PROCESS MODELS IMPLEMENTATION IN THE CONSTRUCTION INDUSTRY: A LITERATURE SYNTHESIS

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Category:

Literature review

Purpose

Different process models have been developed by academia and industry to enhance the effectiveness and efficiency of the design and construction activity in response to the need for improving performance. However, the effective and widespread adoption and use of process models has been limited, and the benefits resulting from these endeavours have been ambiguous at best and not existent at worst. This paper synthesises the key general and construction specific literature related to process model implementation around a generic model, providing a systematic picture on the current knowledge on implementation.

Design/methodology/approach

Secondary data sources were reviewed, criticised and synthesised. The books and academic papers identified focused on the areas of process management in construction and manufacturing, change management and knowledge/technology transfer.

Findings

The paper concludes that the body of literature related to process model implementation lacks an integrated focus and cohesion, and the need to appropriately locate and operate the implementation strategy within a visible organisational context is not adequately addressed.

Research limitations/implications

The paper review and synthesis is limited to relevant literature within the context of implementation of process models.

Practical Implications

Gaps in the literature are identified and discussed, and a set of questions proposed to stipulate future research.

Originality/value

The paper originality relates to providing a broad, systemic perspective on the complexity of process models implementation, analysing it from different but interrelated conceptual lenses.

Key words: construction industry; process models; implementation; literature review

Introduction

The construction industry has been challenged to be able to deliver projects that are predictable on cost, time and quality, through an understanding of customer requirements (Egan, 1998; DTI, 2002). A key part of this broad agenda relates to the need for improving the performance of the design and construction process. Numerous reports, for example Egan (1998), DTI (2002) and Fairclough (2002) have examined the process management aspects of design and construction, and constantly concluded the need for innovation and change in process management practices. The complexity of design and construction has been consistently noted as the primary reason for the difficulty in sustaining significant improvements in this area (Aouad et al., 1994).

It has been proposed that the means to navigate through and reduce this complexity is the development and implementation of generic process models, which would allow for a consistent and integrated design and construction process (Kagioglou et al., 1998). Even though relationships are complex and dynamic in a project environment, the underlying generic processes remain broadly consistent (Mill and Ion, 1994; Kagioglou, et al., 1998). Consequently, process mapping is becoming widely accepted.

However, the effective adoption and use of these models in practice is slow, and there have been ambiguous signs of improvement resulting from these solutions (Austin et al., 2000). Hammer and Champy (2001), for instance, identified that implementation of new or redesigned processes fail in 50 to 70% of Business Process Reengineering (BPR) initiatives. There are a number of reasons cited for these failure rates. Smith and Morrow (1999) analysed product development process modelling efforts in manufacturing and concluded that models failed on the criterion of applicability to projects. Finally, Lawson et al. (2003) depict that model failure occurs because of lack of motivation, with process maps left unused on the shelf regardless of the time, knowledge and effort invested in developing them.

The departing point for this paper is an assertion that there is a mismatch between the espoused benefits of generic process models and the actual benefits realised in practice. The aim of this paper is to understand this mismatch from the perspective that the espoused benefits are not accomplished because of inadequate consideration of implementation of generic process models.

This paper is organised around three main issues: (a) the main triggers and outcomes for implementation, drawing from process research; (b) insights into the implementation process, using the organisational change literature as conceptual lenses from which to understand implementation steps; and (c) insights into the implementation process from a knowledge transfer perspective. The last section of the paper set out a number of questions for future research.

Implementation concept model

Three areas of knowledge are investigated to provide new theoretical insights on implementation, i.e. process management, change management and technology transfer. Such literature domains have been structured around a generic model shown in Figure 1, which aims to provide a holistic and systematic perspective on implementation.

FIGURE 1 HERE

This model argues that successful implementation outcomes (i.e. the effective adoption and sustained use of a process model within a construction firm) can be achieved through suitable implementation triggers (related to the improvement need), and will be determined by an appropriate implementation process (i.e. the strategy and steps used, and the way the model content is transferred to its users) as well as by the usefulness of the process model content.

Implementation triggers and outcomes

Implementation triggers relate to the reasons why a company decides to invest on process models. Outcomes are benefits that accrue from it. One of the goals of modelling processes is the creation of predictive models that improve managerial decision-making (Smith and Morrow, 1999) and optimise process predictability. The same authors stress that developing models is useful for both learning about the process and suggesting ways for improvement. Prior to approaching process model implementation it is important to provide a brief review of process modelling, presented as follows.

Process models and maps

Processes have been the focus of studies in different areas such as New Product Development (NPD), Business Process Reengineering and Operations Management for many years. Due to this diversity, different definitions of processes can be found in the literature (Lindsay et al., 2003). Therefore, there has been an evolving definitional debate emerging from a variety of different perspectives.

