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Using the Delphi Technique to Identify BPM Capability Areas

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Abstract

Organizations increasingly recognize the need to adopt a process orientation as a means of approaching challenges such as globalization, Enterprise Systems implementations or alternative improvement perspectives. A comprehensive understanding of the operational capacity to support and extend BPM strategies is critical to this endeavour. To this end, organizations require appropriate frameworks, which assist in identifying and evaluating their BPM capabilities. The development of maturity models has long been recognized as a means of assessing capabilities within a given domain. However, due to the idiosyncratic structure of many of the more than 150 available maturity models they can not be translated into tools that are embraced and applied by practitioners. To address this issue, the Delphi technique has been adopted during the development of a maturity model for Business Process Management. This paper presents the design and conduct of the Delphi Study series including the major outcomes being definitions of the six factors critical to BPM (i.e. Strategic Alignment, Governance, Methods, Information Technology, People and Culture) and the identification of capability areas whose measurement is seen to be necessary for assessing the maturity of these factors.

Keywords

Process Management, Delphi, maturity, model, design science

Introduction

Business Process Management (BPM) is a popular, but complex management practice that many organizations find difficult to implement and progress. This is supported by research conducted by Pritchard and Armistead (1999) which indicates that 97% of the surveyed European organizations considered BPM to be important to the organization and only 3% had not commenced BPM practices. Despite this importance 73% were classified as being only at the early stages of adoption (Pritchard and Armistead, 1999:13). A recent review of CIO's by Gartner (Gartner 2007) confirmed the significance of BPM with the top issue identified for third year running being improving business processes. Whilst the Gartner study focused attention on improving business processes, as opposed to the holistic management approach BPM proposed by Pritchard and Armistead, it none-the-less confirms that interest in process management (in one form or another) remains at the forefront of organizational issues. Within this paper BPM refers to the holistic management approach proposed by Pritchard and Armistead whilst information technology is seen to encapsulate as well as BPM systems a range of items including Process-aware Information Systems, process modelling software, process performance monitoring and control systems and other related software such as simulation tools and information management systems that are relevant to the management of processes within and across organizations.

One of the main challenges for managers responsible for BPM in their organization is to convert the potential benefits of BPM into company-specific actual benefits along a well-structured pathway of increasing BPM capability development. Maturity models are widely used as an evaluative and comparative basis for improvement (Harmon 2004) and in order to derive an informed approach for increasing the capability of a specific area within an organization (Paulk et al. 1993). Models have been designed to assess the maturity (i.e. competency, capability, level of sophistication) of a selected domain based on a defined set of criteria. Paulk et al. (1993: 5) stress that improved BPM maturity (BPMM) results "in an increase in the process capability of the organization". Consequently, it is not a surprise that recently a number of models to measure the maturity of different facets of BPM have been proposed (Davenport, 2005). Arguably the proliferation of models in this domain is an indication that existing models are not sufficient and as a consequence not being widely accepted by practitioners.

This paper focuses on the use of the Delphi technique within a larger body of research aimed at developing a BPM maturity model. Section 2 of this paper summarizes related work and Section 3 discusses the development of a proposed new BPM maturity model. Section 4 focuses on the design of the Delphi study including strategies to address inherent design limitations. Section 5 shows the effectiveness of the Delphi technique in

gaining consensus on the factor definitions and BPM capability areas identified during the studies. Finally, Section 6 concludes with a review of limitations and potential research stemming from this research.

Related Work

A common base for many existing maturity models has been the Capability Maturity Model (CMM) which evaluates maturity based on five stages of maturity with '5' representing the highest level. Among others, Harmon (2004) developed a Business Process Management Maturity model based on the CMM. In a similar way, Fisher (2004) combined five "levers of change" with fives states of maturity. A search in the area of process management maturity models identifies over 150 available models that address one or more components of BPM. One could ask then, why look to develop a new BPM maturity model when there are so many maturity models already in the BPM domain? Essentially we see a number of issues with existing maturity models.

