DEVELOPMENT OF A DECISION SUPPORT SYSTEM FOR EVALUATION OF BUSINESS PROCESS MANAGEMENT SYSTEMS

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DEVELOPMENT OF A DECISION SUPPORT SYSTEM FOR EVALUATION OF BUSINESS PROCESS MANAGEMENT SYSTEMS

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Thesis Abstract

İsmail Cingil, “Development of a Decision Support System for Evaluation of Business Process Management Systems”

Owing to the fact that product assortment has been increased and product life cycle period has been decreased, surviving in this competitive market is not easy and may result in commercial failures for the organizations that cannot act against changes in a very short time. In order to overcome this dilemma, Business Process Management (BPM) systems are used by organizations.

BPM system helps organizations to measure their processes and optimize their resources which increase their competence and intercept the idle operations that in turn decrease the decision period. There are many BPM products in the market and they all argue that they offer a complete BPM solution. However, implementing an Information System (IS) is costly and many of the implementations result in failure, therefore choosing the appropriate BPM system is important for the organizations.

The purpose of this study is to help organizations to choose a proper BPM system for their business processes by developing a Decision Support System (DSS) by which they can evaluate and compare different BPM systems.

The developed DSS is based on the three evaluation criteria groups; ISO/IEC 9126 Standards, Technical Criteria (Khan, 2004) and Marketing Criteria (Hill et. al., 2006) which are derived from literature survey, prior empirical studies and evaluation methods, series of observations, several brainstorming sessions and industry expert consultancy. Finally, two different BPM systems are evaluated by using the DSS Environment and the results are compared.

Tez Özeti

İsmail Cingil, "İş Süreç Yazılımları'nın Değerlendirilmeleri Amacıyla Bir Karar Destek Sistemi'nin Geliştirilmesi"

Ürün çeşitliğinin artması ve ürün hayat döngüsünün azalması dolayısıyla, bu rekabetçi ortamda organizasyonların varlıklarını sürdürmeleri zorlaşmış ve bu değişime karşı kısa süre içerisinde aksiyon alamayan organizasyonlar için ticari kayıpların oluşmasına neden olmuştur. Bu zor durumun üstüsinden gelmek amacıyla, İş Süreç Yazılım (İSY) sistemleri organizasyonlar tarafından kullanılmaktadır.

İSY sistemleri organizasyonların süreçlerini ölçmelerine ve kaynaklarını eniyilemelerine yardımcı olmakta ve dolayısıyla verimliliği artırtırarak ve atıl faaliyetleri önleyerek karar alma süresini kısaltmaktadır. Piyasada bir çok İSY ürünü bulunmakta ve tamamı bütün bir İSY çözümü sunduklarını iddia etmektedirler. Ancak, Bilgi Sistemleri (BS) uygulamaları maliyetli olmakta ve bir çok uygulama başarısızlıkla sonuçlanmaktadır, bu nedenle uygun bir İSY sistemi seçmek organizasyonlar için oldukça önemlidir.

Bu çalışmanın amacı organizasyonların farklı İSY sistemlerinin değerlendirebilecekleri ve karşılaştırabilecekleri bir Karar Destek Sistemi (KDS) geliştirerek iş süreçleri için uygun bir İSY yazılımı seçmelerine yardımcı olmaktır.

Geliştirilen KDS; literatür taraması, önceki deneysel çalışmalar ve değerlendirme metotları, bir seri gözlem, çeşitli beyin fırtınası oturumları ve uzman kişilere danışmalar sonucu elde edilen ISO/IEC 9126 Standardı, Teknik Kriterler (Khan, 2004) ve Pazarlama Kriterleri (Hill et. al., 2006) üzerine kurulmuştur. Sonuç olarak, tamamlanan KDS iki faklı İSY sistemi üzerinde uygulanmış ve sonuçlar karşılaştırılmıştır.

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CONTENTS

FIGURES

TABLES

CHAPTER 1

INTRODUCTION

"You can't manage, operate and
optimize if you can't measure it…"

In our epoch, organizations are obliged to make decisions more rapidly due to expanded product ranges and reduced product life cycle period. In addition, various processes are to be performed which in turn make the structure of the decision processes even more complicated by the reason of handling more processes and accessing data quickly from assorted sources. Owing to the fact that it is challenging to stay in today's competitive markets, organizations need to continually improve their efficiency by using improvements in information technology. To achieve this, they prefer to use Business Process Management (BPM) systems which offer control mechanisms where business processes to be measured are determined and where these measurement results of these processes are used to optimize the resources in order to increase efficiency, eliminate waste and abandon unproductive work.

However, there are many BPM products in the market and many new ones are entering; and they all argue that they support all of the above mentioned BPM

system features. Owing to the fact that installation of improper systems result in financial, operational and opportunity costs, organizations have to consider all aspects of the systems and evaluate alternatives. Therefore, it becomes difficult for the organizations to choose the right product for managing their business processes.

As a result, developing an evaluation framework for assessing BPM systems becomes crucial to decrease the selection period and compare systems. Furthermore, development of a consistent evaluation framework also helps the BPM market to build a common terminology and provides mature systems for organizations. Moreover, developing a framework which combines BPM system features and software characteristics is necessary to overwhelm system comparison dilemmas and benefit from the system as much as possible.

Researchers from BPM industry experts, academic areas and the International Standardization Organization (ISO) propose some evaluation methods to overcome the problems while choosing and comparing appropriate software or BPM systems. These evaluation methods can be grouped under three categories which are Khan's Capability and Completeness Matrix (Khan, 2004), Gartner's Magic Quadrant (Hill et. al., 2007) and ISO/IEC 9126 Software Evaluation Standard (ISO, 2001) which involves functionality, reliability, usability, efficiency, maintainability and portability characteristics of software products.

This thesis aims to develop a framework, which combines the three groups mentioned above, for assessment of a BPM product at its component levels by identifying and classifying its features and then evaluating each feature by various criteria. In this respect, based on the literature survey, prior empirical studies and evaluation methods, a series of observations, several brainstorming sessions and

industry expert consultancy and many evaluation criteria for assessment have been determined. Then, using those criteria, a framework model has been designed and a Decision Support System (DSS) has been developed based on this model. The developed DSS is so flexible that it is open to improvements by adding/deleting/updating a criteria, changing criteria weights etc. In this study, two different BPM products were evaluated by the use of the generated DSS environment.

CHAPTER 2

LITERATURE SURVEY

Business Process Management (BPM)

In 1986, Six Sigma was emerged and 'processes' concept drew attention of organizations. In July 1990 the business process reengineering (BPR) movement started and highlighted technology as a major enabler of process management and process change. In 2002, BPM which was claimed to be the most significant topic on the management agenda came in to the business world and attracted organizations (Fig 1) (Jestin and Nelis, 2006).

Large corporations tried to implement Enterprise Resource Planning (ERP) software due to the direct corollary of the reengineering evolution and the advance of Information Technology (IT). Even though it had widespread use in the corporate world, ERP software was costly to execute and not easy to change once executed. With the development of business process and internet centered tools, a new technological business world began with a process oriented model and

implementation framework to utilize business solutions. Accordingly, the increased relationship between business process designers and IT diminished the gap between the business requirements and the final installed system (Chang, 2006).

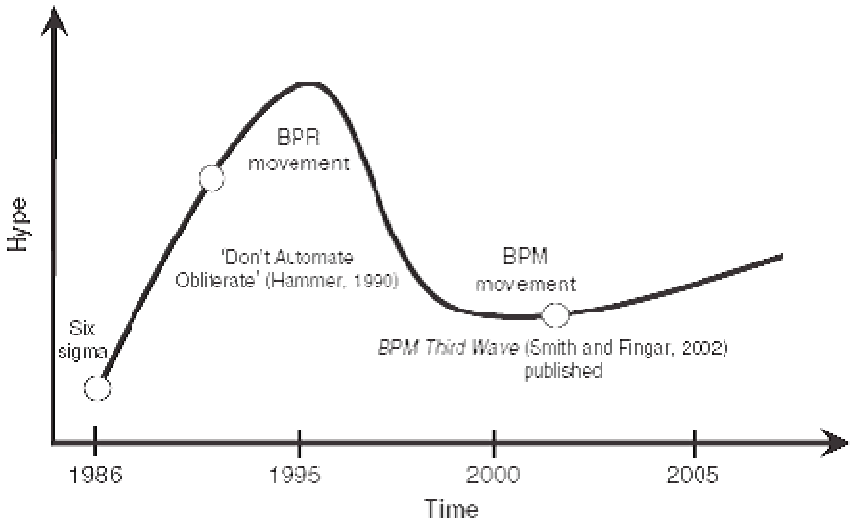


Fig 1 The BPM Hype Cycle (Jeston & Nelis, 2006)

According to Arora (2005), the purpose of BPM is to deal with changes which strive for decreasing cost, increasing efficiency, superiority, agility and visibility in the most optimized way. Khan (2003) defines BPM as a captivating technology designed especially to control business processes and focus on the problems and challenges faced by every businessperson in every organization. BPM can also be defined as the automation of business processes through which documents, information or tasks are delivered from one participant to another, in line with a set of routine rules.

Furthermore, BPM supports business processes using schemes, procedures, and software to design, perform, manipulate, and examine operational processes

including individuals, institutes, applications, documents and other basis of information (M. Weske, 2004).

The three main drivers of BPM are the need to improve responsiveness, the competitive threat and the need to improve quality which has an effect on improved relationships with customers, better cross-functional working and a change in organizational culture. Therefore, business processes are designed to be customer-oriented, cross-functional and value-based which generate intelligence, eradicate litter and discard inefficient work, bringing in outstanding productivity and superior perceived service levels for customers (Pritchard & Armistead, 1999).

BPM Components

In order to ensure that the BPM product is adequate to organization needs as described above, the competencies of the BPM product must be defined. Jestin and Nelis (2006), have classified the competencies of a BPM product according to its components (Fig 2). These components, which build up the BPM product are Process Modeling and Design (PMD), Activity Based Costing (ABC), Simulation, Balanced Scorecard (BSC), Process (Workflow) Engine (PE), Business Rules Engine (BRE), Enterprise Application Integration (EAI), Document Management System (DMS) and Business Activity Monitoring (BAM).