The framework of scientific management describes processes as transformations of inputs into outputs by approaching the idea of task, as described by Taylor (1913). According to this perspective, processes can be broken up into smaller, more manageable parts, which are smaller versions of the whole operations of which they form a part (Slack et al., 2001). This is a potentially powerful idea, since the same set of managerial principles can be used at different levels, which simplifies management (Koskela, 2000).

However, production processes need to be analysed not only as transformations but also as flows and as value generation (Koskela, 2000). Transformations, flows and value exist as different aspects of processes. For instance, each design task is in itself a transformation, and it is a stage in the total flow of design. Also, internal and external client requirements direct the transformation of input information into a design solution. Therefore, the three views should be approached in an integrated fashion (Huovila et al., 1997; Koskela, 2000). Indeed, the importance of analysing the flow of information as well as value generation aspects of design has been well acknowledged in the literature (see, for instance, Cooper and Press, 1995; Anumba and Evbuomwan, 1997; Barrett and Stanley, 1999; Cooper, 2001).

Furthermore, there are shortcomings in analysing processes only as transformations. For instance, considering that the total amount of work can be divided into parts and managed as if these parts were separated is not sufficient to improve design (Huovila et al., 1997). This is

because each task has an impact on the timeliness and on the quality of output of the subsequent tasks. Lindsay et al. (2003) supports this argument, stating that the traditional approach to input-process-output lacks concepts to model coordination activities involving actors, information exchanges and coordination structures, which have important influences over the quality of the process. By conceptualising processes as transformations, flows and value generation, such considerations become possible.

Finally, the aim of a process is to produce a product that fulfils clients' needs. Process activities are related to one another by a trigger relationship and are also triggered by external events representing a process starting with a commitment to a client and ending with the termination of that commitment (Linsay et al., 2003). It has been argued that in construction, focus should be given to fulfilling clients' needs in order to deliver better quality throughout the industry (DTI, 2002). Conceptualising process as value generation is beneficial as it makes the focus on clients needs more explicit.

Regarding process models, the literature describes two broad types of process maps: (a) true maps of what happens ('as-is' models); and (b) potential maps of what ought to happen ('to-be' models). 'As-is' models simply try to depict the process, some focusing on the process as a whole (e.g. Prasad et al., 1998; Yazdani and Holmes, 1999), while others describe parts of it (e.g. Mazijoglou and Scrivener, 1998). In turn, 'to-be' models attempt to provide protocols and tools to support improved process management. Those models generally aim at organising work and information flows (Prasad et al., 1998), and provide a set of tools, such as templates containing checklists of the key steps in a project.

It is here argued that both types of models are needed, i.e. in order to 'prescribe' action (through a to-be model) there needs to be a clear understanding and description of current

practice, which can be achieved through a descriptive, as-is model. Furthermore, modelling will influence current and future practice regardless of whether a model is prescriptive or descriptive and, therefore, process models will need to be implemented in some way.

Process maps can present different levels of detail of the process being modelled. Broadly speaking, two levels are found in the literature: generic and detailed maps. Models which describe the process to a detailed level are usually developed using structured modelling approaches, e.g. IDEF0 (Sanvido, 1990), which focuses on defining information flows. However, such approaches tend to be over-detailed for use by non-specialists and tend to ignore the organisational context which structures the flows of information being mapped (Kartam et al., 1997; Winch and Carr, 2001).

On the other hand, generic (or 'high-level') maps provide an overview of the whole process, describing its main stages and activities (Kagioglou et al., 1998). They focus on flows of information within an organisation and between different actors. Typically a two dimensional map is designed, describing a dimension of sequence, or stages in one axis, and actors or functions responsible for each sub-process on the other axis. Sub-processes describing activities or tasks are usually defined through different levels of detail. Deliverables are typically identified, and generally phase reviews are incorporated. Examples of such models can be found both in the manufacturing (e.g. Pahl and Beitz, 1988; Pugh, 1991; Ulrich and Eppinger, 2000; Cooper, 2001) and construction domains (RIBA, 1980; BPF, 1983; Cornick, 1991; Kagioglou et al., 1998; Gray and Hughes, 2001).

Even though the main aim of modelling is the effective use of the model in real life settings, studies on processes tend to focus on the design of the process model, rather than on the design *and* implementation. For example, BPF (1993), Tunstall (2000) and Gray and Hughes

(2001) do not present any considerations on implementation. Some studies from the process management domain superficially address implementation issues (e.g. Kagioglou et al., 1998), but the implementation process is not comprehensively analysed nor described.

It is argued here that the superficiality of advice about implementation found within process management literature has been leading to an excessive focus on the design and form of the process models themselves, without appropriately considering their implementation. This narrow focus is producing over elaborate models that cannot be effectively implemented. This goal displacement gives partial insight into the cause of low success rates identified in the use of process models in practice.

There is thus a significant gap in the literature with respect to the implementation, rather than design of process models. In the area of strategic management, for example, Grant (1997: vii) stresses that "a strategy that cannot be implemented is worthless: strategy must be formulated with a view to its implementation". In the same way, a process model should be designed with a view to its implementation, and as this review shows, this consideration is often missing within the literature.