First, a number of available models capture only a discrete component of BPM. For example, Luftman's Strategic Alignment model (Luftman, 2003) model looks only at the alignment of IT and strategy. Similarly, Edwards et al. (2001) Process Transformation Framework is designed to identify areas of process change and the strategies required to address them. Whilst the aspects addressed by these (and other similar models) are undoubtedly important to BPM they do not encompass all facets of BPM that are critical to progression.

Second, a number of existing models are relevant to the management of a specific process and not to the management of all processes. For example, the CMM was designed to assess the maturity of the software development process. The SEI has since developed the CMM Integration to combine the multitude of spin-off CMM-models that were subsequently developed (e.g. the SA-CMM for software acquisition, the P-CMM for people and the IPD-CMM for integrated product development (Huang and Han, 2006). Despite this, whilst the CMMI now reflects broader process and project management aspects such as Organizational Training (OT), Organization Innovation and Deployment (OID) and Project Monitoring and Control (PMC) it remains a model for assessing the maturity of the software-related processes with specific process areas including Configuration Management (CM) and Product Integrated (PI) to name a few (Carnegie Mellon University, 2005).

Third, a number of the existing models which are based on the CMM are linear in nature requiring a sequential and logical progression through the maturity stages. Smith and Fingar (2004) argue that a CMM-based maturity model which postulates well-organized and repeatable processes cannot capture the need for business process innovation. A short-coming in this approach has been recognized by the developers of the CMM with the replacement CMMI-SW/SE providing the ability to apply either a *staged* or a *continuous* representation. With *staged* being more prescriptive in that it provides a recommended order in which to approach process improvement whilst the *continuous* representation acknowledges that different progression paths are possible (Carnegie Mellon University, 2005). Similar issues have also been identified within the BPM domain with Ittner and Larcker (1997) finding that the approach to BPM can differ between organizations with different paths to BPM adoption possible and that organizations are likely to have different optimal levels of BPM. Furthermore, Pritchard and Armistead (1999) and Maull et al. (2003) also identified complexities when attempting to assess BPM on the basis of metrics such as lapsed time, staffing and budgets.

Finally, a number of available models appear to be "power-point deep" in that they are proprietary in nature, have not been rigorously developed and tested, and are not supported by tools that enable them to be applied within a wide range of organizations.

The continued interest in BPM maturity and the shortcomings of existing maturity models has led to the development of a new BPMM model that aims to address these shortcomings.

Proposed BPM Maturity Model

A number of design principles have been established for this research as we wanted to develop a BPM maturity model:

- With a *solid theoretical foundation*. Consequently, we carefully studied previous research on BPM and the development of maturity models across a range of domains. Our proposed model has been heavily influenced by the consolidation of these previous research outcomes.
- That had the potential to become a *widely accepted global standard* rather than providing yet another competitive maturity model. As such we approached authors and developers of previous BPM maturity models for collaboration.
- That captured the entire scope of BPM as a *holistic* management practice. For this we relied heavily on existing literature in BPM and related areas and on conducting exploratory case studies with organizations that were prima-facie mature in their approach to BPM.

- That balanced the theoretical rigor of the model with *high applicability*. To achieve this we developed a research approach that incorporated aspects of both behavioral and design science As a consequence, over the last two years our model has been applied, at different stages of its development lifecycle, to a number of organizations in a range of industries.
- That could be operationalized in such a way that it *supports the individual information needs of different stakeholder groups*. As a consequence, an assessment model is being developed that can be applied to various levels of the organization. The data collected using the assessment model enables results to be presented to varying levels of detail.

The resultant conceptual model as shown in Figure 1 includes six factors identified as being critical to BPM being: Strategic Alignment, Governance, Methods, Information Technology, People and Culture.

