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Success Factors of Business Process Management Systems Implementation

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Abstract

In this research (critical) success factors for Business Process Management Systems implementation are identified and qualitatively validated. Furthermore a list of critical success factors is constructed. Based on the identified factors a BPMS implementation approach is suggested. Future research consists of situationally considering the success factors in relation to phases in the implementation approach.

Keywords

Business Process Management Systems, Implementation, Critical Success Factors

Business Process Management Systems

Today, interest in Business Process Management (BPM) and Service Oriented Architecture (SOA) is rapidly rising. Many software development and consultancy firms sell and/or implement Business Process Management Systems (BPMS) that are based on the concepts of BPM and SOA (Smith & Fingar 2003, Hill 2006). Yet, most vendors and resellers largely seem to neglect the specific implementation aspects of BPMS, and instead use existing software development methodologies or project management principles during implementation. In many cases the implementation of a BPMS is regarded as yet another software development project, which is not fully true (Krafzig et al. 2005). Using software development methodologies such as the waterfall method, rapid application development (RAD) or Rational Unified Process (RUP) ignores the business side of a BPMS implementation such as process analysis, performance measurement and continuous (quality) improvement.

At the same time, in professional journals and forums the discussion is mostly about *what* BPM and SOA concepts are and *why* organizations should start projects in this area, merely neglecting the *how*. How should a business process management system be implemented to realize business value? In this paper we identify (critical) success factors and implementation approaches for BPMS.

Business Process Management Systems are based on developments in both the business and IT domain (Ravesteyn, 2007). The most important influences in BPMS from a management perspective are Total Quality Management (TQM) and Business Process Reengineering (BPR) (Deming 1982; Hammer & Champy 1993). We can also identify different types of information system concepts that have influenced BPMS as it is currently used, like Enterprise Resource Planning (ERP) systems, Workflow Management (WFM) systems, advanced planning systems and more. What once started as the automation of a company's internal processes has now become the digitisation of supply chains (Davis & Spekman 2003). One of the key contributors to this has been the Internet, associated network standardization, and web services orientation.

In this paper we address the definition and origin of BPMS, and we continue to construct a framework of success factors with respect to BPMS implementation, which will be validated through qualitative analysis. We end with conclusions and future research.

Identifying Success Factors for BPMS Implementation

Several definitions of BPMS are available (Aalst et al. 2003; Fremantle et al. 2002; Weske et al. 2004). Taking into account these definitions we propose a more detailed definition that is based on the latest developments. In this paper we define BPMS as a (suite of) software application(s) that enable the modelling, execution, technical and operational monitoring, and user representation of business processes and rules, based on integration of both existing and new information systems functionality that is orchestrated and integrated via services.

In order to identify the most important factors that influence the success of BPMS implementation, a literature study of 104 articles and books was conducted. For each article or book the domain and type of research approach was registered. The different domains used to categorize the literature follow the influences of the evolution of BPMSs and are total quality management (TQM), business process reengineering (BPR), business process management (BPM), workflow management (WFM), enterprise application integration (EAI), business activity monitoring (BAM), business process management systems, and a category others. An overview of the types of research approaches used to categorize the papers is depicted in figure 1.

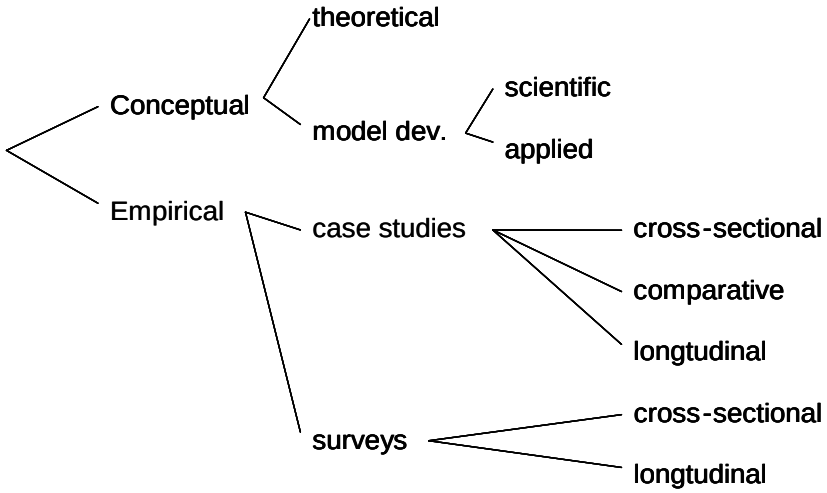

Figure 1: Type of Research Approaches

With the categorization of the literature a list was compiled with over 337 success factors from the different books and articles. This list was derived from the different domains in which the literature was categorized according to the following composition: 3.86% of the factors came from TQM, 17.51% from BPR, 29.97% BPM, 11.57% WFM, 12.76% EAI, 2.08% BAM, 12.17% from the BPMS domain and 10.08% from various other related areas. Factors relating to SOA were not listed as a separate domain but as part of the EAI domain.