Implementation triggers

For companies, the main triggers for designing and implementing generic models are to achieve some of the benefits that have been claimed by the use of processes. The espoused benefits described in the literature are here classified under three generic themes: benefits for the **organisation**; the **process**; and the **client**. These are summarised in Table 1.

TABLE 1 HERE

Probably the most important organisational benefit relates to the possibility of achieving consistency and integration through the replication of the managerial practices embedded in the generic process to all company projects. The replication of the process and its activities, deliverables and functions makes it possible to achieve more predictable outcomes (Kagioglou et al., 1998; Ulrich and Eppinger, 2000; Cooper, 2001; Winch and Carr, 2001). Furthermore, a process model can act as a means to educate new employees, since it describes the company's 'way' of working (Gray and Hughes, 2001; Cooper, 2001). Finally, it can provide the basis for contractual arrangements between clients and suppliers.

Many benefits have been described at the project level. A process specifies the phases a project will go through and checkpoints along the way (Cooper, 2001). Following the process is one way of assuring the product quality (Pugh 1991; Ulrich and Eppinger, 2000) and reducing cycle times and costs (Reinertsen, 1997; Kagioglou et al, 1998; Cooper, 2001). Further, the roles of stakeholders can be clearly defined (Gray and Hughes, 2001). A process model can also act as a benchmark for assessing the performance of ongoing projects (Cooper, 2001).

For clients, the major benefit relates to the possibility of achieving better value for money through a product free of defects, satisfying fitness for purpose, with reasonable running costs and delivered on time (Reinertsen, 1997; Kagioglou et al., 1998; Ulrich and Eppinger, 2000).

Maylor (1996) describes that empirical studies in the NPD area normally describe benefits in using models, but they do so regardless of complementary activities that might be taking place within the firms. Consequently, it is difficult to determine weather the benefits claimed are directly from the use of a process model or if they are a by-product of the use of various techniques. Maylor (1996) also states that there is generally little consideration of the factors

which may influence outcomes, and also whether there exists significant adverse effects from implementing processes. Finally, even though the organisational context is extremely important in determining the relevance of a process model (Pettigrew, 1987; Bresnen and Marshall, 2001), this issue seem to have been abstracted away from most research into process model design.

Implementation outcomes

The outcomes of implementation efforts have not been consistently successful. Stickland (1998), for example, suggests that 70% of BPR programs fail, and states that the reason for this is related to poor management of the change process within companies. Kotter (1995) states that companies suffer from problems in managing change as they look for short cuts by expecting individuals to execute new working practices without training or awareness of need. Cooper (2001) further supports this idea, stating that lack of training and education is responsible for scepticism and lack of acceptance when processes are implemented.

A further factor that has contributed to unsuccessful implementation outcomes is that producing clear evidence of performance effects (i.e. measuring benefits from a process model use) is a difficult endeavour, especially in project environments like construction (Bresnen and Marshall, 2001). In construction it is difficult to clearly compare results between projects due to their uniqueness, and it is also hard to establish links between the performance of a project and the use of a process model.

Discussion

In summary, in the process management domain, much effort has been put in developing process models for product development in manufacturing, and for design and construction.

Different concepts and principles have been proposed and a number of benefits in adopting processes have been described. Nonetheless, the understanding of process model implementation is limited. As a consequence, there is little evidence that construction companies have accomplished the espoused benefits of using process models.

There are three main causes for the superficiality of the advice on implementation found within process literature. First, a process model design is a difficult, long-term exercise involving different knowledge domains (Formoso et al., 2001). Due to this factor, studies tend to put great focus on the model design, leaving implementation as an area for further research. Second, most models found in the literature have not been developed considering empirical evidence, nor have been empirically validated, which suggests that the research strategies applied do not lead to the consideration of implementation. Finally, implementation issues are multifaceted, complex, and tend to be context specific, and therefore it is difficult to generalise results from empirical studies.

Process model implementation should be approached considering the specific context in which it takes place, especially in construction where companies tend to design 'in-house' process models. Therefore, the model itself directly influences implementation success. Furthermore, implementation success could be measured with basis on the accomplishment of the expected benefits. From this thinking, two research questions are posed:

- What are the actual improvements to current practices brought about by process models devised/implemented in construction firms?
- Are the espoused benefits of process models achieved in practice? And if not, why are process model implementation efforts often unsuccessful in practice?

Implementation process

'Implementation process' here refer to the steps that a firm goes through to design and use a process model. The literature on process management presents generic guidelines on the implementation process. In addition, the organisational change domain presents models to support change programmes. Both are discussed below.