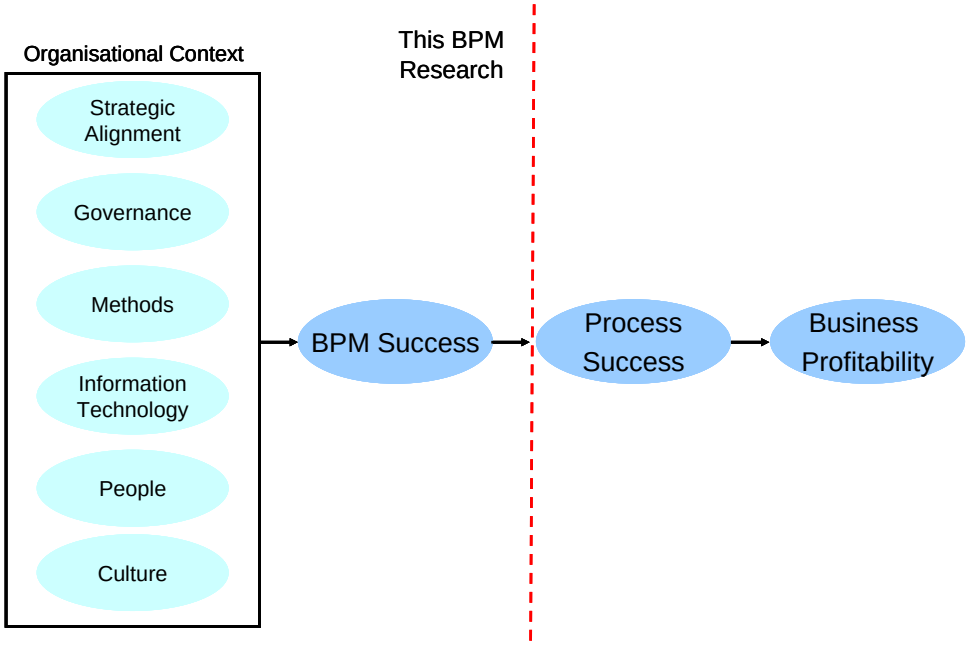

Figure 1: Conceptual BPM Maturity Model

The factors are the result of an extensive literature review, combined with feedback from a number of case studies undertaken to test an earlier version of the model and focus groups with a number of individuals involved in developing other BPM maturity models. A sample summary of literature supporting these factors is shown in Table 1.

Table 1: Origin of Factors in Conceptual BPM Maturity Model

Factor	Source
Strategic Alignment	Elzinga et al., 1995; Hammer, 2001; Hung, 2006; Jarrar et al., 2000; Pritchard and Armistead, 1999; Puah K.Y. and Tang K.H, 2000; Zairi, 1997; Zairi and Sinclair, 1995
Governance	Braganza and Lambert, 2000; Gulledge and Sommer, 2002; Harmon, 2005; Jarrar et al., 2000; Pritchard and Armistead, 1999
Methods	Adesola and Baines, 2005; Harrington, 1991; Kettinger et al. 1997; Pritchard and Armistead, 1999; Zairi, 1997
Information Technology	Gulledge and Sommer, 2002; Hammer and Champy, 1993; McDaniel, 2001
People	Elzinga et al., 1995; Hung, 2006; Llewellyn and Armistead, 2000; Pritchard and Armistead, 1999; Zairi and Sinclair, 1995; Zairi, 1997
Culture	Elzinga et al., 1995; Llewellyn and Armistead, 2000; Pritchard and Armistead, 1999; Spanyi, 2003, Zairi, 1997; Zairi and Sinclair, 1995

Further insights into the development of the initial conceptual model can be found in (references removed for review purposes). Following the development of the conceptual model we wanted to extend the understanding of the factors by identifying capability areas within each that were representative of BPM maturity. To achieve this we selected the Delphi Technique (Dalkey and Helmer, 1963) from a number of research methods including case study and nominal group techniques. The design and conduct of the Delphi Study series is discuss next.

Delphi Study - Design

The specific aims of the Delphi studies were to: (1) agree a definition for each of the factors; and (2) identify a number of key capability areas for each of the factors. Whilst agreeing a common definition can be considered contextual, we considered it an essential starting point of the Delphi studies to establish "common ground" for the identification of the capability areas.