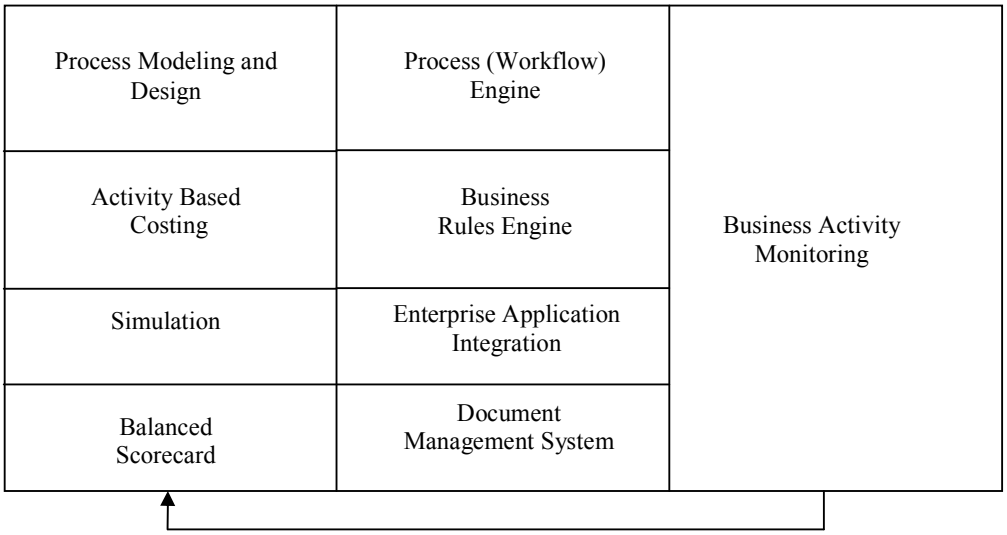


Fig 2 Components of an Automated BPM Solution (Jeston & Nelis, 2006)

Process Modeling and Design (PMD)

One of the most crucial components of the BPM system is the PMD component that organizations model their processes and sub-processes. The PMD component allows staff from business divisions to have a more active position in developing process-driven applications which reduces the period and energy that developers require to build, set up, and upgrade the applications (Adobe Systems Incorporated, 2007).

The major advantages of the PMD component are (Jeston & Nelis, 2006):

- Using and modifying models by staff at any time in any site, resulting in more stability, less suspends and lowers costs,
- Running the process model (e.g. validate its correctness, up-to- date stage and effectiveness) which gives the opportunity to make corrections and therefore results in superior quality,
- Broadcasting process models, so that the staff can refer to them and the associated information (e.g. current templates for letters, web pages, and

application forms), which results in more staff using the process models, and in different outcomes in superior quality and more results.

Activity Based Costing (ABC)

ABC differs from traditional costing as the ability to calculate precise process, product and service costs, and assess the effectiveness of pricing strategies and customers (May, 2003). Process cost calculations such as cost per process, cost of acquisition of new customers, cost to serve customers are only a piece of information that, the organization needs to have reasonable decisions. Considering facts above, the ABC component provides measurable and transparent processes and, as a result, potential control of process costs. The ABC component helps confident strategic decisions on the cost side and to accomplish continuous cost saving. The major advantages of the ABC component are (Jeston & Nelis, 2006):

- Recognizing cost components of processes which result in prices and costs being more aligned,
- Comparing several processes and detecting areas for improvement which results in lower costs.

Simulation

Simulation of business processes with statistical methods provides information about the performance, drawbacks and resource bottlenecks of processes (Devis Rob, 2007). According to Jeston and Nelis (2006), simulation demonstrates whether processes can be performed as they are designed and whether Key Performance Indicators (KPIs) predefined at the design stage offer organizations the chance to assess various alternatives and carry out reasonable benchmarking without any cost-

intensive process adjustments. The major advantages of the Simulation component are (Jeston & Nelis, 2006):

- Clarifying bottlenecks in the process and dependencies of processes and resources which decrease costs and increase efficiency,
- Weighting against different processes on the basis of their competencies and rapidity and revealing best practices which outcomes lower costs and better results,
- Confirming improved process and analyzing it in contrast to various situations,
- Shrinking implementation expenditures and providing more resourceful processes.

Balanced Scorecard (BSC)

A BSC puts together financial measures asserting outcomes of company's operations, and the operational measures that result in transparent aspect outcomes. The BSC component provides managers supervision business from four key viewpoints (Kaplan & Norton, 1992):

- *Customer Perspective:* How do customers see us?

- *Internal Perspective:* What must we excel at?

- *Innovation and Learning Perspective:* Can we continue to improve? And create value?

- *Financial Perspective*: How do we look to shareholders?

Providing information from four key viewpoints, the BSC component minimizes information overload by reducing the number of measures handled. Jeston and Nelis (2006) emphasize that BSC component establishes numerous measures and KPIs or other essential measures to assess processes which can then be related to the

strategic goals of the organization. Moreover, BSC measures can be established for the estimated processing costs and timeframes, where afterwards these goals can be compared to costs and timeframes realized. The major advantages of a BSC component are (Jeston & Nelis, 2006):

- Linking processes and their results to goals of the organization which results in better performances and lower costs,
- Monitoring progress of processes and their contribution to the organization goals which result in better performances and lower costs,
- Modifying goals and finding out their influence on processes which result in more agility of the processes and the organization all together.

Process (Workflow) Engine (PE)

Jeston and Nelis (2006) described the PE component as "a workflow system which describes the automation of internal business operations, tasks and transactions that simplify and streamline current business processes". Furthermore, the PE component is the software component that performs transactions or events designed.

Another definition given by Ader (2002) is that the PE component creates process instances, interprets created instances models, and manages their execution. Moreover, the PE component typically routes the flow and synchronizes activities, assigns resources to activities, notifies individuals and invokes applications, and transmits data and documents to individuals and applications.

The major advantages of the PE component are (Jeston & Nelis, 2006):

- Automating operations that can be identical which results in lower costs, throughput time and increased superiority,

- Routing work on the basis of dependencies and skills, resulting in reduced throughput time and better quality,
- Making staff concentrate on key work that results in more employee satisfaction and better quality.

Business Rules Engine (BRE)

From a business perspective a business rule is a guidance for obligations that concern actions, practices or procedures related to an organization. However from an information systems perspective it is defined as a statement that defines or constrains some aspect of the business which is intended to assert business structure, or to control or influence the behavior of the business (Business Rule Group, 2008) .

According to Jeston and Nelis (2006), the BRE component offers the kind of agility that organization removes business rules from code-based legacy application systems into a BRE component. The major advantages of BRE component are:

- Automating more work which results in better quality and lower costs and throughput time (Jeston & Nelis, 2006),
- Analyzing and administrating the business rules before publishing any changes, resulting in better quality and reduced costs (Jeston & Nelis, 2006),
- Identifying, examining and administrating the business rules which do not heavily rely on IT, resulting in more effective, manageable and agile processes (Jeston & Nelis, 2006),
- Providing simple policy changes by logic and data separation which result in uncomplicated and rapid adaptation of the application (Xiaoming & Mani, 2008).

Enterprise Application Integration (EAI)

EAI was developed in order to automate the transfer of data between applications and computers (Khan, 2004), and enables systems to communicate with each other (Sarkar, 2006).

The EAI component offers the interface layer between the process models within the process engine and the legacy applications of the organization. EAI is a key component and is likely to initiate a project to fail if not previously considered. The major advantages of the EAI component are:

- Implementing BPM automation together with the existing system, but with more benefits and limited costs (Jeston & Nelis, 2006),
- Reducing redundancy and inconsistency of data, which results in lower costs and better quality (Jeston & Nelis, 2006),
- Helping organizations to overcome problems without proprietary and point to point integration and alternatively deploying an EAI platform which integrates all applications for which adaptors are most available and provided by the BPM (Khan, 2004),
- Connecting all systems in IT that result in mutually functioning applications, adequately allocating information resources and increase in efficiency by removing separate databases used in organization (Yang & Liu, 2008),
- Allowing easier and faster access to other applications by the use of Service Oriented Architecture (SOA) technology (Filenet, 2006).

Document Management System (DMS)

A DMS component provides a platform for storing and securing electronic documents, images, and other files (Appian Corporation, 2006), can deal with an

increasing number of electronic deliveries (Reijers, 2006) and is a standardized method for indexing and managing documents which come into the organization in various forms, e.g. paper, microfiche, fax and e-mail, utilizing such techniques as document imaging (May, 2003).

According to Jeston and Nelis (2006), "if an automated BPM solution is implemented without an accompanying integrated document management system, the organization risks making its processes extremely fast, and then having to wait for the physical paperwork to catch up". Therefore, scanned images of the paperwork of processes are necessary. Otherwise, entire BPM implementation is at great risk and cannot provide the expected benefits for business. The key advantages of the DMS component are (Jeston & Nelis, 2006):

- Documents are electronically available, so work can be completed using the electronic version, reducing throughput significantly (no need to wait for the paper to arrive),
- Recovery and tracking of documents can be accomplished straightforwardly, resulting in lower costs and faster throughput times.

Business Activity Monitoring (BAM)

A BAM component is designed to offer closed-loop flexibility to business processes and performance (Palmer, 2005), which gathers and correlates events and shows the findings in a visual layout or dashboards with regular updates, and can take or advise corrective actions for defined event conditions. These corrective actions may result in the launching of a new business process or adjusting to an existing one, or calling of a Web service (FileNet, 2006) and also in diagnosing the operational processes with data logged by the BAM component (Weske, van der Aalst, & Verbeek, 2004).

In order to effectively implement and assess measures for the non-stop optimization of business processes, gathering and examination of performance related process information is an indispensable requirement. Jeston and Nelis (2006) imply that the BAM component automatically identifies performance data from organization processes, particularly those that cover systems, and thus makes it possible to examine them. The BAM component helps to uncover weaknesses in process handling and to optimize processing throughput times not only from the PE component, but also gathered information from various software application systems within the organization. Moreover, the BAM component functions as an early warning system by showing not only historical information but also predictive information for the monitoring of business processes. The key advantages of the BAM component are:

- Monitoring processes instantaneously and drilling down into problem areas, and therefore resulting in less problems and lower costs (Jeston & Nelis, 2006),
- Providing proactive actions that lead to better quality by estimating interruptions and Service Level Agreements (SLAs) that cannot be met (Jeston & Nelis, 2006),
- Comparing processes against competitors and industry standards which result in better performance (Jeston & Nelis, 2006),
- Offering a method with which business owners can maintain organization's strategic plan (Adams, 2003),
- Providing diagrams which ease resolution of problems that result in giving better decisions (Ader, ILOG, 2006).

