSoft software is used by more than 50% of the US and European HRM market SAP is the world's largest inter-enterprise software company in the world Baan has supplied 2800 ERP systems been to 4800 sites around the world	1999 Jacobs and Weston, 2007		
2000s	ERP spending grew to $47 billion in 2001. ERP remains the tope spending priority in 2005 The global ERP market had grown 3-13% per year, between the years 2000 and 2004. In 2005, AMR Research reported that the market for ERP software grew surprisingly by 14% in 2004 and became a $23.6 billion business. By 2006, SAP had 96400 ERP installations across 25 industry sectors, and over 34000 customers and 12 million users worldwide Rumours of 'death' but ERP sees a 'resurgence' with SAP reporting a 34% surge in licensing revenue at the end of 2010 to a new record ERP systems have been a $60m industry for some time and are expected to grow	Bradley, 2008 Basoglu et al 2006 Jacobs and Weston, 2007 Deloitte Tech Trends 2011 Sykes et al, 2014	ERP projects estimated to be, on average, 178% over budget, took 2.5 times longer than intended and delivered only 30% of the benefit High failure rates (40-50%) and user dissatisfaction start to be reported with ERP implementation in 2001 based on 2 independent surveys of 200 US firms reported by the Standish Group. Independent ERP research based on 172 organisations implementation experiences between Sept.2012–Jan. 2013, highlights average cost of implementation to be $7.3 million dollars, 59% of projects exceed planned budgets, and 56% of respondents believed that they had received less than 50-percent of the benefits they anticipated from ERP.	Basoglu et al, 2006 Standish Group (2013) Panorama (2013)

Figure 1: Evolution of the RP innovation over time



APPENDIX A: Organizational Level Implementation of RP Systems[2]

	Experience of Implementation	Reasons for Failure	Implications	References
1970s	• Potential advantage of MRP over, or in conjunction with, existing systems (e.g. Statistical inventory control) • Need for an integrated approach • Scope of MRP for management functions of production, capacity planning and performance control	• Lack of integration • Uncertainties ('nervousness') in the system • Sensitivity of MRP to outside influences	• Better understanding of management problems • Potential of mixed systems	Davis 1975; Fortuin, 1977; New 1975; Steele 1975
Indicative quotes	*The vast amount of data processing required for MRP made implementation difficult in the pre-computer era. This situation changed dramatically when computers became available... An MRP system user may feel that not all inventory items warrant such elaborate treatment. If certain items are excluded from the MRP system and controlled by some means of SIC techniques, a mixed system is created* (Fortuin, 1977, p 98) *An MRP system can help with performing other management functions than production and inventory control, for instance priority planning, capacity planning and performance control* (Fortuin, 1977, p 99)			
1980s	• Very mixed results - failures reported • Benefits are significant but costs are also substantial • Advantages of MRP for company performance questioned • Major system benefits but implementation difficult • Major challenges in managing implementation	• Poor implementation methods and management of change • People and behavioural problems • Management misunderstandings /false expectations of the system • Lack of management commitment • Lack of fit between business requirements and software	• Think of MRP as concept of management not just a technical system • Improve of task-system fit • Customise system to fit context but not by too much • Improve change/people management process • Focus on behavioural aspects • Need more cases of implementation	Miller, 1981; Schroeder et al, 1981; White et al, 1982; Krupp, 1984; Anderson and Schroeder, 1984; Callerman and Heyle, 1985; Cerveny and Scott, 1989
Indicative	*We can conclude that the average company installing MRP has achieved significant benefits… The study also found that the average costs of MRP installation were substantial*. (Schroeder et al, 1981, p. 8/9)			

[2] This summary is drawn from a meta-review of peer-reviewed papers available on Business Source Premier (N=42) that offered systematic reviews of RP implementation and/or surveys of implementation and/or multiple case studies. It does not include trade journals/books/vendor reports.