Selection of the Delphi Technique

The Delphi technique is considered beneficial when: (1) dealing with complex issues (Ono and Wedemeyer, 1994); and (2) there is a lack of empirical evidence (Murphy et al., 1998). In particular, the Delphi technique and its inherent focus on seeking consensus between experts can facilitate overcoming the idiosyncratic structure of a model. Okoli and Pawlowski (2004) indicate that the two major areas for application of the Delphi technique are the traditional forecasting and more recently concept/framework development where studies typically involve a two step process being: (1) identifying and elaborating a set of concepts and (2) classification/taxonomy development. This research fits these criteria, in particular: (1) the research aims to develop a conceptual model for assessing BPM maturity; (2) BPM is considered a complex domain; and (3) there is little existing empirical evidence regarding BPM maturity.

Other benefits of the Delphi technique that influenced selection included: (1) anonymity leads to more creative outcomes and adds richness to data (van de Ven and Delbecq, 1974); (2) issues inherent in face-to-face groups such as dominate personalities, conflict and group pressures are virtually eliminated (Murphy et al., 1998); and (3) geographic boundaries and associated travel and co-ordination factors are essentially removed (Okoli and Pawlowski, 2004). Anonymity of respondents (both within the expert panel and the coding team) was ensured by allocating and referencing participants using a number and not their name; personalizing emails; and coordinating questions between the coding team and the panelist through a central point.

Selection of the Expert Panel

A vital aspect of the Delphi Technique is the selection of the expert panel. Powell (2003) indicates that this selection will potentially determine the success of a Delphi study. In a similar vein to the approach taken by Okoli and Pawlowski (2004) an iterative 5 step approach was used in selecting experts: (1) Prepare a worksheet that identifies potential classifications; (2) Populate the worksheet with potential experts; (3) Evaluate experts; (4) Invite experts; and (5) Nominate additional experts (using referrals from invited experts and further investigation). In determining a list of potential panelists a number of demographic considerations including: *category; region; and expertise* (in a given factor) were considered.

The *category* classification was selected to ensure a balance of views from both theoretical and practical perspectives. Classification was on the basis of *academia* and *industry*. Industry experts were further considered on the basis of their occupation with an aim to include executive level representation from BPM consulting organizations and organizations interested in the application of a BPM maturity model. Academic experts were required to have a minimum of PhD qualification or Professorial position. Consideration was also given to experts within both categories that were re-known authors in the BPM domain.

Classification by *region* was considered important for two reasons. Firstly, we wanted to ensure the model was influenced by any regional differences that might influence the approach to BPM adoption and practice. Second, we wanted to ensure contemporary *global* BPM issues were incorporated in the model. It is important to note that the invitation of BPM experts based on region was not considered to be *representative* of the state of BPM practices within a given region. The aim was to have at least one expert for each category (e.g. academic or industry) from each region.

Finally, we wanted to distinguish individual *expertise* on the basis of the six factors contained in the model. This was important as we planned to conduct a separate study for each of the factors. We did this because we wanted to gain deep insights into each of the factors and to ensure that each factor represented a mutually exclusive component of BPM. By conducting a separate study for each factor we believed that any commonality between factors would become evident in the capability areas identified. Some attempt to classify potential panelists on this basis was made by the researchers to assist in determining who to invite, however, each panelist was asked to select which of the six studies they agreed to participate in. A perceived benefit of self-nomination was that it would potentially increase motivation and commitment to the studies. This approach resulted in a number of experts selecting to participate in all six studies whilst some selected only specific studies. We believe that this phenomenon has strengthened the results of the studies as the common core of experts has provided a level of continuity and consistency across the studies whilst the new experts entering each study limited the potential for the 'common core' to artificially create the concept of *mutual exclusivity* within each factor.