Evaluation Frameworks for BPM Systems

Organizations in need of choosing and implementing the right BPM system confront puzzlement due to developing status of BPM systems, incompatible vendor claims, confusing jargon punctuated by many buzzwords, and marketing hype as vendors try to stake a claim in this very large market. These uncertainties cause difficulties for the organizations while collecting necessary information to assess the BPM systems (Khan, 2004).Therefore, there is an increasing interest in the software industry for providing an appropriate BPM tool.

This interest has directed practitioners to study proposing evaluation frameworks to resolve selection and implementation problems of BPM product investments. The three main groups of evaluation criteria that the practitioners have considered are: Khan's Capability and Completeness Matrix (Khan, 2004), Gartner's Magic Quadrant (Hill et. al., 2006) and ISO/IEC Software Evaluation Standards (ISO-JTC, 2000).

On the other hand, academicians are also working on this emerging field, but those studies are not sufficient to create a strong academic foundation for this subject (Charles, 2007). There are very limited studies in literature that propose a framework for BPM system assessments (Lee et. al, 2005; Lei and Singh, 1997; Vjeran, 2007; Rolon, 2006; Harrel and Field, 1996; Waller, 2006)

Evaluation Framework Based on Capability and Completeness of BPM Systems

In 2004, Khan proposed a framework to evaluate BPM systems which splits the features of BPM systems into two categories; capabilities (Tables 1 and 12) and

completeness (Tables 2 and 13). He described capabilities as the ability of the product to meet BPM requirements of organization, and defined completeness as the ability of the product to meet current and future BPM needs. As a result, capabilities can be thought of as mandatory features, while completeness might be useful to address future needs.

Table 1 Key Capability Features of BPM Systems (Khan, 2004)

1. Robust Business Rules	11. Flexible Forms Support
2. Role Based Routing	12. Web-based Architecture
3. Relationship Routing	13. Automation Agents
4. Relative Routing	14. Custom Views
5. Parallel Routing	15. Simulation
6. Ad Hoc Routing	16. Process Documentation
7. Queues and Groups	17. Status Monitoring
8. Process Rollback	18. Authentication and Security
9. Sub-Processes	19. Distributed User Administration
10. Escalation and Exceptions	20. Task Delegation and Conferring

Table 2 Key Completeness Features of BPM Systems (Khan, 2004)

1. Graphic Designer	6. Business Metrics and Monitoring
2. Collaborative Design	7. BPM Administrator
3. Modeling	8. Web Services and Integration
4. Organizational Charts and Directory Integration	9. Database Connectivity and Transaction Processing
5. Multiple Client Interface	10. Scalable BPM Server

Khan (2004) designed a matrix in his framework to classify a BPM system according to its capability and completeness features (Fig 3). The classification resulted in four types of BPM systems which are BPM Engines, BPM Enablers, Application Specific BPM and General Purpose BPM.

		Completeness	
		Low	High
Capabilities	High	BPM Engines	General Purpose BPM
	Low	BPM Enablers	Application Specific BPM

Fig 3 BPM Completeness - Capability Matrix (Khan, 2004)

Khan (2004) defined BPM products as BPM Engines if they score high on capabilities but low on completeness. BPM Engines or Servers as Khan (2004) claimed, provide the basic logic to implement BPM. BPM Engines do not include reporting tools, administration tools, the workflow inbox or "client" interface which enables users to take part in workflow. However, large organizations benefit from BPM Engines in developing BPM solutions with customized clients. Self-governing software vendors need BPM Engines to develop full software applications and services with integrated BPM capabilities. Although some customized features leverage the capabilities of BPM Engines and add "completeness", customized features may have cost highly to the organizations. According to Khan (2004), examples of BPM Engines include Microsoft BizTalk Server and File Net Visual Workflow.

Another BPM type is the BPM Enablers which score low in both capability and completeness. BPM Enablers are considered infrastructure technologies and by adding code and logic they can be used as a BPM solution. Microsoft Exchange and IBM Lotus Notes are examples of BPM Enablers (Khan, 2004).

Some applications, such as ERP, CRM, sales force automation, document-content management and asset management have built-in BPM capabilities which add value to the application and are therefore classified as Application Specific BPM solutions. They score high on completeness because workflow is built in and strongly integrated with other functions of the application. However, the capabilities of these applications are low since their design objective compared to BPM is just to add value to core application, and not to become a robust general purpose BPM solution. When assessing applications of this kind, the nature of the processes being automated is a key factor. Application-Specific BPM is an acceptable choice as long as the process needs to integrate with the core application and with the users of that application only. Examples of Application Specific BPM include the embedded workflow capabilities provided by PeopleSoft, SAP, Open Text or Oracle (Khan, 2004).

Scoring high on capabilities and completeness results in General Purpose BPM product. General Purpose BPM systems are intended to address the whole process lifecycle. Therefore it is reasonable to select these products for most BPM projects. Moreover, when considering the products that claim they handle a wide range of BPM requirements, it is essential to make sure that the ability to handle processes that involve both people and application, exist. Although a BPM system perfectly supports application integration, limited human centric process features can be limited since handling workflows between humans that have lots of exceptions and routing factors is difficult. On the other hand, if the BPM system has imperfect integration capability, it may not be able to push and pull information to and from

enterprise systems. General Purpose BPM includes products from FileNet, Staffware, Savvion, Ultimus and others (Khan, 2004).

Evaluation Framework Based on Ability to Execute and Completeness of Vision of BPM Systems

Since 2006, another widely accepted evaluation of BPM systems has been published yearly by Gartner Research Group under the name of Magic Quadrant of BPM Suites (Fig 4).

		Completeness of Vision	
		Low	High
Ability to Execute	High	Challengers	Leaders
	Low	Niche Players	Visionaries

Fig 4 Magic Quadrant of BPM Suites (Hill et. al, 2007)

The quadrant is composed of "ability to execute" (Tables 3 and 17) and "completeness of vision" (Tables 4 and 17) criteria and composed of Leaders, Challengers, Visionaries and Niche Players (Hill, Cantara, Deitert, & Kerremans, 2007).

Table 3 Key Ability to Execute Features of BPM Systems (Gartner, 2006)

1. Product/Service
2. Overall Viability (Business Unit, Financial, Strategy, Organization)
3. Sales Execution/Pricing
4. Market Responsiveness and Track Record
5. Marketing Execution
6. Customer Experience
7. Operations

Table 4 Key Completeness of Vision Features of BPM Systems (Gartner, 2006)

1. Market Understanding
2. Marketing Strategy
3. Sales Strategy
4. Offering (Product) Strategy
5. Business Model
6. Vertical/Industry Strategy
7. Innovation
8. Geographic Strategy

Providing enhanced sales and marketing execution, excellent product capabilities and easing business users in the whole process improvement life cycle makes the BPM suite a Leader product. Leader BPM suites are extremely good at providing high partnership between business users and IT professionals, not only in the design and modeling phase but also in execution and optimization phases (Hill et. al., 2007).

Challengers score high on ability to execute, but low on completeness of vision criteria. These products show greater sales execution and resilient financials for continuing investments. Moreover, Challengers show signs of strengths similar to leaders, over targeting business analyst equally primary process designers and making all parts of the process obvious, controllable and progressively more adaptable by operational managers and process participants, not solely IT (Hill et. al., 2007).

Conversely, Visionaries are new family members of the BPM suite market. Therefore, they have less operation and less market visibility compared to Leaders and Challengers.

Scoring low on both, Niche Players come up to the market as they expand and concentrate on specific geographic areas or industries to answer particular needs (Hill & Sinur, 2006).

The results of the 2008 evaluation by Gartner's Magic Quadrant give information about the positioning of BPM products in the market (Fig 5).

Fig 5 Gartner 2008 Magic Quadrant of BPM Suites

Evaluation Framework Based on ISO/IEC Standards

ISO/IEC standards have been broadly used for software product assessments and so can be explicitly considered for BPM product evaluations also. ISO/IEC 14598 Information Technology – Software Product Evaluation Standard (Table 5) defines the fundamental processes for evaluating software products and ISO/IEC 9126 Software Engineering – Product Quality Standard (Table 6) give quality indicators for the evaluation of software product.

Table 5 ISO/IEC 14598 IT – Software Product Evaluation Standard

BS ISO/IEC 14598-1: 1999	IT - Software Pro. Eva. - Part 1: General overview
BS ISO/IEC 14598-2: 2000	Software Eng. - Part 2: Planning and management
BS ISO/IEC 14598-3: 2000	Software Eng. - Part 3: Process for developers.
BS ISO/IEC 14598-4: 1999	Software Eng. - Part 4: Process for acquirers.
BS ISO/IEC 14598-5: 1998	Software Eng. - Part 5: Process for evaluators.
BS ISO/IEC 14598-6: 2001	Software Eng. - Part 6: Documentation of evaluation modules

Table 6 ISO/IEC 9126 Software Engineering - Product Quality Standard

ISO/IEC 9126-1: 2001	Product Quality – Part 1 – Quality Model
ISO/IEC TR 9126-2: 2003	Product Quality – Part 2 – External Metrics
ISO/IEC TR 9126-3: 2003	Product Quality – Part 3 – Internal Metrics
ISO/IEC TR 9126-4: 2004	Product Quality – Part 4 – Quality in Use

ISO/IEC 14598 standard is composed of six main topics and covers software evaluation processes. In this standard:

- Part 1 - General overview: Gives a general overview of software evaluation standard and usage of other parts,
- Part 2 - Planning and management: Defines the planning and management of software which consists of evaluation planning, the endorsement of this plan and the technology transfer between the project and the organization (ISO-JTC, 2000),
- Part 3 - Process for developers: Supports requirements and recommendations for the practical implementation of software product evaluation when the evaluation is conducted correspondingly with the development and performed by the developer (ISO-JTC, 2000),
- Part 4 - Process for acquirers: Contains necessities, suggestions and strategies for the regular measurement, evaluation and assessment of software product quality during acquisition of BPM system (ISO-JTC, 1999),

- Part 5 - Process for evaluators: Provides evaluation framework for external or independent evaluators when quite a few participants require recognizing, consent and confidence evaluation results and it's strongly connected with ISO/IEC 9126 standard (ISO-JTC, 1998),
- Part 6 - Documentation of evaluation modules: Explains the formation and content of the documentation of evaluation module used (ISO-JTC, 2001).