Based on the list of success factors and their background domains, a distinction could be made between factors that are mentioned in only one domain, and factors that are common among more domains. For example, quantitative measuring and use of statistics to control the effectiveness of improvement actions is only mentioned in relation to TQM, while the importance of top management support is mentioned throughout almost all domains. This gives a first indication of the importance of some factors. To shorten the list the number of times a factor was mentioned was recorded. This reduced the total number of factors to 55 unique success factors. Accordingly the factors are categorized based on business/IT-alignment principles (Henderson and Venkatraman, 1993) and the identified main aspects when implementing BPMSs (1) management and organisation (2) architecture and (3) IT integration (Ravesteyn, 2007). The clustering that is made (see appendix 1) contains five dimensions, which include both IT and non-IT categories.

As a first validation the factors that were found in the literature study can be compared to success factors relating to other types of management or IT implementation projects therefore in table 1 a comparison is made with factors found in related research such as the implementation of Enterprise Resource Planning systems or Business Process Management (the latter from a management perspective).

Table 1: A Comparison of Success Factors

ERP	BPM	BPMS
Technical fit	Organizational & cultural change	Management involvement
Organizational fit	Aligning the BPM approach with corporate goals and strategy	Strategic alignment
Strategic fit	Focus on the customer and their requirements	Understanding the process
Business process reengineering	Process measurement and improvement	Quality of project management
Top management support	Need for a structured approach to BPM	Change management
Project planning	Top management commitment	Involving the right people
Training	Benchmarking	Defining performance metrics
Ease of use	Process aware information systems	Quality of modeling technique
Resistance	Infrastructure and realignment	Organizing for continuous optimization
Competitive pressures		Understanding the BPMS concept
		Availability of data
		Quality of data sources
		Granularity of services
		Integration of existing applications via services
Based on:Kamhawi (2007), Hong and Kim (2003), Bradford and Florin (2003)	Based on: Armistead and Machin (1997), Elzinga et al. (1995), Harrington (1995), Lee and Dale (1998), Zairi (1997), Rosemann et al. (2004)	

Based on this comparison we can conclude that the factors that are specific to the implementation of a BPMS are typically the factors relating to the development and use of services together with the related data such as granularity of services, integration of existing applications via services, and availability and quality of data. The use of services as a means to leverage the outcome of BPM implementations is largely unexplored and moreover, it is hard to compare BPMS implementations with other types of implementation projects. For this reason dedicated research into BPMS implementation is necessary.

Validation Methodology

To validate the complete list of success factors that were identified a multi method research approach was used consisting of three techniques: open interviewing, measuring the necessity of the success factors using a 5-point Likert-scale (direct validation), and measuring the factors by creating and measuring constructs that relate to a factor (indirect validation). By gathering data from different angles a clearer picture of the real world can be modelled and validated (Baarda et al., 2001).

In the open interviews several questions were formulated concerning the difficulties of implementing business process management systems to get the conversation started. During the interviews two people made notes that were compared afterwards. From the notes the success factors mentioned were matched with the earlier identified factors, while other important aspects or factors that had not yet been identified previously were listed separately. The second validation technique consisted of statements that directly related to the identified factors and in which a respondent indicated whether he or she agreed or disagreed with the statement. In the third survey technique several items per factor were constructed and a respondent could agree or disagree with the items, in this way a success factor was measured indirectly.

The different validation techniques were used in all of the five areas in which the factors were clustered. We used a different set of respondents per cluster with special knowledge of the topic at hand. For instance respondents with development skills do not necessarily have knowledge about process architecture therefore a different group of people with architecture design skills were asked to participate in that area of the research. In table 2 an overview is given of the research methodology that was used, the type and number of companies that participated in the research, and between brackets the function of the respondent, the size of the company and the level of BPM knowledge of the respondent.