Table 2: Demographics of Delphi Study Participants

	Strategic Alignment		Governance		Methods		Information Technology		People		Culture	
Category / Region	I	A	I	A	I	A	I	A	I	A	I	A
USA	8	6	10	6	10	5	9	4	9	5	8	5
Australasia	2	1	2	2	2	2	2	1	2	1	2	1
Europe	1	-	1	-	1	1	1	1	1	-	1	-
Category Total	***11***	***7***	***13***	***8***	***13***	***8***	***12***	***6***	***12***	***6***	***11***	***6***

Determining the Number of Rounds

To determine the appropriate number of rounds for the proposed Delphi studies consideration was given to both: the aim of the studies and the experiences of similar studies. In a study into the optimal number of rounds Erffmeyer et al. (1986) achieved stability after the fourth round. In more recent studies, Mulligan (2002), Powell (2003) and Richards and Curran (2002) considered three rounds were appropriate, whilst Murphy et al. (1998) and van de Ven and Delbecq (1974) suggested two or more and Loo (2002), three to four. It has been recognized in prior studies that there are times when consensus between panelists was not always possible (Richards and Curran, 2002). Whilst we recognized this possibility it was important to the development of our model that there was strong agreement on the capability areas that were derived. As a consequence criteria were developed to indicate when a satisfactory level of consensus had been reached and to determine the number of rounds conducted for each study. The criteria used was: (1) an average satisfaction rating of at least 7.5; (2) all satisfaction ratings being 5 or more; and (3) a standard deviation in satisfaction ratings of less than 1.5. This resulted in a 3 round study being conducted for each of Governance, People and Culture and a 4 round study being conducted for Strategic Alignment, Methods and IT.

Minimising the Impact of Limitations in the Delphi Technique

A number of criticisms of the Delphi technique were recognized including: (1) the flexible nature of Delphi study design (van de Ven and Delbecq, 1974); (2) the discussion course is determined by the researchers (Dalkey and Helmer, 1963); and (3) accuracy and validity of outcomes (Ono and Wedemeyer, 1994). Whilst these disadvantages arguably apply to some degree to many research methods, measures were taken to minimize their potential impact. Such measures included: (1) establishing assessment criteria; (2) use of a coding team; (3) conducting a pilot study and (4) applying Lincoln and Guba's (1985) criteria for assessing the quality of qualitative research.

Assessment Criteria

Whilst the structure and design of the studies was consistent across all studies a separate study was conducted for each of the six factors. This approach was selected over conducting a single composite study in order to gain deeper insights into each of the factors. A measurement scale was developed for use through the studies with panelists being asked to rate their level of satisfaction with both the proposed definition and the capability areas using a 10 point scale (1 – Not Satisfied and 10 – Very Satisfied). In addition criteria were developed to manage the outcomes for each study in a consistent manner. The criteria included achieving: (1) Average satisfaction of not less than 7.5; (2) All individual ratings at least a 5; and (3) Minimal variance between responses (defined as attaining a standard deviation of 1.5 or less). Finally, during the last round of each study the expert panel was asked to "weight" the capability areas by allocating a total of 10 points between the final five capability areas based on the perceived importance, i.e. the more points allocated the higher the importance.

Use of a Coding Team

A coding team was established for the analysis of data. In addition to the principal researcher, this team included two other individuals each with an extensive knowledge of BPM and a PhD in Information Systems. Members of this team were selected based on: (1) category – academics were chosen due to their understanding of qualitative research methods; and (2) region – individuals were chosen from regions representative of the experts' regions. In particular, selection on the basis of BPM knowledge and region was considered important for highlighting any potential cultural inferences during the consolidation process. Coding team members were: (1) Not be able to participate in the expert panel at any stage; (2) Unaware of the identity of expert panel members (except the Principal Researcher); (3) Not advised of any demographic details of the expert panel members in relation to responses being coded (except the Principal Researcher); and (4) Required to

individually code responses prior to consolidating as a team. The coding team was given access to N-Vivo for use in analysing data.