On the other hand, ISO/IEC 9126 is composed of six main characteristics (Fig 6) which are Functionality, Reliability, Usability, Efficiency, Maintainability and Portability. Moreover, these characteristics are divided into sub characteristics and each of them is used to measure the characteristics of a software product (ISO, 2001).

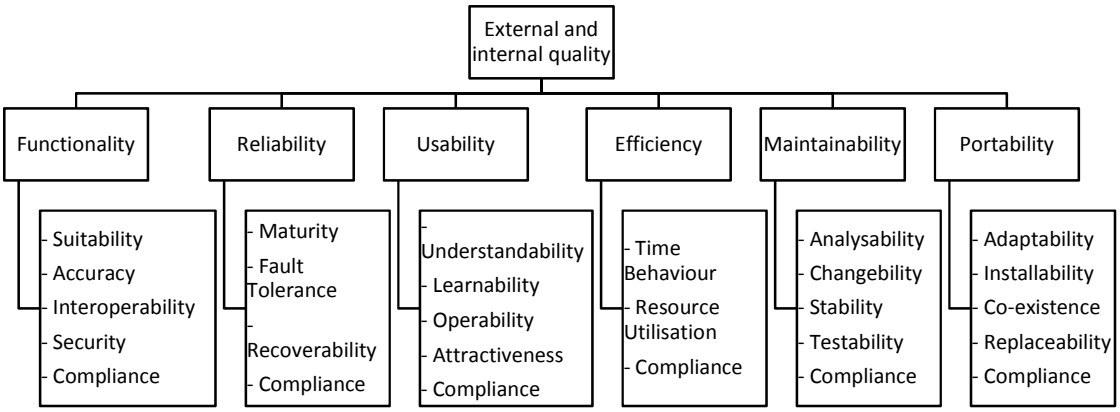


Fig 6 ISO/IEC 9126 Software Product – Quality Standards Evaluation Characteristics (ISO, 2001)

The relation between ISO/IEC 14598 and ISO/IEC 9126 standards used for the assessment of a software product can be illustrated as in figure 7.

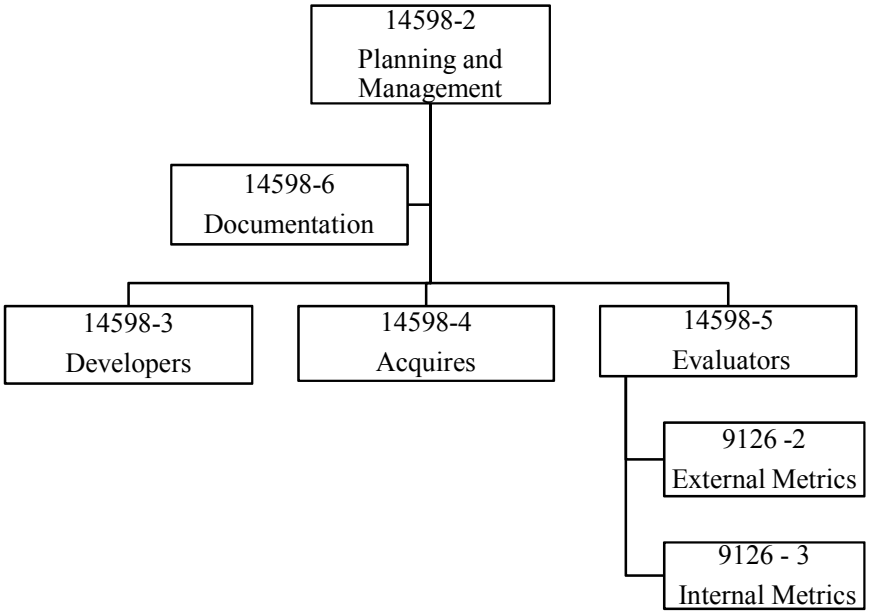


Fig 7 Relation Between ISO/IEC 14598 and ISO/IEC 9126 Standards (BS ISO/IEC 14598-1, 1999)

Other Evaluation Frameworks for BPM Systems

There are several other evaluation frameworks that have been developed by considering some of the above evaluation criteria groups to assess BPM systems. Among these frameworks, some assess a BPM product entirely but do not give deep analysis for its components (Lee et. al., 2005; TEC, 2007), whereas some assess only one component of a BPM product but in a more detailed way (Lei & Singh,1997; Vjeran, 2007; Rolon, 2006; Hlupic et. al., 2007). In addition, the developed frameworks cover only technical features of BPM systems and do not evaluate a product from the marketing perspective.

Evaluation Frameworks Assessing an Entire BPM System

The evaluation framework proposed by Lee, et. al. (2005), is based on ISO/IEC 9126 standard and it states the specific quality evaluation metrics covering the difference between the BPM and other software products and indicates the characteristics of process based software. The steps used while building the framework (Table 14) are as below (Lee et. al., 2005):

- General requirements of the BPM system are defined,
- Component based assessment of a BPM system with ISO/IEC 9126 standard evaluation metrics is structured,
- Supplementary evaluation metrics specific for a BPM system are added,
- Evaluation metrics specific for a BPM system are prioritized.

The framework includes:

- Quality characteristics such as functionality, reliability, usability, efficiency, maintainability, portability, integrability and domain specific needs, sub characteristics for each quality characteristics and their priorities
- BPM components such as BPM Modeler, BPM Server, Administration Tool, BPM Monitoring, BPM IDE and BPM Builder
- Descriptions where features of BPM system are defined
- Case examples which summarize the quality characteristics of a related BPM component.

This framework is developed in terms of assessment of BPM components approach. However the components of the BPM are limited with the BPM Modeler, BPM Server, Administration Tool, BPM Monitoring, BPM IDE and BPM Builder.

Priorities are given to the metrics in the framework as A+, A, B+, B, C based on the characteristics of the BPM product (Lee et. al., 2005).

Another evaluation framework that assesses a BPM product entirely is provided by Technology Evaluation Center (TEC). TEC (2007) defines main criteria as process modeling, security management, process collaboration, form management, workflow portal, monitoring and management, process analytics and product technology and support. There are a total of 610 items included in the checklist of this evaluation framework and scores are given according to the support of related features by the BPM product. For example, if a product supports a feature out of the box, it gets 100 points. However if the product needs some customization or modification, it gets 40 or 70 points (TEC, 2007). This approach is feasible due to elimination of subjective assessment of BPM systems. However, the number of questions needs to be reduced and items should be matched with related components of the BPM system in order to ease the evaluation process and conduct proper comparisons of different systems.

Evaluation Frameworks Assessing a Specific Component of a BPM System

The evaluation framework proposed by Lei and Singh (1997) covers only workflow metamodels of the PMD component in which the languages are used in designing business processes. They define key dimensions of metamodels as granularity, control flow, data flow, organizational model, role binding, exception handling, transaction support and commitment support.

Related to the framework of Lei and Singh (1997), Vjeran (2007) claims that a properly developed evaluation criteria of workflow metamodels should enable

comparison, selection and appropriate handling of methods and tools built upon them. Vjeran (2007) states that it is not yet obvious which metrics are required in order to conduct and increase the quality of model design and therefore proposes enhanced criteria and sub criteria which include nine main criteria consisting of domain of application, origins, concepts and constructs, modeling language and notation, cohesion, openness, usability, maintainability and pragmatic aspects where those nine main criteria are divided into forty subcategories. The proposed framework is based on comparative study of associated work, analysis of existing workflow metamodels, modeling frameworks, existing standards and practical knowledge. Although developed evaluation framework is based on several analysis techniques the framework needs to have more precise definition of evaluation criteria to enhance precision. Moreover, quantification, formalization and metrics should be realized wherever possible to reduce subjective assessment (Vjeran, 2007).

Rolon et. al. (2006) proposed an evaluation framework to assess business process models called Framework for the Modeling and Evaluation of Software Processes (FMESP). They started with defining base measures and derived measure according to Business Process Management Notation (BPMN) terminology. Moreover, since business process models and software process models show particular relationship concerning the principal elements that both are made up of, it was approved that metrics for software process models could be applied to business process models (Rolon et. al., 2006).

There is an assessment framework also developed for simulation component of a BPM system which puts together a list of guidelines to assist managers in

selecting a simulation package to be deployed in the context of business process change projects (Hlupic et. al, 2007).

Ghani et. al. (2008) argued that, although criteria based researches are vital to compare BPM products, there needs a unique connection of criteria to BPM system features in order to measure the related criteria effectively. Therefore, they propose the Goal Question Metrics (GQM) method to evaluate and maintainability and understandability of a system. This approach was also used in the developed evaluation framework model.

CHAPTER 3

METHODOLOGY

In this chapter, the methodologies followed for the design of the BPM assessment framework model and for the development of DSS based on this model are explained in a detailed manner.

Model Design of BPM System Evaluation Framework

Framework model design process can be described in three phases (Fig 8). In Phase 1, the literature and BPM industry were explored and the main components of a BPM product and the main three evaluation criteria groups, ISO/IEC 9126 Standards, Technical Criteria (Khan, 2004) and Marketing Criteria (Hill et. al., 2006) were identified for the assessment as discussed in Chapter 2. In Phase 2, necessary matching and mappings were done between and within BPM components and criteria groups. Following the completion of Phase 2, necessity arose to find out exact questions to evaluate the BPM system. Therefore, in Phase 3, literature and industry were researched again for the second time to find the most suitable assessment questions for each of the evaluation criteria.