Table 2: An Overview of Research Participants

Cluster	Research Methodology	Type & No. of Companies
Management of Organisation & Processes	Create Constructs	3* IT Consultancy: (BPM man. consultant, 40000, medium), (bus. consultant, 5000, medium), (marketing, 5000, medium), Software Dev. (solution consultant, 900, high)
	Scale Construction	5* IT Consultancy: (proj. man., 1300, high), (proj. man., 1200, medium), (consultant, 1500, medium), (engineer, 500,low), (consultant, 550, very low), Solar Shading (soft. dev., 175, high)
	Qualitative (Interview)	IT Consultancy (business process man., 8500, low), Software Dev. (prog. man., 550, high)
Architecture Design	Create Constructs	2*Software Dev.: (solution arch., 1500, very high), (solution arch., 1500, high), Global Business Services (backup & restore operator, 4800, medium), Navigation (proj. man., 700, medium), Timber (marketing director, 199630, low), Industrial (bus. dev. man., unknown, medium), Software Outsourcing (systems arch., 1000, high), Marketing (operations manager, 80000, medium)
	Scale Construction	Global Bus. Services (proj. man., 4800, medium), 2* Software Dev.: (consultant, 550, High), (consultant, 550, medium), 3*IT Consulting: (SOA architect, 75000, high), (soft. arch., 6000, medium), (delivery man.,6000 ,very low), Industrial (proc. man., 4500, medium)
	Qualitative (Interview)	6*IT Consulting: (proc. man., 300, medium), (chief architect, 70, high), (proj. leader, 500, medium), (proj. leader, 70, high), (spokesman, 6000, high), (account man., 1400, high)
Measurement & Control	Create Constructs	IT Consulting (tester, 300, medium), Healthcare (developer, 2500, low), 2*Pharmaceutical: (SAP cons., 19000, very low), (administrator,19000, very low), Finance (director, 45, high), Fashion (application man., 450, very high), 2*B2B Wholesaler: (marketing intell. specialist, 250, medium), (purchaser, 250, low)
	Scale Construction	2*IT Consulting: (appl. dev., 30, medium), (man. cons., 59000, medium)
	Qualitative (Interview)	2*IT Consulting: (CEO, 9, very low), (sr. programmer, 9, very low), Online Travel & Advertising (IT manager, 30, medium)
Management of Implementation & Change	Create Constructs	2*Business Consultancy: (sr. cons., 60, low), (sr. cons., 60, very low), 4*Finance: (proj. man., 40000, medium), (proj. man., 40000, medium), (man. packaged solutions, 40000, low), (director, 45, high)
	Scale Construction	4*IT Consultancy: (programmer, 146000, low), (consultant,146000, very low), (proj. man., 1200, medium), (cons., unknown, very low), Finance (man. IT department, 220, medium), Manufacturing (programmer, 175, medium)
	Qualitative (Interview)	IT Consultancy (bus. & IT cons., 13, low), Real-estate (bus. analyst, 100, low)
Development of an IT Solution Based on SOA	Create Constructs	IT Consultancy (partner, 5000, high), Finance (man. design & architecture, 3000, very high), Manufacturing (IT manager, 10000, medium)
	Scale Construction	3*Software Dev.: (sol. consultant, 900, high), (sol. consultant, 62255, high), (sol. consultant, 62255, very high)
	Qualitative (Interview)	Software Dev. (tech. arch., 62255, high), Finance (CEO, 45, high)

Besides the different techniques and questions per area, a set of meta-questions was developed that had to be answered by all respondents. In this way the organization typologies, size, knowledge level on SOA / middleware / BPMS etc. was measured. In total 76 respondents from 45 different companies were interviewed or filled in the survey. Due to the low number of respondents per cluster it is not possible to do a detailed quantitative analyses, therefore our validation is considered qualitative.