Pilot Study

To improve the Delphi study design we conducted a pilot study. As we were planning to conduct a series of Delphi studies (i.e. one for each of the factors) we decided to use the first (i.e. Strategic Alignment factor) as a pilot study. Following completion of the Strategic Alignment study a telephone conference was arranged to elicit feedback from panel members regarding the format and timeframes for the remaining studies. This led to minor modifications to the remaining studies. Changes to the design following the pilot study has resulted in some data (i.e. average and standard deviation ratings of the proposed capability areas) not being obtained for the Strategic Alignment factor. We considered the impact of extending the Strategic Alignment study to capture this data in light of the potential for fatigue among respondents, especially those who were participating in all six studies. Our determination was that the lack of this information for the Strategic Alignment study was not significant as the studies are not comparative. Another modification to the design was the decision to limit the number of capability areas identified to 5 items. By way of explanation, the initial short-list of capability areas for Strategic Alignment included 7 items as reflected in Table 3.

Table 3: Perceived Importance Example from Pilot Study

Capability Area	Average	Standard Deviation	Highest Score	Number of 0's Scored
Process Improvement Plan	1.77	0.83	4	0
Strategy and Process Capability Linkage	1.77	1.17	4	2
Enterprise Process Architecture	1.69	1.03	4	2
Process Output Measurement	1.46	0.97	3	3
Process Customers and Other Stakeholders	1.30	1.18	4	3
Strategic Priorities	1.08	0.86	2	4
Operational Translation	0.92	0.86	2	4

When these were rated by the panel two of the capability areas received a rating of zero from more than 30% of the expert panel. This resulted in the average 'perceived importance' score for these two areas being significantly less than that for the other five capability areas. Comments provided by the expert panel indicated that they believed these two areas could be combined within the remaining five capability areas without diminishing the comprehensiveness of the final list. As a result in future studies the initial list of capability areas was limited to 5 items. No further zero ratings were received in further studies. Other changes included adjusting the timeframes and introducing the capability area question in the first round rather than delaying to a subsequent round.

Reliability and Validity

Lincoln and Guba's (1985) criteria were used to guide the development of the Delphi series. The *credibility* of results was achieved by having experts from the BPM domain participate in the studies. Academics, authors, executives and consultants with a high level of BPM experience and knowledge participated in the studies to ensure a range of contemporary views were captured. Furthermore, to minimize the impact of any cultural inferences with respect to wording members of both the panel and the coding team were selected to represent three different geographic regions including: Australasia; Europe and America. To assist with the *transferability* and *dependability* of results arising from the Delphi studies a comprehensive description including context and assumptions was prepared. *Confirmability* of results was achieved in a number of ways. First, members of the coding team independently coded responses to derive individual definitions and lists of capability areas. Following this they conferred and agreed a single, consolidated response for returning to the panelists for rating and comment. The panelists were then asked to separately rate their satisfaction with the proposed definition and capability areas using a 10 point scale with 1 – Not Satisfied and 10 – Very Satisfied. Panel members were also given the opportunity to provide comments to support their individual ratings. These comments were used by the coding team to revise the definition and capability areas in the next round. Rounds continued until consensus (as determined by defined criteria) was achieved. Finally, following the completion of all Delphi studies two reports were prepared: Delphi Study Executive Summary and Delphi Study Series Summary. All participants of the Delphi studies (including coders) were provided with a copy of both reports and asked to provide feedback and comment as required.

Delphi Study - Results

The outcomes from the conduct of the Delphi studies were twofold. First we wanted to establish common definitions for each of the factors to ensure that the context for identifying capability areas was consistent. Second, we wanted to identify the BPM capability areas that were perceived to be most important and as such would guide the direction of future research into measuring BPM maturity.

Final Definitions

In the first round of each Delphi study the panel members were asked: In the context of Business Process Management, how do you define *factor x*?

- List (up to) 5 terms that you believe are vital to any definition of *factor x* (in the context of Business Process Management). Please provide a brief explanation of these terms if required.