quotes	*MRP literature gives many impressive testimonials as to the results of successful implementation. Unfortunately, case histories of unsuccessful implementation are also common. The potential MRP implementer may well be more discouraged by difficulties than encouraged by benefits.* (White et al, 1982, p 145) *With the generally increased use of MRP it is becoming clear that there are many failures or near failures along with the successes. For example, a study we conducted indicated that less than 10% of the companies were getting the full benefits from MRP, another 30% were getting good benefits but not full results, and more than half were getting modest or no benefits.* (Anderson and Schroeder, 1984, p. 57) *The best inventory turnover was achieved by class A companies, who had a great deal of computerization and high data accuracy. On the other four performance measures, being a class D company detracted from performance, but being a Class A, B or C company did not necessarily add to performance*. (Schroeder et al, 1981, p.8) *The best approach seems to use vendor supplied software with some modifications, not too much and not too little.* (Schroeder et al, 1981, p.8) *It has frequently been stated that the technical problems in MRP implementation have been solved. The remaining problems in implementation are 'people problems' Generally, the survey results support this view.* (White et al, 1982, p. 146) *Success or failure of the implementation effort does not appear to depend on any specific features of the system… This finding supports the view that MRP implementation is a continuous process rather than a goal to be reached* (White et al, 1982, p. 152) *What appears primarily to distinguish success from failure is the nature of management commitment in the company and the implementation process used. It is not the specific hardware, software or the system itself... Firms that have failed have not been able to cope with the organizational change, behavioural issues, and people issues involved in successful MRP implementation.*. (Anderson and Schroeder, 1984, p 58) *In most cases of failure, management has not properly conceptualized the organizational change required of MRP systems and prepared people for these changes through education and an organized implementation process* *The published success rates for MRP implementation are quite low. Failure rates of up to 50% have been reported. Experts form from academic and practitioner communities have concluded that the problems with MRP implementation are people related, not technical, in nature* (Callerman and Heyle, 1985) *The trend is towards purchased systems (vis a vis home grown ones)….There were no significant differences in any of the success measures between homegrown and purchased systems but the homegrown systems took longer to implement* (Cerveny and Scott, 1989)			
1990s	• Surveys/case studies of implementation reveal very high failure rates of MRPII and (later) ERP systems • Systems offer significant benefits but not delivering on promises • Major issues around implementation of MRP2/ERP and need for organizational integration • Use/implementation is context dependent – technology-organization fit emphasized	• Political factors and ownership • User resistance/ managers' perceptions/beliefs • Lack of top management support • Poor change management/ planning • Change in product market. • Poor project management and/or project team • Lack of accuracy/ discipline in data • Pro-adoption bias by supplier networks • Compatibility of hardware and	• Align the organization system with the technical system • Create enabling framework for implementation • Commit top management support • Improve project management • Resources for training and education • Choose firm-relevant solutions with limited customisation	Cooper and Zmud 1990; Kinnie et al 1992; Plenert, 1993; Swan and Clark, 1992; Brown 1993; Wilson et al, 1994; Robertson et al, 1996; Sum et al, 1997;

		software to firm • Lack of software vendor support	• Use information sources not dominated by suppliers • Adapt organization to fit RP system	
Indicative quotes	*Research suggests that around half of MRP implementations do not attain the targets set for them…. While another study indicated that around 70% of MRP systems could be regarded as failures.* (Kinnie et al 1992) *Significant benefits such as improved customer service, better production scheduling, and reduced manufacturing costs, can accrue from the successful implementation of MRP. However the success rate is low*. (Sum et al, 1997 p 77) *The implementation of ERP is never a straightforward task. According to Martin 1988 about 90% of ERP projects are late of over budget and almost half fail to achieve the desirable results.* (Peng and Nunes, 2009, p. 926). *While the relative percentages of successful and unsuccessful implementations differ from study to study, one unifying theme which binds them all is the surprisingly high failure rate* (Brown, 1993 p25) *Four non-technical aspects were seen as critically important…the extent of planning, the ownership of the changes, managers' perceptions of the change and the standards used for evaluation* (Kinnie et al, 1992) *It is the usage, not the design of MRP that is causing its competitive shortcomings* (Plenert, 1993) *Despite all the difficulties, there is a high degree of consensus as to how to achieve MRPII success. The key factors include a thorough understanding of the philosophy and discipline underlying MRPII, the creation of an 'enabling framework', comprising top management support, maintaining stability around implementation and to commit resources to support education'.* (Wilson et al, 1994 p 236) *While involvement in inter-organizational networks gave potential adopters access to information about new technology, this information tended to reinforce supplier images of best practice and did not always lead firms to develop appropriate technological solutions* (Robertson and Swan, 1996 p 333) *MRPII has been presented by technology suppliers as 'the' best practice for computer-aided production management…users face major problems in choosing and designing firm-specific solutions* (Robertson and Swan, 1996 p334) *We now have a more concrete idea of what constitutes a critical success factor in MRP implementation* (Sum et al, 1997)			
2000s	• High importance of ERP systems emphasized alongside continued high failure rates • Implementation entails change in business processes to accommodate the system • Whole system approach better than 'best of breed' or 'piecemeal' approach • ERP implementation viewed as organizational transformation, not just an IT solution • Systematic identification of CSFs (critical success factors)	• Lack of top management support • Poor project planning and management • Poor data accuracy and control systems • Lack of education/training/ communication • Software/hardware compatibility, • Characteristics of users • Poor understanding of strategic goals/ business requirements • Multi-site integration issues • Poor change management	• Improve CSFs (e.g. top management support, user involvement, data management, project management/ implementation team, organizational change management, education and training) • Improve performance/ evaluation metrics • Implement ERP as an organizational	Hing and Kim 2001; Petroni, 2002; Robey et al, 2002; Skok and Legge 2002; Umble et al 2003; Ehie and Madsen, 2004; King and Burgess 2005; Muscatello and Parente, 2006; Dery et al, 2006; Basoglu et al 2007; Finney and Corbett 2007; Ngai et al, 2008; Bradley 2008;