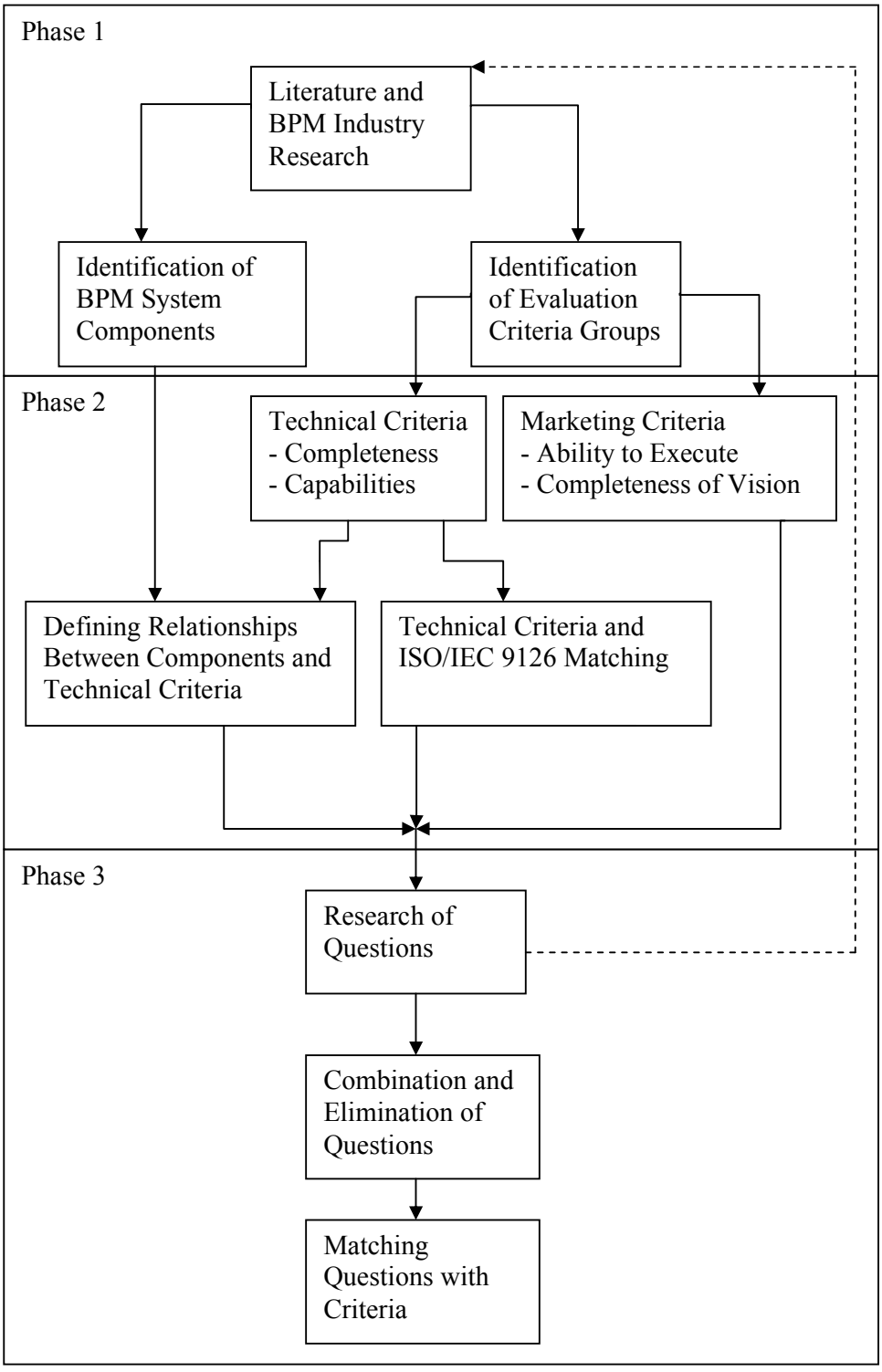


Fig 8 Framework Development Process

During Phase 1, components of a BPM system and the ideal interconnectivity between these components were defined (Fig 9).The interconnectivity in Stage 1 shows that process is designed with the PMD component, and then it is run by the PE component. The BRE component provides a robust environment to comply with organization wide or legal obligations. The EAI component also eases the process lifecycle by transferring knowledge between applications without any need for human interaction. The DMS component is used by process participants to eliminate paperwork. Furthermore, in Stage 2 all activities can be checked from the BAM component screen and the indicators can be used for process improvement. In Stage 3, BSC, Simulation and ABC components are used to support designing a better process model by sending feedback to Stage 1 again.

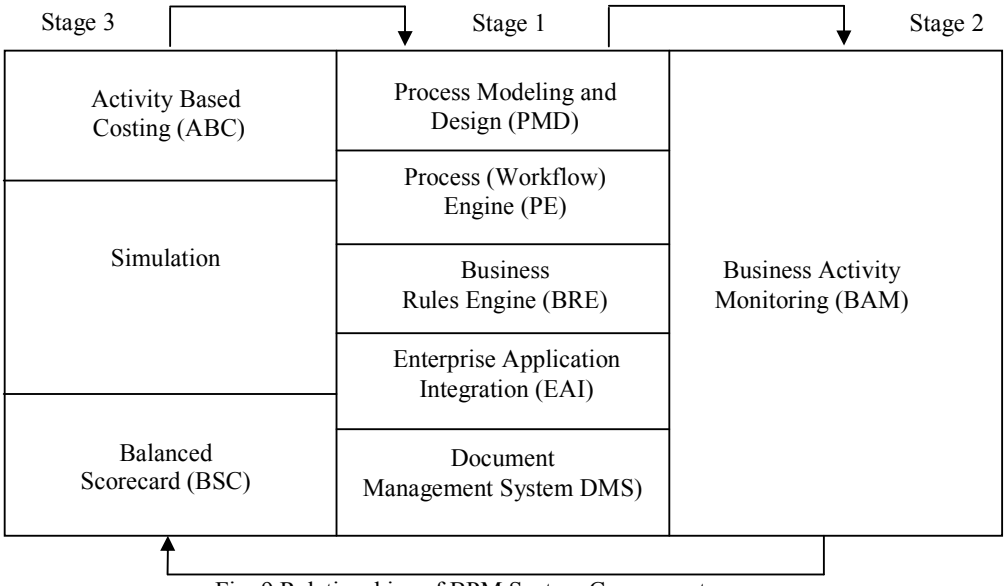


Fig 9 Relationships of BPM System Components

After defining the interconnectivity between components, criteria groups and the criteria they include were identified exactly as they have been discussed in Chapter 2. After that, in Phase 2, appropriate Technical Criteria were mapped to the

appropriate component (Table 7) and can be seen from Table 7, where the numbers in “Capabilities” and “Completeness” columns correspond to the numbers in Tables 1 and 2 respectively, not all of the components were related to each criteria. Only the appropriate capability and completeness criteria were mapped with the related BPM system components. For example, the capability criteria that are related to the ABC component are web-based architecture, simulation, status monitoring and authentication/security capabilities. Similarly the completeness criteria such as multiple client interface, business activity and monitoring and BPM administration are related to the ABC component.

Table 7 BPM System Components and Technical Criteria Match

Component	Capabilities	Completeness
ABC	12-15-17-18	5-6-7
BSC	12-15-17-18	6-7
BAM	1-2-3-4-5-6-7-8-9-10-12-15-16-17-18	6-7
BRE	1-2-3-4-5-6-7-8-9-10-12-15-18-19	1-2-3-4-7-10
DMS	1-2-3-4-5-6-7-8-11-12-15-17-18-19	1-2-3-7-10
EAI	8-12-13-15-16-18	7-8-9-10
WFE	1-2-3-4-5-6-7-8-9-10-12-14-15-17-18-19-20	1-2-3-4-5-7-10
PMD	1-2-3-4-5-6-7-8-9-10-11-12-15-18-19	1-2-3-4-7-10
Simulation	1-2-3-4-5-6-7-8-9-10-12-15-17-18	1-2-3-6-7-11

Following the mapping of Technical Criteria and BPM system components, ISO/IEC 9126 characteristics and appropriate criteria matching was attempted (Tables 8 and 9). For example, Ad-hoc routing capability was matched with functionality/accuracy-suitability, reliability/fault tolerance-maturity-recoverability sub characteristics.

Besides Technical Criteria, Marketing criteria were also considered in this phase, but contrary to Technical Criteria they were only mapped to the entire BPM product under the title of “Market Perspective”.

Table 8 Capability Features of BPM Systems and ISO/IEC 9126 Sub Characteristics Matching

		Efficiency			Functionality					Maintainability					Portability					Reliability				Usability				
Criteria	Subcriteria	Compliance	Resource Utilization	Time Behavior	Accuracy	Func. Compliance	Interoperatability	Security	Suitability	Analyzability	Changeability	Compliance	Stability	Testability	Adaptability	Co-existence	Compliance	Installability	Replaceability	Fault tolerance	Maturity	Recoverability	Reliability Compliance	Attractiveness	Learnability	Operability	Understandability	Usability Compliance
Capabilities	Ad hoc routing				x				x											x	x	x						
	Authentication and security							x	x											x	x	x						
	Automation agents						x		x											x	x	x						
	Custom views								x											x	x	x		x	x	x	x	x
	Distributed User administration								x											x	x	x						
	Escalation & Exceptions Handling:				x				x											x	x	x		x		x		
	Flexible forms support								x											x	x	x			x		x	
	Parallel routing				x				x											x	x	x						
	Process documentation								x											x	x	x		x	x	x	x	x
	Process rollback								x											x	x	x		x		x		
	Queues and Groups								x											x	x	x						
	Relationship routing				x				x											x	x	x						
	Relative routing				x				x											x	x	x						
	Robust Business Rules				x				x											x	x	x						
	Role-based routing				x				x											x	x	x						
	Simulation				x				x	x	x	x	x	x						x	x	x		x	x	x	x	x
	Status monitoring				x				x											x	x	x		x	x	x	x	x
	Sub-processes								x											x	x	x						
	Task delegation & conferring								x											x	x	x		x		x		
	Web-based architecture	x							x											x	x	x						

Table 9 Completeness Features of BPM Systems and ISO/IEC 9126 Sub Characteristics Matching

		Efficiency			Functionality					Maintainability					Portability					Reliability				Usability				
Criteria	Subcriteria	Compliance	Resource Utilization	Time Behavior	Accuracy	Func. Compliance	Interoperability	Security	Suitability	Analyzability	Changeability	Compliance	Stability	Testability	Adaptability	Co-existence	Compliance	Installability	Replaceability	Fault tolerance	Maturity	Recoverability	Reliability Compliance	Attractiveness	Learnability	Operability	Understandability	Usability Compliance
Completeness	BPM administration								x	x	x	x	x	x						x	x	x	x					
	Business metrics and monitoring		x	x	x				x						x	x	x			x	x	x	x	x	x	x	x	x
	Collaborative design								x	x	x	x	x	x					x	x	x	x	x					
	Database connectivity and transaction processing		x	x			x		x						x	x	x			x	x	x	x					
	Graphical designer								x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Modeling	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Multiple client interfaces								x						x					x	x	x	x	x	x	x	x	x
	Organization charts and directory integration								x						x					x	x	x	x	x	x	x	x	x
	Scalable BPM Server		x	x					x						x				x	x	x	x	x					
	Web services and integration	x	x	x		x	x		x						x	x	x	x	x	x	x	x	x					

In Phase 3, the BPM field was studied again to find appropriate questions for each component- technical criteria -ISO/IEC 9126 match and Marketing Criteria. Because understanding the relationships between component and criteria and between criteria and ISO/IEC 9126 would have been difficult for the evaluator, appropriate questions were used. This question style evaluation helped a lot to understand each Technical Criteria match or Marketing Criteria. Now only related questions would be answered and there would be no need to deal with the relationship in each mapping during evaluation of a BPM product.