Validation Results

Most of the companies in this research are from the domains of software development, (IT) consulting and finance. Sectors like manufacturing, wholesale and healthcare form a small minority of the research population. Although a large part of respondents work in the IT (or related) domain and could potentially be biased, a comparison of the answers has not produced any evidence for this. Not all respondents completed the meta-questions correctly so for the results on those questions only 68 respondents were taken into account. From this list 81% of the respondents said they had an enterprise architecture in place (an overview of the most important processes and information systems). 67% of the respondents claimed they were either experimenting or actively engaged in SOA projects, while of the remaining respondents 8 persons didn't know whether their company was using SOA and 1 person said the company (active in the IT sector) had stopped their SOA project after encountering problems. Of all respondents 54% stated that they had a Business Process Management System in

place, of this group 4 respondents said that BPMS projects were done both internally at their own company as externally at customers. When asked if their company was using middleware software to integrate different IT systems 72% answered this was indeed the case. The vendors that were mentioned most as suppliers of middleware are Oracle (11 times), SAP (10 times) and IBM (10 times). Other vendors that were mentioned were amongst others Microsoft (3), Cordys (3) and Webmethods (2). Besides this 11 respondents answered their company used more than one middleware supplier.

When we look at the relation between the use of a BPMS, being engaged in SOA and having an enterprise architecture, we found that 4 out of 37 respondents that said their company was using a BPMS also said they did not have an enterprise architecture and were not engaged in any SOA project. Besides this 2 respondents said they didn't use SOA while their company did have a BPMS and an enterprise architecture. This leaves a majority of 31 respondents, which have all three in place together. This seems to support the notion that there is a relationship between BPMS, having an enterprise architecture and being engaged in SOA.

In the remainder of this section the results of the different research types that were applied per cluster are discussed. The results from the open interviews were determined by taking the transcripts of the interviews, checking whether the text contained the proposed success factors, and listing factors that were mentioned by the interviewee but not defined earlier. As for the direct validation type the outcomes are determined by taking the means of all Likert-based scores of the success factors, after which they are prioritised based on these mean values. Lastly, as for the indirect validation type the outcomes are determined by taking the scores for the constructs (also on a Likert scale), which are redirected to the success factors; subsequently the factors were prioritised based on their calculated mean values. Table 3 shows the outcomes of our validation versus the initial literature study. From the literature study all factors mentioned more than one time are listed while from our validation only those factors are mentioned that were considered of high importance.

Table 3: Validation results and ranking

	Literature Study	Validation Research
Cluster A	Project management Change management Understanding the BPM concept, Management involvement, Strategic Alignment Governance & accountability Training Culture	Project Management Culture Change Management Understanding the BPM Concept
Cluster B	Understanding the process Use the 'best' modeling standards & techniques Organizing the modelling 'design' phase Maintenance and control - including quality - of the models is important Interdependencies and Integration of Data sources Discovery of Information Process orientation Defining (web) services Understanding the BPMS paradigm Business & IT divide Use of Business Rules	Organization of the modelling design phase Understanding the process Use the 'best' modelling standards & techniques Interdependencies and Integration of Data sources

	Literature Study	Validation Research
Cluster C	Integration of processes and data (Use of) Web services IT infrastructure is not aligned to the developed solution Embedded business logic within communications networks	"*Remark:* in this research no clear ranking or difference in importance of the success factors was found for this cluster."
Cluster D	Project management Change management Involving the right people in the project	Involving the right people in the project Change management Project management
Cluster E	Performance measurement Continuous optimisation An organization and culture of quality	Continuous optimisation Performance measurement An organization and culture of quality

According to the outcomes of the different research types in the Management of Organization and Processes cluster all factors that are found during the literature study seem valid. However the ranking that was found during the literature study does not coincide with the findings from this research. Based on the interview data, project management is the most important success factor followed by an organizations culture, which was not ranked high in the literature study, and finally change management together with understanding the BPM concept. Besides the factors already in the research, respondents also mentioned some previously unmentioned factors such as the influence of the outside world (for example laws and competitors) and the need for a critical trigger. As one respondent mentioned, "*without a critical trigger the implementation of BPM won't be successful. A burning platform is needed to be able to make such a radical change*".

Based on the respondents that were questioned for the Architecture Design cluster we found that all success factors are recognized. However the priority that the respondents gave to the different factors is different. According to the outcomes the organization of the modelling design phase is the factor that has the most impact next to understanding the process. Respectively using the 'best' modelling standards & techniques and the interdependencies and integration of data sources are deemed less important.

In the Developing an IT Solution Based on SOA cluster the results showed diverse support for the factors based on services. Some respondents identify these factors as critical while other say they are not defined clearly. Managing process integrity is deemed valid with no clear judgement about the importance. Based on the results of this research it is not possible to state which success factors in this cluster should be deemed critical. This 'vagueness' among the respondents might be due to the many discussions in the field of SOA (both by science and business people) that do not result in a clear vision on what success factors for SOA actually are.