		• Lack of cultural/business process fit	transformation project, paying attention to cultural and business process change • Implement whole system and prepare organization to fit • Manage consultants and choose vendors carefully • Fit CSFs to phase of implementation	Peng and Nunes, 2009; Dezdar and Sulaiman, 2009; Francoise et al, 2009; Momoh and Shehab, 2010; Ghosh and Skibniewski 2010; Grabski et al 2011; Shiang Ten et al 2011; Powell, 2011; Sundtoft Hald and Mouritsen 2012; Shaul and Tauber 2013
Indicative quotes	*In a survey of the IT managers responsible for their organizations' ERP projects, two-thirds of the respondents viewed their ERP systems as their organizations' most strategic computing platform. Despite such importance, it was reported that three-quarters of the ERP projects were judge to be unsuccessful* (Hing and Kim, 2001) *The latest data (AMR) show the market for ERP will grow from $13.4 billion in 2003 to a projected £15.8 billion in 2008. Unfortunately, most ERP implementations have not lived up to expectations.* (Ehie et al, 2004) *Significant benefits, such as improved customer service, better production scheduling and reduced manufacturing costs can accrue form the successful implementation of MRP…. However implementation success rate is low, especially among SMEs* (Petroni, 2002 p. 345) *ERP systems appear to be an innovation that makes dreams come true. .. Unfortunately, these plans do not come true most of the time* (Basoglu et al, 2007 p.74) *Although ERP has been depicted as a panacea in both literature and practices, there are many reports of companies that run into costly implementations, suffer fatal difficulties, and must have to cope with severe maintenance problems along the implementation process.*(Shaul and Taber, 2013, p *A critical factor making implementation a hard task is that the implementation of MRP packages is often combined with the restructuring of business processes.* (Petroni, 2002 p. 330) *MRP systems must be implemented as a total system … A piecemeal approach can create 'islands' of MRP but can fall short of achieving company-wide improvements that increase the firm's competitiveness* (Petroni 2002) *Buying into an ERP means much more than purchasing software and involves buying into the software vendors view of best practices for many of the company's processes* (Shaul and Tauber, 2013, p. 18) *A company that implements ERP must, for the most part, accept the vendor's assumptions about the company and change existing processes and procedures to confirm to them*. (Umble et al, 2003) *Many organizations had changed their strategies by adopting ERP software packages rather than doing in-house development.* (Bsoglu et al, 2007) P 76 *ERP should be viewed as an organizational transformation not as an IT project* (King and Burgess, 2005) *The need to approach implementation from a change management perspective is central to the success of any ERP project* (Finney and Corbett, 2007, p 344) *ERP implementation should not be viewed as just an IT solution but as a system that would transform the company into a more efficient and effective organization* (Ehie et al, 2004) *An ERP system is more than the use of stand-alone pre-written software. It is a change management initiative, which encompasses a review of business*			

	processes across the whole organization (Skok and Legge, 2002) *ERP adoption must be seen as a business decision not as a technology decision (Muscatelle and Parento, 2006)* *ERP systems differ qualitatively from prior large scale IT implementations in three ways: 1 ERP will impact the whole organization. 2. Employees may be learning new business processes in addition to new software, 3. ERP is often a business led initiative, rather than IT led*. (Bradley, 2008, p 178) *Results suggest 9 critical factors – namely, inadequate resources, poor user involvement, uses' resistance to change, high attrition rate of project team members, lack of top management commitment, poor project management, inadequate project team composition, ineffective change management and unrealistic project scheduling – have a high impact on ERP implementation* (Garg and Garg, 2012) *Nine factors are found to be critical in the failure of ERP implementation – excessive customization, dilemma or internal integration, poor understanding of business implications and requirements, lack of change management, poor data quality, misalignment of IT with business, hidden costs, limited training and lack of top management support* (Momoh and Shehab, 2010, p 537)

[i] We recognise that TQM does not encompass the whole quality movement which also includes ISO and Six Sigma strands. For the comparative purposes of this paper, however, TQM provides the more relevant and well documented case of diffusion/implementation.