In addition, all defined questions and matching's were revaluated together to combine, eliminate or add related question and/or match to finalize the framework. Finally, 315 questions were selected and there were various changes in the matches. The distribution of the questions and the final matches are given in Tables 10 and 11 for component-capability and component-completeness matches respectively where previously presented, new and eliminated matches are shown explicitly and numbers in the boxes show the number of questions for the related matching. The distribution of questions for BPM system components (Fig 10), for capability features of Technical Criteria (Fig 11) and for completeness features of Technical Criteria (Fig 12) are also graphed.

Table 10 Comparison of Components and Capability Criteria with Initial Match

Component	Ad hoc routing	Authentication and security	Automation agents	Custom views	Distributed User administration	Escalation & Exceptions Handling:	Flexible forms support	Parallel routing	Process documentation	Process rollback	Queues and Groups	Relationship routing	Relative routing	Robust Business Rules	Role-based routing	Simulation	Status monitoring	Sub-processes	Task delegation & conferring	Web-based architecture	Capability Total	Grand Total
Activity Based Costing (ABC)																					0	0
Balanced Scorecard (BSC)				1																	1	1
Business Activity Monitoring (BAM)		1			1	3											14				19	19
Business Rule Engine (BRE)														17							17	17
Document Management System (DMS)		2					3														5	5
Enterprise Application Integration (EAI)			15						2												17	17
Process (Workflow) Engine	9	8	4	7		5	2	1		1	1	1	1				1	3	2	1	47	47
Process Modeling and Design		2	1	1	1		37								2			1			45	45
Simulation																12					12	12
Grand Total	9	13	20	9	2	8	42	1	2	1	1	1	1	17	2	12	15	4	2	1	163	163

Green: Questions for previous match

Grey : no Questions for previous match

Yellow : new mapping with Questions

Table 11 Comparison of Components and Completeness Criteria with Initial Match

Component	BPM administration	Business metrics and monitoring	Collaborative design	Database connectivity and transaction processing	Graphical designer	Modeling	Multiple client interfaces	Organization charts and directory integration	Scalable BPM Server	Web services and integration	Blank	Grand Total
Activity Based Costing (ABC)												
Balanced Scorecard (BSC)		2										2
Business Activity Monitoring (BAM)	3	16					1				6	26
Business Rule Engine (BRE)	1					1					22	24
Document Management System (DMS)	2		1				1		1		5	10
Enterprise Application Integration (EAI)				5						6	22	33
Process (Workflow) Engine	4				1		2	1		2	21	31
Process Modeling and Design		4	2	4	14	2		9		1	27	63
Simulation						4						4
Grand Total	10	22	3	9	15	7	4	10	1	9	103	193

Green: Questions for previous match

Grey : No questions for previous match

Yellow : New mapping with questions

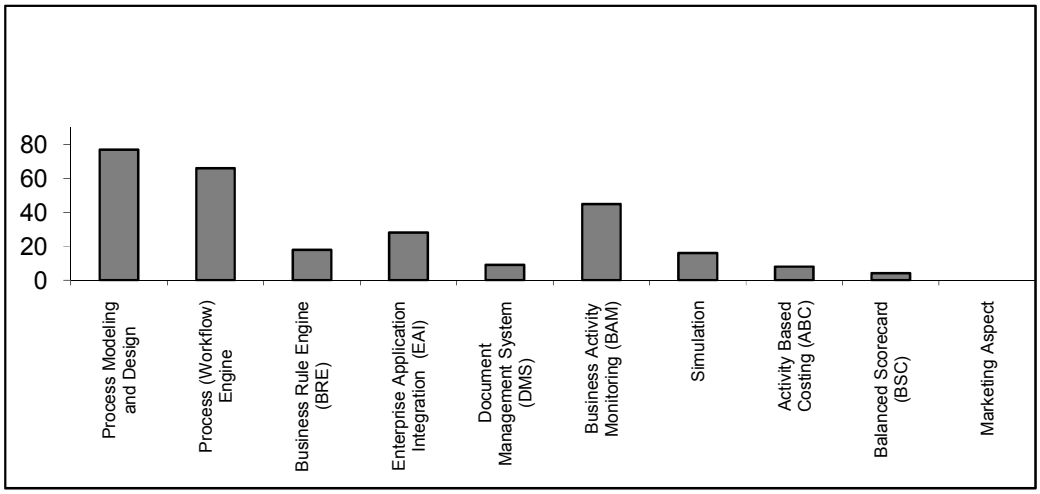


Fig 10 Distribution of Questions for BPM Components

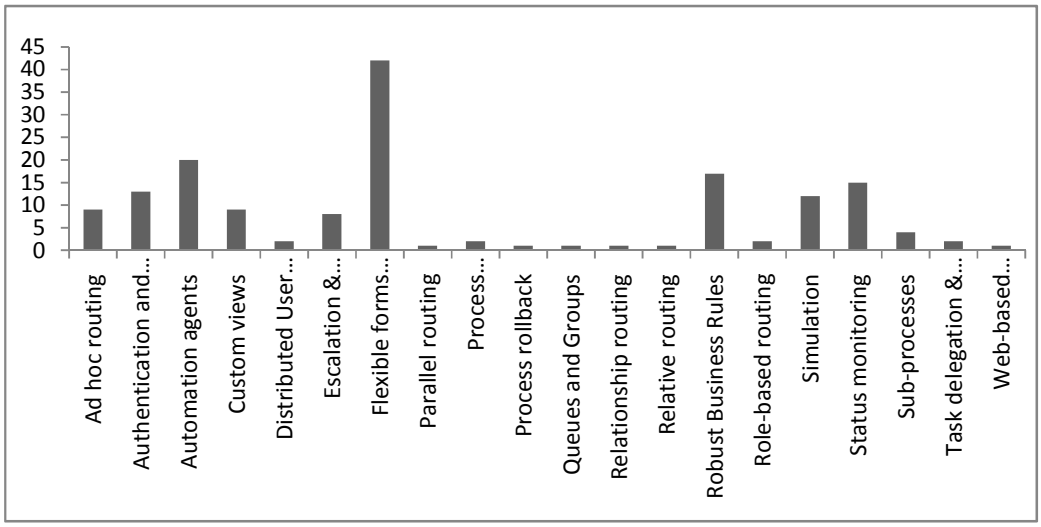


Fig 11 Distribution of Questions for Capability Criteria

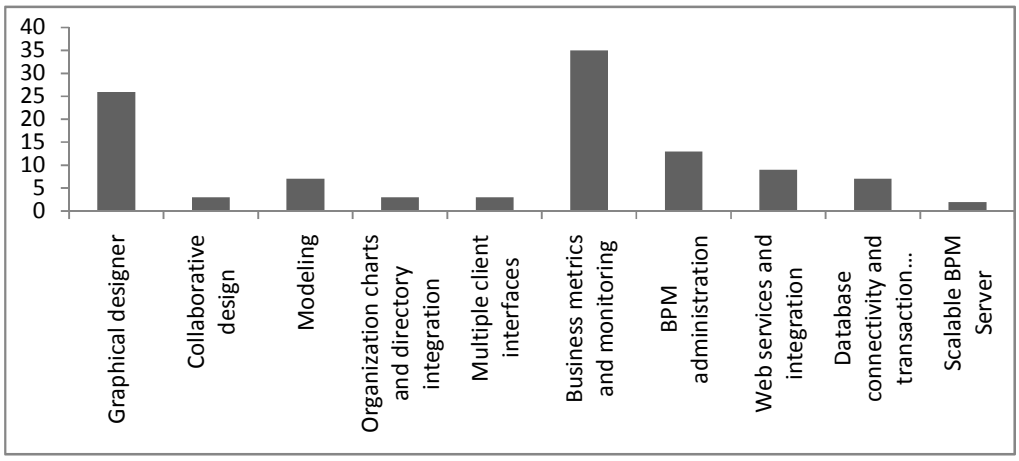


Fig 12 Distribution of Questions for Completeness Criteria

Quantification of BPM System Evaluation Framework Model

In order to assess a BPM system using the evaluation framework model developed, the framework needs to be quantified in terms of grading Technical Criteria matches and Marketing Criteria, giving weights for each mapping level in the model, and calculating scores for each mapping level using the necessary weights and grades/scores. The quantification steps of the framework model, which are explained below, are also shown graphically in Figure 13. The variables and indexes used are defined in Tables 12 and 13:

1. Assignment of weights $\{w_i;\ i=1,2,...,9\}$ of each component over BPM product evaluation
2. Assignment of weights $\{w_{ij};\ i = 1,2,\ldots,9, j = 1,2,\ldots,45\}$ of each sub criteria over the corresponding criteria for the related BPM component evaluation

3. Assignment of equal weights $\{w^{m}{}_{ijp}$; *i=1,2,...,9 j=31,32,...,45; p=1,2,...,n_{ij} }* for the questions over marketing sub criteria for the corresponding component
4. Assignment of weights $\{w_{ijk}\ ;\ i = 1,2,\ldots,9, j = 1,2,\ldots,30, k = 1,2,\ldots,6\}$ of each ISO 9126 characteristics over each technical sub criteria for the related BPM component evaluation
5. Assigment of equal weights $\{w_{ijkl}\ ;\ i = 1,2,\ldots,9, j = 1,2,\ldots,30, k = 1,2,\ldots,6$ *; l=1,2,...,m_k }* for ISO/IEC 9126 sub characteristics over the related ISO/IEC 9126 characteristics for the evaluation of the technical sub criteria for the corresponding component
6. Assigment of equal weights $\{w^{t}{}_{ijklq}\ ;\ i = 1,2,\ldots,9, j = 1,2,\ldots,30, k = 1,2,\ldots,6$ *; l=1,2,...,m_k; q=1,2,...,n_{ijkl} }* for the questions over ISO/IEC 9126 sub characteristics and the related ISO/IEC 9126 characteristic match for the evaluation of the technical sub criteria for the corresponding component
7. Input of grades for the questions

   $\{AG_{ijklq};\ i = 1,2,\ldots,9;\ j = 1,2,\ldots,20;\ k = 1,2,\ldots,6\ ;\ l = 1,2,\ldots,m_k;\ q = 1,2,\ldots,n_{ijkl}\}$,

   $\{CG_{ijklq};\ i = 1,2,\ldots,9;\ j = 21,22,\ldots,30;\ k = 1,2,\ldots,6\ ;\ l = 1,2,\ldots,m_k;\ q = 1,2,\ldots,n_{ijkl}\}$,

   $\{CVG_{ijp};\ i = 1,2,\ldots,9;\ j = 31,32,\ldots,38;\ p = 1,2,\ldots,n_{ij}\}$,

   $\{AEG_{ijp}\ ; i = 1,2,\ldots,9;\ j = 39,40,\ldots,45;\ p = 1,2,\ldots,n_{ij}\}$.