In the Design and Construction Process Protocol (Kagioglou et al., 1998) generic implementation guidelines are presented. The importance of a process representing a generic set of principles that allow for a consistent application in a repeatable form has been emphasised. It also stressed that process models should be interpreted, adopted and applied in a flexible manner across projects, teams and client needs, with benefits being clearly measured. Those are important guidelines, but more information is needed to support process models adoption in practice.

The NPD literature provides information on implementation by presenting 'processes' to implement processes. For instance, Cooper's (2001) model has three stages: (1) defining process requirements; (2) designing the process; and (3) implementing it through training, internal marketing, and having a process 'owner'. A similar model is presented by Smith and Reinerstein (1995), stressing: (a) need for planning implementation; (b) implementing the process from the beginning of a project; (c) getting the right leader and providing training; (d) getting management to facilitate the process; (e) using past experiences to demonstrate how behaviour can be changed; and (f) gradually roll-out implementation. It can be argued that if there is a need for a process model to implement a process model, maybe there would be a need for a further process prescribing advice on the process to implement a process model, which could lead to a never-ending cycle!

Guidance on implementation is also provided through several conceptual models and methodologies found in the Business Process Reengineering literature (e.g. Selegna and Fazel, 1996; Vakola et al., 2000; Tissari and Heikkila, 2001). Even though such methodologies have been developed with different focuses, consensus has emerged and some common themes can be identified, described as follows.

The first common theme is that such methodologies are one-off type models, i.e. they have a defined start and end. Therefore, they concentrate on creating change rather than managing change as a continuous event (Cooper, 1994; Stickland, 1998).

A second common theme is that they provide prescriptive sequential steps to implement changes (Vakola et al., 2000), and most models in the literature present similar steps. They start with the definition of strategic goals and targets. Then, there is the selection and analysis of the processes to be reengineered, followed by process redesign. After that, models describe the need for an implementation plan, pilot and rollout implementation. Most models emphasise the need for creating a team, having a champion, and changing the organisational structure and capabilities. Even though it appears that a consensus has emerged in the literature on the prescriptive steps to be used, the results from the application of such steps have not been generally successful (Hammer and Champy, 2001).

The potential oversimplification of such change models is a major problem described in the literature (Beer et al., 1993; Cao et al., 2001). In many cases the simplified diagrammatic formats appear to be just common sense (Cao et al., 2001), which can lead to the omission of important steps and a lack of rigour in the application of such models (Beer et al., 1993). The lack of change expertise on the part of managers, trainers and developers has been identified as one of the reasons for these problems (Hammer and Champy, 2001).

Lindsay et al. (2003) states that BPR represents a ‘repackaging’ of traditional techniques derived from scientific management, which are very mechanistic in nature. The authors also point out that even though attempts have been made to soften such techniques (by adding, for instance, team working) the models still represent positivistic approaches that should be used to shape and structure human activities. In this way, the literature fails to address the complexity and non-linear nature of much of the work carried out in organisations. It also assumes that humans are rational decision makers co-operating together to achieve agreed and clearly defined goals, and are concerned with past practice and promoting standardised best practice (Lindsay et al. 2003). As demonstrated by Pettigrew and Whipp (1991), companies are composed by individuals and groups which can have differing values, needs and goals, which sometimes leads to conflicts, and these factors are generally not considered within the BPR literature.

Implementation needs to be understood as an organisational change, which involves change at individual, group and organisational levels (Stickland, 1998). Individuals need to be capable and motivated to change their behaviour in some way to allow the adoption of a process model. Social norms also play an important influence in determining perceptions, motivations and behaviours (French and Bell, 1995), as different groups will have varying views on the process and on its implementation, which can lead to potentially conflicting actions between such groups.

The design and implementation of a process model can be understood through the well known **unfreeze, move and refreeze** change process proposed by Lewin (1946). The design of a process model can be the means to ‘unfreeze’ the way the process is currently developed, demonstrating problems and improvement areas. The adaptation of the model and its adoption

into a specific project can be analysed as moving from the ‘old’ way of developing projects to the ‘new’ one. The adoption of the generic model into different projects can be approached as refreezing, or embedding new working practices in the company. These concepts informed the theoretical framework for implementation, presented in Figure 2.

FIGURE 2 HERE

Examining the implementation of process models from the organisation to the project level (i.e. from the generic to the specific process model), and among multiple projects of a firm is a valid way to understand how these models can improve the management of the design and construction process (Tissari and Heikkila, 2001). To validate this statement, a further research question is proposed:

- How do construction project teams implement process models (how the implementation process occurs within specific cases)?

Implementation content

‘Implementation content’ refers to the transfer of the knowledge embedded in a process model from the model developers to its users, thus providing a complimentary perspective on implementation. Knowledge (or technology) transfer literature provides insights that can assist a better understanding of process models implementation in three ways.

First, implementation involves the transfer of the knowledge embedded in the generic model to its users. To ‘move’ technology (i.e. a process model) within an organisation involves two main actions: transmission (i.e. sending or presenting knowledge to a potential user) and absorption (understanding and interpretation) by the user (Davenport and Prusak, 1998). In

this way, the users will be able to apply the knowledge to manage the project in hand and, as a result, identify potential benefits (as well as problems) from the process model' use at organisational, project and individual levels.