Following analysis by the coding team a proposed definition was returned to the panel for rating and comment. The coding team used the feedback and ratings to improve the proposed definition. In subsequent rounds the panel members were provided with: (1) the previous proposed definition; (2) a summary of comments and ratings arising from the prior round; and (3) a revised definition based on feedback received during the prior round. Rating and comment by the panel members continued until the assessment criteria had been met. In the context of BPM, the final Delphi study definitions derived are:

> **Strategic Alignment** is the continual tight linkage of organizational priorities and enterprise processes enabling achievement of business goals.
>
> **Governance** establishes relevant and transparent accountability and decision-making processes to align rewards and guide actions.
>
> **Methods** are the approaches and techniques that support and enable consistent process actions and outcomes.
>
> **Information Technology** is the software, hardware and information management systems that enable and support process activities.
>
> **People** are the individuals and groups who continually enhance and apply their process-related expertise and knowledge.
>
> **Culture** is the collective values and beliefs that shape process-related attitudes and behaviours.

A summary of the average satisfaction and the standard deviation for factor definitions are shown in Figure 2.

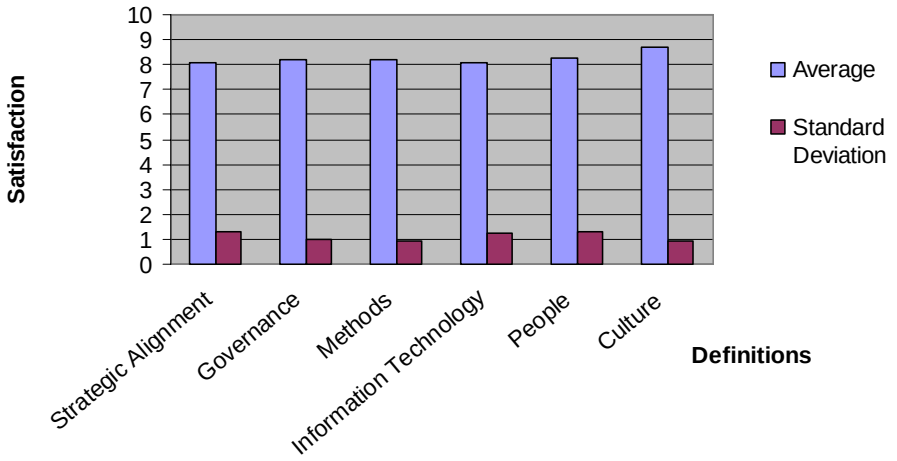

Figure 2: Final Satisfaction Ratings for Definitions

Whilst the definitions derived are arguably contextual, the value in using the Delphi technique with its iterative nature can be seen in the way in the average satisfaction increases and the corresponding standard deviation decreases with each round as depicted in the results for the factor IT provided as an example in Figure 3.

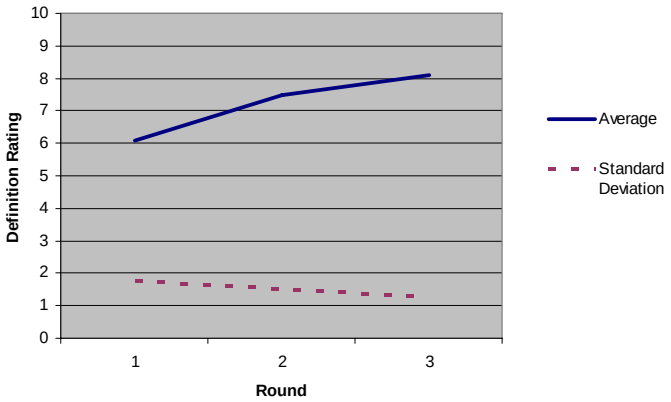

Figure 3: Results for IT factor over all Delphi Study rounds

Final Capability Areas

The main aim of the Delphi studies was to identify and mutually agree capability areas whose measurement was considered to be an indicator of BPM maturity. With respect to capability areas, in the first round of each study the panel members were asked:

- "List (up to) 7 major items within *factor x* that you would like to be able to assess by applying a new BPMM model."