For the Management of Implementation and Change cluster our research showed that involving people is identified as most important factor while the quality of the project management method was least important. This might be because respondents focusing on this specific cluster are taking project management for granted. Also here no factors were stated as missing.

Finally for the Measurement and Control cluster it was suggested that organizing for continuous optimisation appeared to be the most important success factor, immediately followed by defining performance metrics. The third most important factor according to this research is creating an organization with a culture of quality. All factors that were found in the literature study were found to be valid, only the found ranking is different.

After analysing all results we can conclude that the entire list of 55 success factors found in the literature study is recognized and agreed upon by the respondents. Only a few new factors were proposed by the respondents such as the importance of the influence of the environment and the need for a critical trigger when starting a BPMS implementation. In our domain, *critical* success factors can be defined as those areas where 'things have to go right' for a BPMS implementation to succeed (Ward & Peppard, 2002). Based on both the literature study and the discussion above one can consider the success factors identified in Table 4 as most important, and thus critical.

Table 4: Critical success factors for BPMS implementation (random order)

Cluster	*Critical* Success Factors
A. Management of Organization and Processes	1. Project Management 2. Change Management 3. Understanding the BPM Concept
B. Architecture Design	4. Organization of the modelling design phase 5. Understanding the process 6. Using the 'best' modelling standards & techniques 7. Understanding interdependencies and integration of data sources 8. Maintenance and control - including quality - of the models is important
C. Developing an IT Solution Based on SOA	9. Integration of processes and data 10. (Use of) Web services
D. Management of Implementation and Change	11. Change management 12. Involving the right people in the project 13. Project management
E. Measurement and Control	14. Performance measurement 15. Continuous optimisation 16. An organization and culture of quality

One final remark in relation with table 4 should be made. For cluster C this research did not give any clear results on which factors can be considered more important than others. However we do consider the two factors mentioned critical based of the number of times we found them in literature (respectively 14 and 5 times). In the next section a BPMS implementation approach is suggested based on the defined clusters and critical success factors that have been validated in this research.

BPMS Implementation Approach

As identified earlier, the success factors of a BPMS implementation can be classified according to five areas: the organization and processes, architecture design, development of an IT solution based on SOA, the management of implementation and change, and measurement/control. The five areas can be seen as phases in a BPMS implementation. The first is the ongoing domain of the business organization itself. It is here where any BPMS project is either conceived or approved and where the goals, budgets and timeline are decided. In almost all cases a business that wants to start a BPMS project will already have an established organization with running processes, which will be the starting point for the implementation. In this phase it is critical that an organization understands the BPM(S) concept and realizes that a project management organization and a change management strategy are necessary.

The second and third phases of a BPMS implementation, the ‘architecture design’ phase and the ‘development phase’ will deliver a process and information architecture that can be used in the realization of the technical infrastructure (including the integration interfaces) and creation of service oriented business applications. The developed solution will then be implemented in the organization, which is both the start and the end point of any project. During these phases it is key that the right people are involved in the project team so that they are able to take into account all the different critical success factors.

Furthermore two aspects can be distinguished that either support the organization, the project or both: (1) the measurement and control function and (2) the project and change management function. A business that is already in operation will have some type of measurement and control function. For small businesses this will probably only be the accounting function. For medium and large organizations other functions will provide information about the organization and processes, such as a quality department etc. To succeed in implementing a BPM and SOA there should be sufficient measurement information available about the processes that are going

to be modelled and executed. If this is not the case, the implementation should not be started. Metrics on processes are important to be able to continuously measure the effects of any changes.

The project phases (architecture design and development phase) are supported by project and change management simultaneously because applying the BPM and SOA paradigm implies that while working on a project there can already be changes in processes and IT applications. A BPMS implementation can be regarded as a project or series of small projects and therefore it should be understood that both the organization and business processes, and the measurement and control function are in fact just a small part of the project.

In executing a BPMS implementation, an organization can now use these five BPMS implementation aspects as a starting point and take the (critical) success factors per domain into account, based on their priority.

Conclusion

This article describes the outcomes of a multi method research approach that was done to validate the success factors when implementing BPMS. The list of factors, that was initially based on a literature study, is recognized and agreed upon by the respondents in this research and therefore seems valid. However we did receive some suggestions to add factors to the list, which could mean that the current list may not be regarded as complete. Finally a BPMS implementation approach is suggested that takes into account all (critical) success factors that are divided in five different project phases or areas.