One potential problem related to knowledge transfer regards the nature of the knowledge itself. It is argued that a generic process model, as a written document, presents explicit knowledge. Such knowledge can be transferred with reasonable accuracy (Nelson and Winter, 1982). Nonetheless, there is a substantial amount of tacit knowledge involved in managing design and construction (Kagioglou et al., 1998), and there is a large amount of tacit knowledge generated during the process model design. The latter is generated due to the learning that occurs throughout the analysis of the 'as-is' process and the proposition of improvements in the 'to-be' model. Both explicit and tacit knowledge need to be transferred to users to allow successful implementation. Tacit knowledge is especially hard to transfer from the source that creates it to other parts of the organisation (Davenport and Prusak, 1998; Szulanski, 1999) because it cannot be fully articulated through written and verbal communication, and thus must be learned through experience (Nelson and Winter, 1982; Nonaka and Takeuchi, 1995; Empson, 2001).

The second issue is the concept of replication of routines. Replication is a process by which organisations re-utilise knowledge that is already in use (Nelson and Winter, 1982). In this way, the re-utilisation of routines expressed in a model at different projects can be analysed as a replication issue. This is important because the aim of a process model's implementation is the use of the model not only in one project, but in all different projects developed by the company to allow consistency, as represented in Figure 3.

FIGURE 3 HERE

Finally, there are a variety of factors that affect the opportunity to transfer, which originate from different sources and are likely to predict difficulties during transfer (Nonaka and Takeuchi, 1995). Those factors are referred to as measures of 'stickiness' of knowledge transfer (Szulanski, 1999). It is postulated that such measures present barriers that may influence implementation success, providing a framework to better understand the difficulties or stickiness during implementation. Measures of implementation stickiness are described as follows.

The level of complexity of the process model content can generate implementation difficulties. These relate to the ambiguity occuring due to the complexity or depth of the practice to be implemented, referred to as *causal ambiguity* (Szulanski, 1999). Causal ambiguity can create uncertainty in proceeding with implementation and it can occur due to: (a) the model developers' understanding and ability to explain the process model can be incomplete; and (b) the model users' ability to specify the environment in which the model will be applied can also be incomplete (Nonaka and Takeuchi, 1995; Szulanski, 1999). However, such uncertainty can be mitigated if there is evidence that the model has proven robust in other environments.

Assessing model robustness involves considering issues such as the existence of solid proof that the process model is helpful and contributes to the management of design and construction. Such proof could be provided by performance measures or through the model validation by successful implementations. Nonetheless, if there is a certain degree of conjecture on the utility of the process model (Szulanski, 1999; Dixson, 2000), it is likely that users will not apply it. This creates a second type of stickiness, i.e. *unproven knowledge*.

The ease of communications, collaboration and intimacy of the relationship between the process model developer and its users also affects implementation. In cases where there is a laborious and distant relationship (i.e. an *arduous relationship*), problems will arise in implementation due to the difficulties in transferring tacit knowledge (Szulanski, 1999). Empson (2001) further supports this idea, stating that barriers to transferring tacit knowledge could reflect barriers to inter-personal communications.

Poor motivation can also provide difficulties. The motivation of the model developer may vary with the incentive to compete or collaborate with the users and with the effort required to support the transfer (Teece et al., 1997; Davenport and Prusak, 1998). The model users may also lack motivation, as implementation disrupts operations not only with regards to the new working practices, but also in terms of personnel being retrained, as well as infrastructure being modified. Lack of motivation may result in foot dragging, passivity, hidden sabotage, or outright rejection in implementation (Szulanski, 1999).

Forth, the degree to which the model user perceives the donor of the best practice as reliable can potentially generate difficulties during implementation. In this context, the donor of the best practice can be described not only as the developers of the process model themselves, but also the sources of information used to build the process model. It has been argued that a capable and trustworthy process model developer is more likely to influence the behaviour of the model users (Szulanski, 1999).

Also, lack of absorptive capacity of the model users, i.e. their ability to exploit outside sources of knowledge is another potential source of stickiness (Szulanski, 1999). Process model users can have difficulties in their ability to identify, value and apply new knowledge, which is largely a function of the organisation's prior related knowledge (Cohen and Levinthal, 1990).

Finally, the organisational context may affect the willingness and ability of organisational units to complete implementation tasks. In a barren organisational context implementation successes can be difficult (Empson, 2001). Influences can occur through norm and value settings, through incentives and through counsel and support (Szulanski, 1999).