From this list the coding team, first independently and then collaboratively, derived a list of 'top 5' capability areas. In subsequent rounds the panel members were shown the proposed top 5 capability areas together with the mapping of all original items to these areas. The panel members were given the opportunity to rate and comment on the proposed capability areas and the associated mapping. The coding team then used the ratings and comments to improve the list of capability areas and the associated mapping that supported them. Subsequent rounds of the Delphi study followed a similar pattern and were used to increase the average satisfaction, whilst reducing the standard deviation, of panel member responses. The capability areas are considered unique to one factor (although the use of the same names for the Methods and IT capability areas make this somewhat unclear at this stage). The mapping of all items suggested by the panelists during the identification of the capability areas provides a basis for further developing each area in a manner consistent with the intent of Delphi study participants. This mapping will also be used to guide a further review of literature in order to establish support for each capability area from existing literature. The final capability areas are shown in Figure 4 and a summary of each capability areas is provided in the following sections.

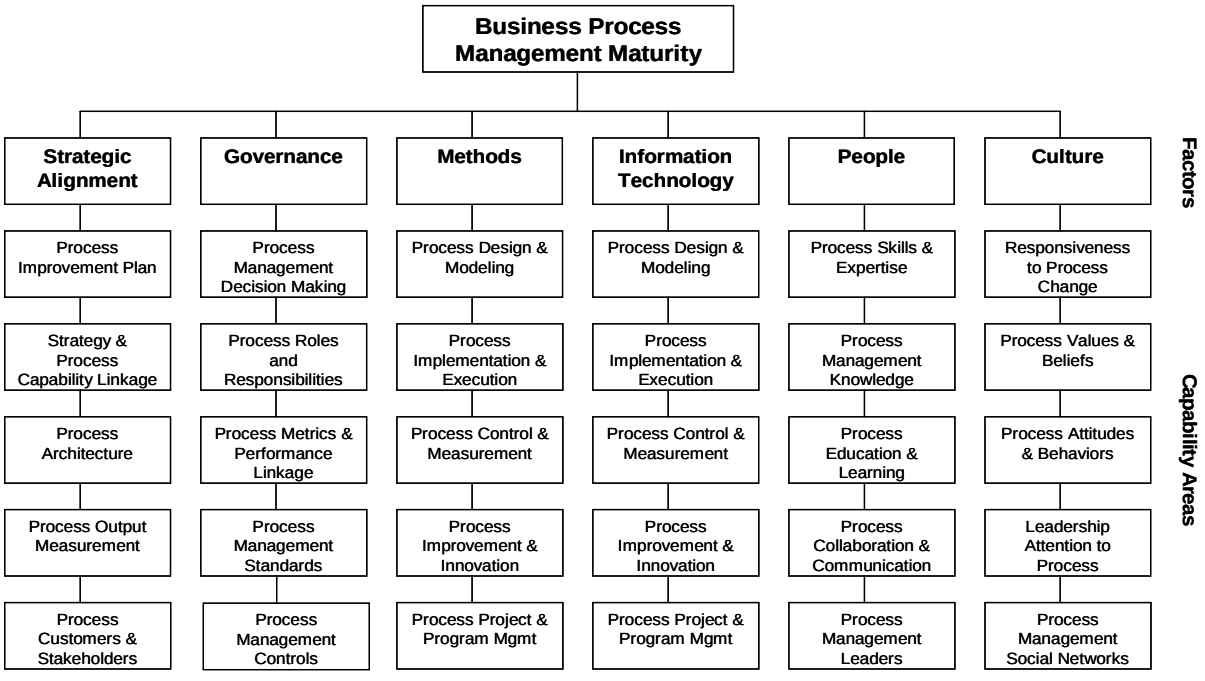

Figure 4: Final BPM Capability Areas

Conclusion, Limitations and Future Research

This paper details the development of a BPM Maturity model using the Delphi technique as a means of capturing contemporary thinking within the BPM domain. The Delphi technique provided a unique opportunity to capture insights from experts in BPM across different geographical regions. A limitation of this research is the absence of experts from some regions such as Asia and Africa. In the case of Asia, representatives were invited but did not agree to participate. In the case of Africa no representatives were identified or invited. A further potential limitation of this paper is that the actual definitions and capability areas derived have previously been published in the practitioner arena. However, the design and application of the Delphi technique in this research has not previously been subjected to the rigour of academic review thus we contend that the significance of this paper lies in its contribution to use and application of qualitative methods to research in the BPM domain.

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