8. Calculation of scores,
    - ISO/IEC 9126 Sub Characteristics Score
    - ISO/IEC 9126 Characteristics Score
    - Sub Criteria Score
    - Component Score
    - BPM Score

Table 12 Indexes used in BPM Evaluation Framework Model

Index	Description
i; i=1,2,...,9	Component index
j; j=1,2,...,45	*j=1,2,...,20* Ability technical sub criteria index, *j=21,22,...,30* Completeness technical sub criteria index, *j=31,32,...,38* Completeness of Vision marketing sub criteria index, *j=39,32,...,45* Ability to Execute marketing sub criteria index
k; k=1,2,...,6	ISO/IEC characteristics index
l; l=1,2,...,m_k	ISO/IEC sub characteristic index m_k is the number of ISO/IEC 9126 sub characters which is used for defining the k^{th} ISO/IEC 9126 characteristic
q; q=1,2,...,n_{ijkl}	Question index for Technical Criteria n_{ijkl} is the number of questions used to evaluate ith component, j^{th} criteria, k^{th} ISO/IEC 9126 characteristic and l^{th} ISO/IEC 9126 sub characteristic match.
p; p=1,2,...,n_{ij}	Question index for Marketing Criteria n_{ij}. is the number of questions used to evaluate ith component and j^{th} criteria match.

Table 13 Variables used in BPM Evaluation Framework Model

Variable	Description
AS	Ability score of BPM system
CS	Completeness score of BPM system
CVS	Completeness of Vision score of BPM system
AES	Ability Execute score of BPM system
w_i; $i = 1,2,\ldots,9$	Weight of component *i* over BPM system evaluation

AS_i; $i = 1,2,\ldots,9$	Ability score of component *i*
CS_i; $i = 1,2,\ldots,9$	Completeness score of component *i*
CVS_i; $i = 1,2,\ldots,9$	Completeness of Vision score of component *i*
AES_i; $i = 1,2,\ldots,9$	Ability to Execute score of component *i*
w_{ij}; $i = 1,2,\ldots,9,$ $j = 1,2,\ldots,45$	Weight of sub subcriteria *j* over the related criteria for evaluation of component *i*
AS_{ij}; $i = 1,2,\ldots,9,$ $j = 1,2,\ldots,20$	Score of j^{th} Ability sub criteria for component *i*
CS_{ij}; $i = 1,2,\ldots,9,$ $j = 21,22,\ldots,30$	Score of j^{th} Completeness sub criteria for component *i*
CVG_{ij}; $i = 1,2,\ldots,9,$ $j = 31,32,\ldots,38$	Score of j^{th} Completeness of Vision sub criteria for component *i*
AEG_{ij}; $i = 1,2,\ldots,9,$ $j = 39,40,\ldots,45$	Score of j^{th} Ability to Execute sub criteria for component *i*
w_{ijk}; $i = 1,2,\ldots,9,$ $j = 1,2,\ldots,30,$ $k = 1,2,\ldots,6$	Weight of k^{th} ISO/IEC 9126 characteristic over j^{th} technical sub criteria for evaluation of component *i*
AS_{ijk}; $i = 1,2,\ldots,9,$ $j = 1,2,\ldots,20,$ $k = 1,2,\ldots,6$	Score of k^{th} ISO/IEC 9126 characteristic and j^{th} Ability sub criteria match for component *i*
CS_{ijk}; $i = 1,2,\ldots,9,$ *j=21,22,...,30*, $k = 1,2,\ldots,6$	Score of k^{th} ISO/IEC 9126 characteristic and j^{th} Completeness sub criteria match for component *i*
w_{ijkl}; $i = 1,2,\ldots,9,$ $j = 1,2,\ldots,30$ $k = 1,2,\ldots,6,$ $l = 1,2,\ldots,m_k$	Weight of l^{th} ISO/IEC 9126 sub characteristic over k^{th} ISO/IEC 9126 characteristic and j^{th} technical sub criteria match for evaluation of component *i*
AS_{ijkl}; $i = 1,2,\ldots,9,$ $j = 1,2,\ldots,20$ $k = 1,2,\ldots,6,$ $l = 1,2,\ldots,m_k$	Score of l^{th} ISO/IEC 9126 sub characteristic, k^{th} ISO/IEC 9126 characteristic and j^{th} Ability sub criteria for component *i*

CS_{ijkl}; $i = 1,2,\ldots,9, \quad j = 21,22,\ldots,30$ $k = 1,2,\ldots,6, \quad l = 1,2,\ldots,m_k$	Score of l^{th} ISO/IEC 9126 sub characteristic, k^{th} ISO/IEC 9126 characteristic and j^{th} Completeness sub criteria for component *i*
AG_{ijklq} $i = 1,2,\ldots,9, \quad j = 21,22,\ldots,30$ $k = 1,2,\ldots,6, \quad l = 1,2,\ldots,m_k,$ $q = 1,2,\ldots,n_{ijkl}$	Grade for q^{th} question of l^{th} ISO/IEC 9126 sub characteristic, k^{th} ISO/IEC 9126 characteristic and j^{th} Ability sub criteria match for component *i*
CG_{ijklq} $i = 1,2,\ldots,9, j = 21,22,\ldots,30$ $k = 1,2,\ldots,6, l = 1,2,\ldots,m_k,$ $q = 1,2,\ldots,n_{ijkl}$	Grade for q^{th} question of l^{th} ISO/IEC 9126 sub characteristic, k^{th} ISO/IEC 9126 characteristic and j^{th} Completeness sub criteria match for component *i*
$w^t{}_{ijklq}$ $i = 1,2,\ldots,9, j = 1,2,\ldots,30$ $k = 1,2,\ldots,6, l = 1,2,\ldots,m_k,$ $q = 1,2,\ldots,n_{ijkl}$	Weight of q^{th} question over the l^{th} ISO/IEC 9126 sub characteristic, k^{th} ISO/IEC 9126 characteristic and j^{th} technical sub criteria match for evaluation of component *i*
CVG_{ijp} $i = 1,2,\ldots,9, \quad j = 31,32,\ldots,38$ $p = 1,2,\ldots,n_{ij}$	Grade for p^{th} question of j^{th} Completeness of Vision sub criteria for component *i*
AEG_{ijp} $i = 1,2,\ldots,9, \quad j = 39,32,\ldots,45$ $p = 1,2,\ldots,n_{ij}$	Grade for p^{th} question of j^{th} Ability to Execute sub criteria for component *i*
$w^m{}_{ijp}$; $i = 1,2,\ldots,9, \quad j = 31,32,\ldots,45$ $p = 1,2,\ldots,n_{ij}$	Weight of p^{th} question over the j^{th} marketing sub criteria for evaluation of component *i*