In summary, the stickiness of knowledge transfer can be used to identify measures of implementation stickiness, which are: (a) causal ambiguity; (b) unproven knowledge; (c) arduous relationship; (d) model developers lack motivation; (e) model users lack motivation; (f) model developer is not perceived as reliable; (g) model user lacks absorptive capacity; and (g) barren organisational context. The suitability of these measures to describe process models implementation problems needs to be assessed through empirical data. In this way, a further research question has been proposed:

- Which 'stickiness' factors affect the success of implementation efforts?

Discussion

The literature on process models implementation has been structured around the model set out in Figure 1, which described its triggers and outcomes, implementation strategy (steps), and the transfer of the process model content. Process management research provides valuable insights on the benefits and possible outcomes from applying process models in practice, but focus is given to process model design, and implementation issues are inadequately described.

The implementation of a process model occurs through a set of steps or activities that need to be defined at the organisational level and conducted at its operational level. Much of the literature on implementation presents generic guidelines and prescriptive models, generally

approaching change as a one-off activity, not consider that it should be managed as a continuous event within organisations. Empirical results have suggested that the use of such frameworks has led to outcomes which were not as successful as expected. Organisational change literature offers the unfreeze, move and refreeze model, which provides a fruitful platform to better understand and therefore enact implementation as a change process within construction organisations. Nonetheless, the need to appropriately link the implementation strategy to the organisational context and to soft people issues (such as consensus, collaboration and motivation) has not been sufficiently addressed.

The importance of explicitly assessing the usefulness of the model content in the organisation and project levels has also not been sufficiently emphasised. It appears that it has been assumed that any change or innovation proposed in such models would be beneficial, regardless of the type of organisation and project to which it is being applied. As a consequence, the literature does not explicitly describe means to assess such usefulness.

The technology transfer literature offers a complementary perspective on the implementation process by looking at the transfer of information within and across implementation steps. It also provides a framework to identify potential problems that can occur in implementation efforts. Such implementation stickiness, related to transferring the knowledge content of the model throughout the organisation and between different projects is yet to be established.

Based on the findings of this literature synthesis it is possible to state that the knowledge on process models implementation is characterised by a lack of clear direction. Several gaps in the understanding of process models implementation in construction are identified, and such gaps hinder our understanding of this multifaceted phenomenon. Such gaps are set out in Figure 4, and they propose an agenda for future research into process models implementation.

Whilst our understanding of implementation is not increased, it is envisaged that companies will continue having difficulties in achieving the espoused benefits of designing and adopting process models.

FIGURE 4 HERE

Conclusions

This paper has explored the literature on process model implementation, drawing from the construction and manufacturing domains. The discussion was structured around the triggers, outcomes, process and content of process models implementation. Gaps on the knowledge have been discussed for each perspective analysed and the following research questions which require further investigation are posed:

- What are the improvements to current practices brought about by process models devised/implemented in construction firms?

- Are the espoused benefits of processes achieved in specific cases? If not, why do process models implementation efforts tend to be unsuccessful in practice?

- How do project teams implement PDP models (how the implementation process occur within specific cases)?

- Which factors affect the success of implementation efforts?

Within process literature, excessive focus has been given to the design of the process models themselves, leaving implementation issues at a marginal level, even though the main aim of

modelling is the use of the models in real life settings to improve process management. This has been leading to practical implementation results which are not as successful as expected.

Examining implementation within company specific settings is a way to better understand how process models can effectively improve process management. Also, a process model could have different roles within a company, for instance it could be a learning instrument or the basis for planning process activities. The exploration and analysis of its role(s) in context specific settings can help in better determining the model effectiveness. It can also contribute to focus further research in the area, as it generates different approaches to the practical aim of process models as well as to implementation approaches.

The need for a better conceptualisation of implementation as a practically oriented phenomenon is clear. The development of a more holistic and integrated theoretical body of knowledge on processes implementation will offer appropriate guidance for companies aiming to successfully implement process models.

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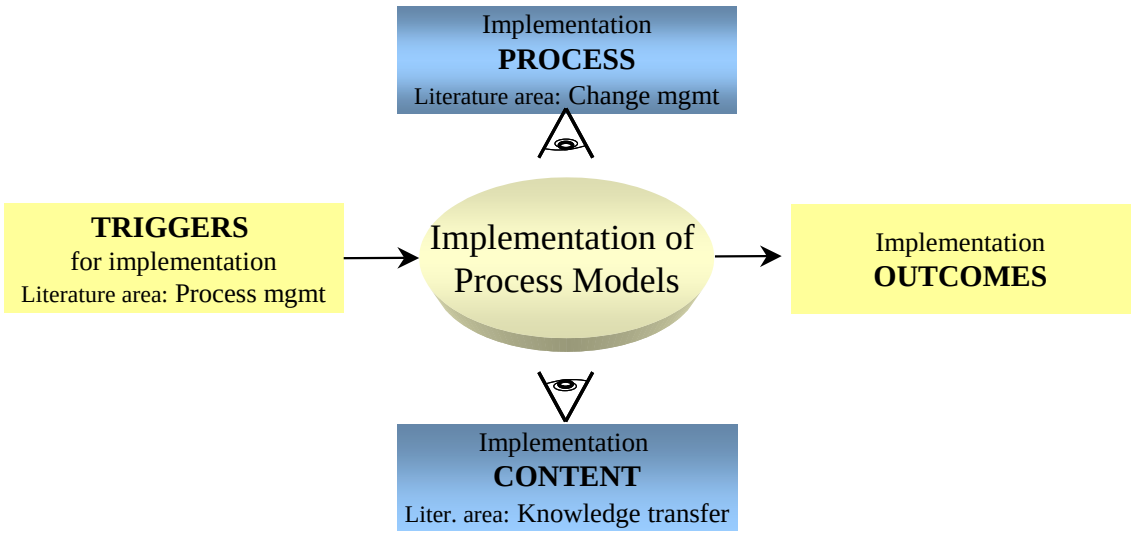