Although the current list of factors seems valid there are some comments we must make. The number of the respondents in the different research types is not large enough to do any profound quantitative analysis and therefore this research must be regarded as a qualitative validation. A larger population of respondents is needed to be able to draw conclusions on basis of quantitative analysis. Besides three of the respondents all are situated in the Netherlands, which makes that the findings of this research are not necessarily applicable in other countries or regions. Finally the clustering that is done was merely subjective and should be further tested and validated by research.

While the attention for BPMS is growing rapidly the amount of research done on BPMS implementation is still limited. The success factors found in this research need further validation. First an extensive quantitative validation is needed that is done on a broad scale. This research can than be extended to other regions to test whether there are any cultural differences. Also in-depth studies are needed to determine whether factors are different depending on the type of organization (for instance in specific sectors) or change during the life of a project.

This paper suggests an implementation approach that has not been tested or validated and neither has there been any research to compare this method to existing implementation approaches for software applications or management projects. Research in this area is needed, we suggest taking into account the many research initiatives that are currently done in the SOA domain.

When the success factors are validated thoroughly and the implementation framework is finalized we want to determine whether it is possible to link specific implementation activities and success factors together. This will then make it possible to quickly suggest a custom-made implementation approach to an organization based on situationality. For this we suggest using method engineering (Harmsen et al. 1994) to develop implementation fragments that can be linked to the (critical) success factors.

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Appendix 1

The following is an overview and clustering of all 55 success factors.

Cluster	Success Factors
A. Management of Organization and Processes	1. Project management 2. Change management and involving people 3. Understanding the BPM concept 4. Management support and involvement 5. Strategic Alignment 6. Governance & accountability 7. Training 8. Culture 9. Take into account the customers, industrial partners and the target environment 10. Create challenging roles and new job perspectives after the project 11.

Cluster	Success Factors
	Establishing a support organization because ongoing maintenance and management is very difficult 12. Treat value as realizable by all stakeholders, irrespective of geography or organizational boundaries 13. Build a knowledge base around processes 14. Implementation guide: follow an "inside-out" strategy, this means first prioritize the integration of internal systems and applications, defining and institutionalizing your business processes then the company is better suited for integration with external systems 15. Use of best practices
B. Architecture Design	16. Understanding the process 17. Use the 'best' modeling standards & techniques 18. Organizing the modeling 'design' phase 19. Maintenance and control - including quality - of the models is important 20. When altering private processes, which modifications are allowed without jeopardizing the correct operation of the overall workflow 21. Strategic objectives and functional objectives should be identified and linked to process model 22. Lack of documentation of embedded processes in application systems 23. Multi process adaptation alternatives should be present, and also a contextual adaptation process 24. Underestimating the difficulty in integrating offshore-supplier employees into the processes and work flows of their companies 25. Modeling interfaces related to software systems 26. Pre-determined collaboration choreography of participating organizations (ad hoc changes are not possible) 27. Interdependencies and Integration of Data sources 28. Discovery of Information 29. Process Orientation 30. Defining (web) services 31. Understanding the BPMS paradigm 32. Business & IT divide 33. Use of Business Rules 34. Sometimes information-processing work is subsumed into the real work that produces the information 35. For global inter-operability, transparency to the end user is needed which has consequences for the information availability
C. Developing an IT Solution Based on SOA	36.IT infrastructure is not aligned to the developed solution 37. Embedded business logic within communications networks 38. Integration of processes and data 39. (Use of) Web services 40. Transformation of design models into implementation models 41. Delay the technology evaluation until process reverse engineering is finished 42. SOA (currently) works best when working with applications from large IT vendors 43. Reliability of Internet (standards) 44. The process manager might get direct access to the application server where connections are running 45. Testing prototypes and the final solution 46. The inflexibility of IT application systems
D. Management of Implementation and Change	1. Project management (repeated) 2. Change management (repeated) 47. Involving people the right people
E. Measurement and Control	48.Performance Measurement 49. Continuous Optimization 50. An organization and culture of Quality 51. Use multiple data gathering approaches 52. The availability of data within the Supply Chain is critical 53. Both formal and informal monitoring and reporting activities should be taken into account 54. Capture information once and at the source (tasks are performed wherever it provides the most value) 55. Granularity and visibility control (information is not available or private information is made public)

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