Figure 1: Generic model of the implementation process

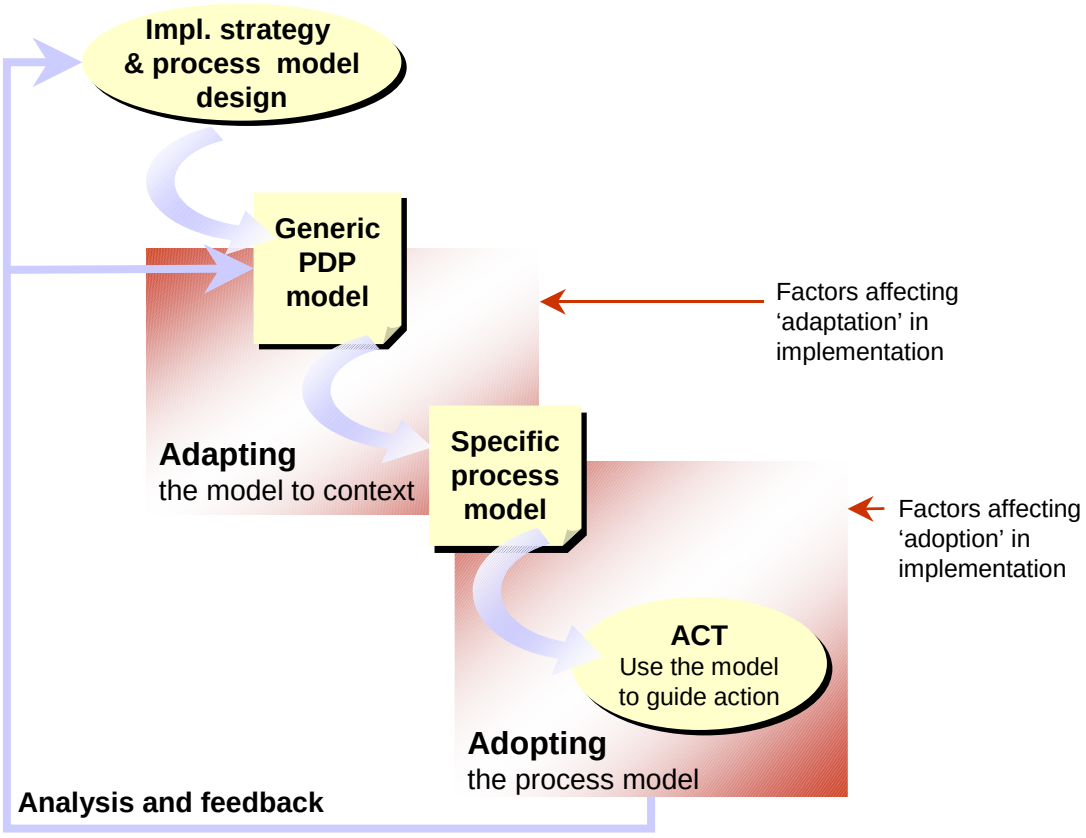

Figure 2: Process models implementation framework

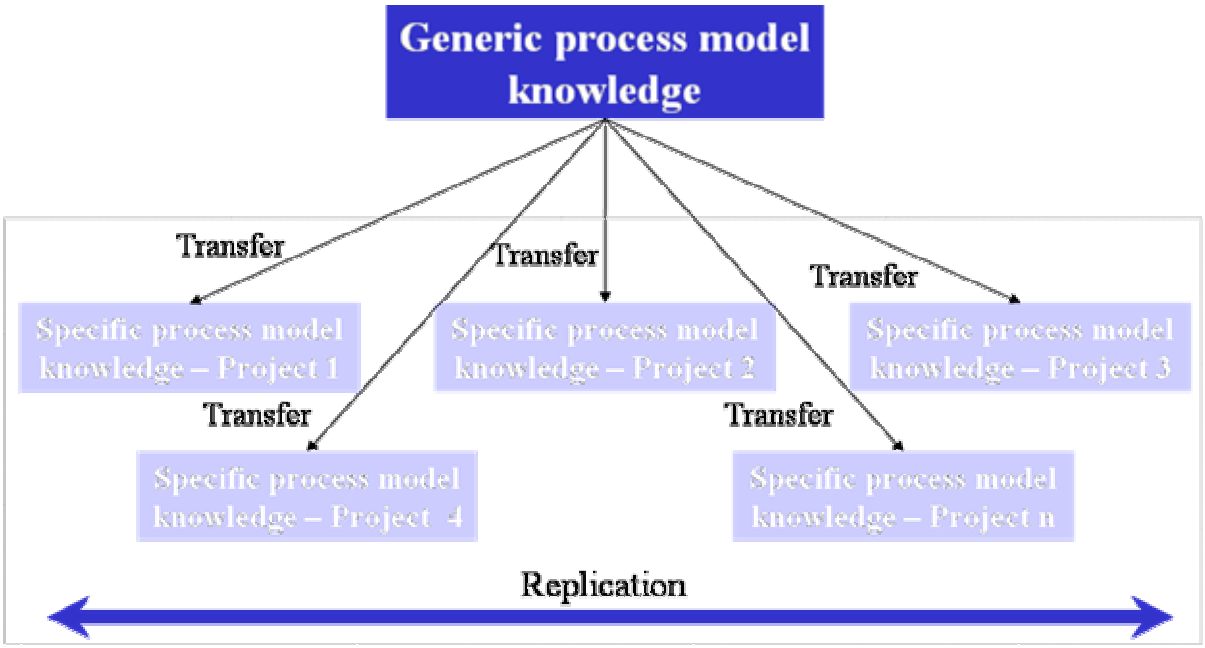

Figure 3: Knowledge transfer from the generic process model to the specific models used to manage different projects

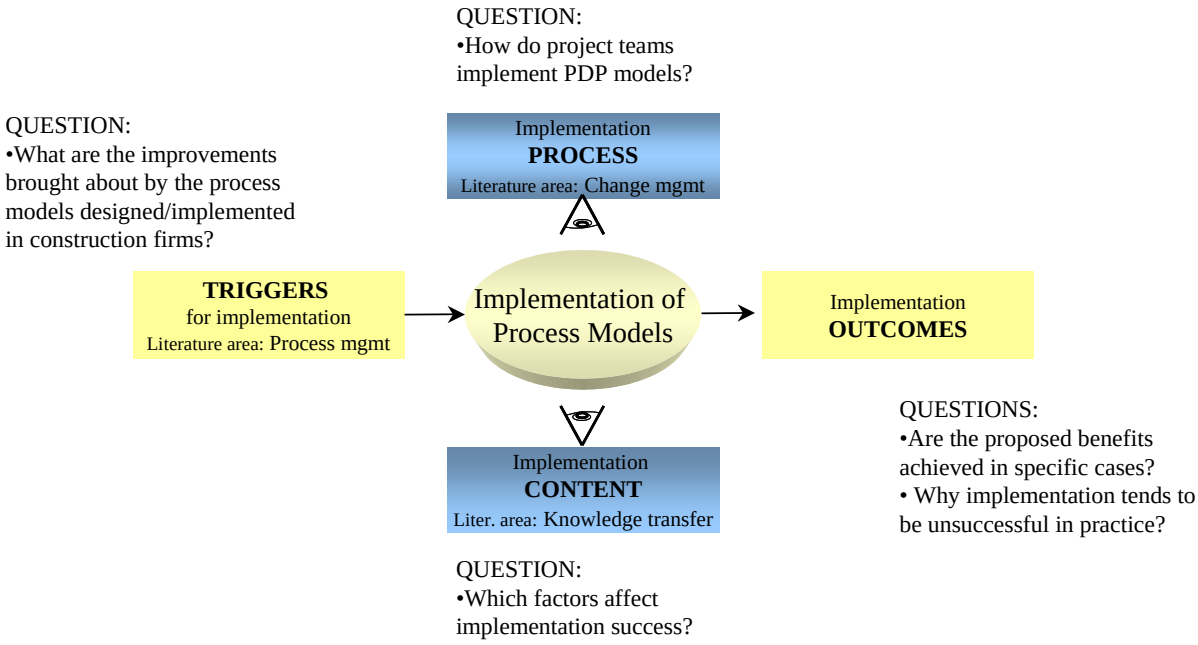

Figure 4: Research questions on process models implementation

Table 1: Espoused benefits of adopting process models

Espoused benefits for the organisation	***Espoused benefits for the process***	***Espoused benefits for the client***
• Competitiveness • Consistency through replication • Optimise predictability • Support partnering and contractual arrangements • Basis for IT systems • Educate new employees	• Less time and costs • Better planning • Better and timely information exchanges • Better communications • Reduce errors and rework • Benchmark for improvement	• Better product quality • Fitness for purpose • Delivered on time • Delivered to costs