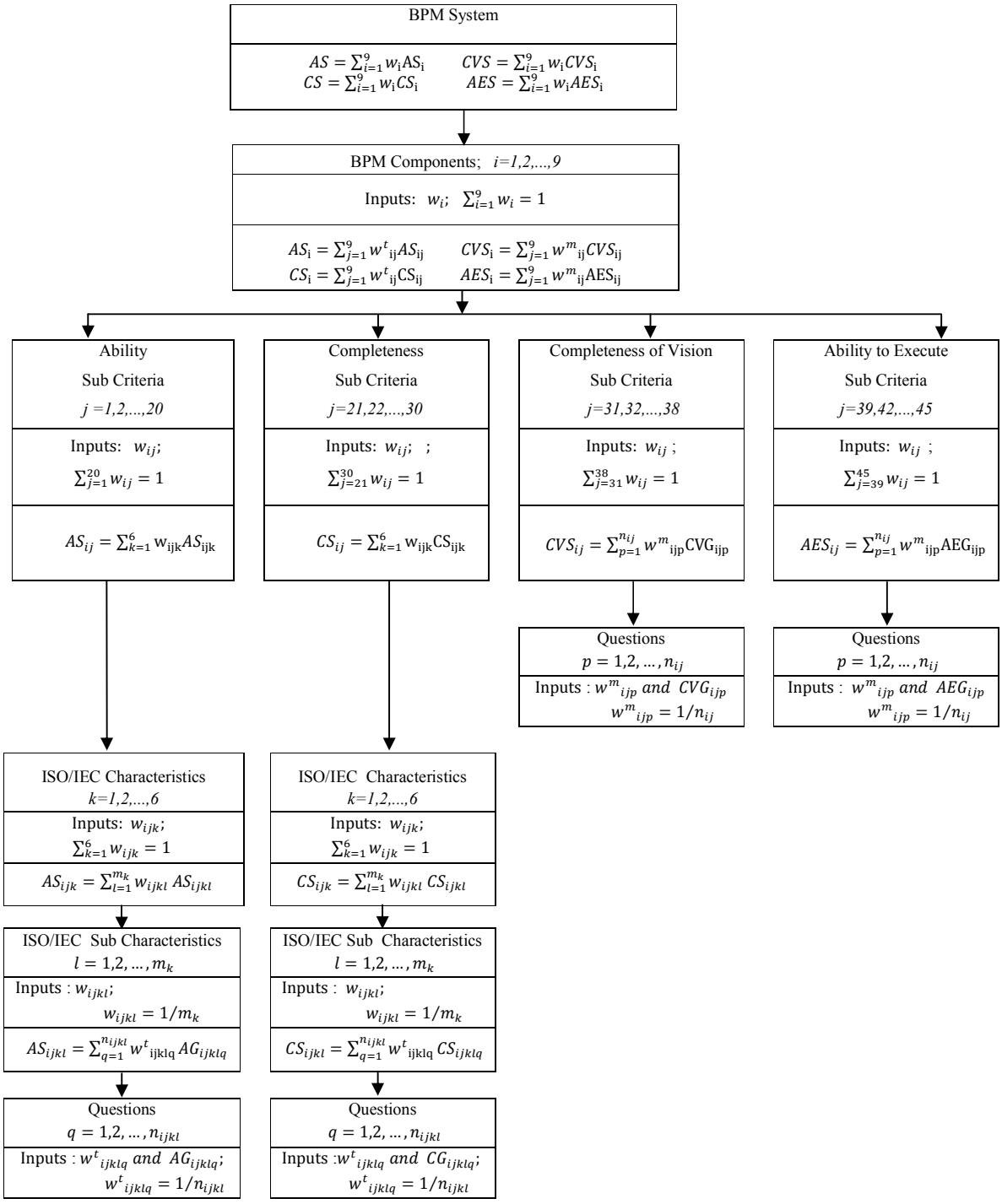


Fig 13 Quantification of the BPM System Evaluation Framework Model

Development of a DSS Based on the BPM Evaluation Framework Model

The developed framework model includes several relationships and in response to this necessity, an evaluation framework DSS is designed and programmed with Microsoft Access to respond to the complicated evaluation process of the framework. As there are many relationships within the framework, Microsoft Access is used to illustrate these relationships and also to store the evaluation data which are explained in the previous section. BPM Evaluation DSS allows entrance of necessary weights and the grades for questions, calculates necessary scores and generates required reports to see evaluation results in a detailed manner.

Database Design of BPM Evaluation DSS

The database given in Fig 14 is designed as the basis of this BPM Evaluation DSS. The ten different files generated are: BPM_COMPONENTS (Table 14), CRITERIA (Table 15), SUBCRITERIA (Table 16), ISO_CHAR (Table 17), ISO_SUBCHAR (Table 18), COMPONENT_SCORE (Table 19), SUBCRITERIA_SCORE (Table 20), ISO_CHAR_SCORE (Table 21), ISO_SUBCHAR_SCORE (Table 22) and QUESTIONS (Table 23). The fields for each file are explained in detail in the related tables.

Table 14 BPM Evaluation DSS: BPM Components Table (BPM_COMPONENT)

Field Name	Data Type	Description
ComponentID	Number	ID of BPM System Component
Component	Text	BPM System Component Name
Description	Memo	Description of BPM System Component

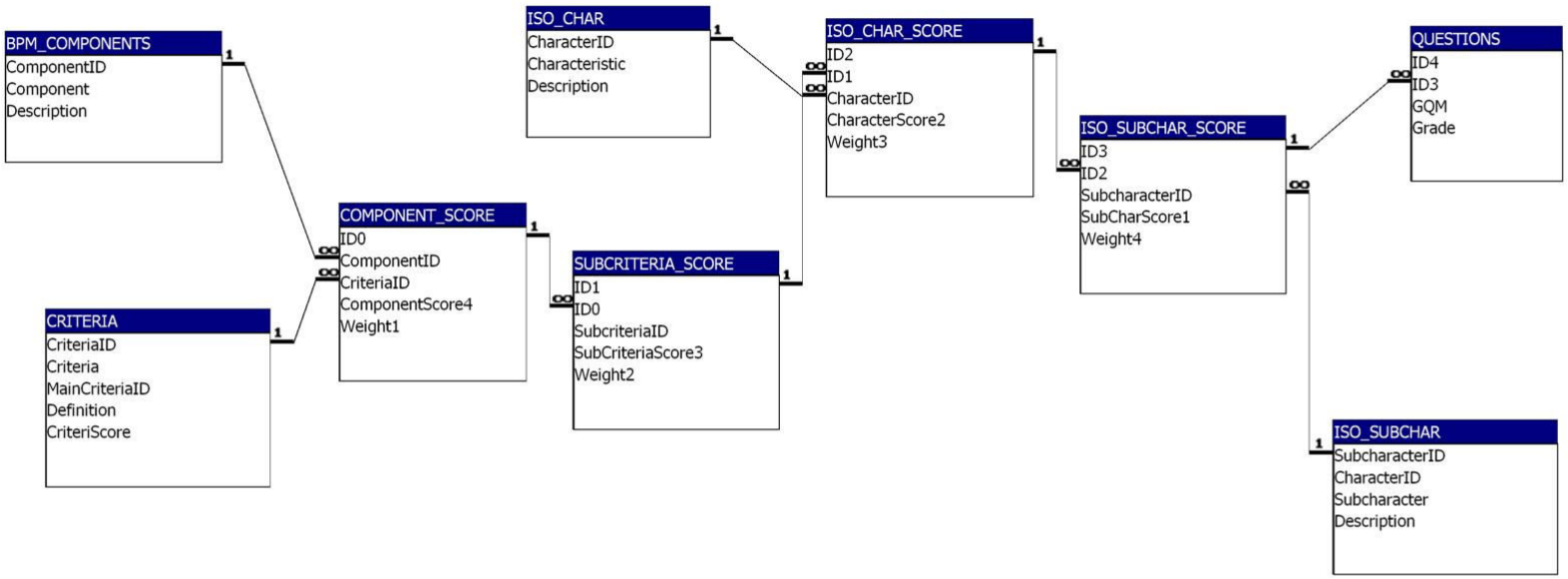


Fig 14 BPM Evaluation DSS – Database Relationships

Table 15 BPM Evaluation DSS: Criteria Table (CRITERIA)

Field Name	Data Type	Description
CriteriaID	AutoNumber	ID of Technical/Marketing Criteria
Criteria	Text	Technical/Marketing Criteria Name
MainCriteriaID	Text	ID of Main Criteria (Technical/Marketing)
Definition	Memo	Description of Technical/Marketing Criteria
CriteriaScore	Number	Score of Technical/Marketing Criteria

Table 16 BPM Evaluation DSS: Sub Criteria Table (SUBCRITERIA)

Field Name	Data Type	Description
SubCriteriaID	AutoNumber	ID of Technical/Marketing Sub Criteria
CriteriaID	Text	ID of Technical/Marketing Criteria
SubCriteria	Memo	Technical/Marketing Sub Criteria Name
Description	Number	Description of Technical/Marketing Sub Criteria

Table 17 BPM Evaluation DSS: ISO/IEC 9126 Characteristics Table (ISO_CHAR)

Field Name	Data Type	Description
CharacterID	AutoNumber	ID of ISO/IEC 9126 Characteristic
Characteristic	Text	Description of ISO/IEC 9126 Characteristic Name
Description	Memo	Description of ISO/IEC 9126 Characteristic

Table 18 BPM Evaluation DSS: ISO/IEC 9126 Sub Characteristics Table (ISO_SUBHAR)

Field Name	Data Type	Description
SubCharacterID	AutoNumber	ID of ISO/IEC 9126 Sub Characteristic
CharacterID	Number	ID of ISO/IEC 9126 Characteristic
SubCharacter	Text	Description of ISO/IEC 9126 Sub Characteristic Name
Description	Memo	Description of ISO/IEC 9126 Sub Characteristic

Table 19 BPM Evaluation DSS: Components Score Table (COMPONENT_SCORE)

Field Name	Data Type	Description
ID0	Number	ID of Component – Criteria
ComponentID	Number	ID of BPM System Component
CriteriaID	Number	ID of Technical/Marketing Criteria
ComponentScore4	Number	Component Level Score
Weight1	Number	Weight of Component over BPM System Evaluation

Table 20 BPM Evaluation DSS: Sub Criteria Score Table (SUBCRITERIA_SCORE)

Field Name	Data Type	Description
ID1	Number	ID of Component – Sub Criteria
ID0	Number	ID of Component – Criteria
SubCriteriaID	Number	ID of Technical/Marketing Sub Criteria
SubCriteriaScore3	Number	Sub Criteria Level Score
Weight2	Number	Weight of Sub Subcriteria over The Related Criteria for Evaluation of Component

Table 21 BPM Evaluation DSS: ISO/IEC 9126 Characteristics Score Table (ISO_CHAR_SCORE)

Field Name	Data Type	Description
ID2	Number	ID of Component – Sub Criteria –Character Match
ID1	Number	ID of Component – Sub Criteria
CharacterID	Number	ID of ISO/IEC 9126 Characteristic
CharacterScore2	Number	Character Level Score
Weight3	Number	Weight of ISO/IEC 9126 Characteristic over Technical Sub Criteria for Evaluation of Component

Table 22 BPM Evaluation DSS: ISO/IEC 9126 Sub Characteristics Score Table (ISO_SUBCHAR_SCORE)

Field Name	Data Type	Description
ID3	Number	ID of Component – Sub Criteria – Sub Character Match
ID2	Number	ID of Component – Sub Criteria –Character Match
SubCharacterID	Number	ID of ISO/IEC 9126 Sub Characteristic
SubCharacterScore1	Number	Sub Character Level Score
Weight4	Number	Weight of ISO/IEC 9126 Sub Characteristic Over ISO/IEC 9126 characteristic and technical sub criteria match for evaluation of component

Table 23 BPM Evaluation DSS: Questions Table (QUESTIONS)

Field Name	Data Type	Description
ID4	Number	ID of Question
ID3	Number	ID of Component – Sub Criteria – Sub Character Match
Question	Memo	Question
Grade	Number	Grade of Related Question

Input Forms of BPM Evaluation DSS

After the database design is completed, the necessary data input forms which are Weights Entrance Form, Grade Entrance Form and Calculation of Scores Form are designed.

Weights Entrance Form

In the evaluation process not all of the relations between ISO/IEC 9126 sub character and ISO/IEC 9126 character, ISO/IEC 9126 character and sub criteria, sub criteria and criteria, component and criteria may have the same importance level. Therefore, it is important to give weights for relations in order to reflect the effect of this importance on the given grades. BPM Evaluation DSS provides a Weight Entrance Form (Fig 15) where all of the necessary definitions are shown in order to enter the appropriate weight:

- Information for the BPM system component
- Information for Technical or Marketing Criteria
- Information for Technical or Marketing sub criteria
- Information for ISO/IEC 9126 characteristics
- Information for ISO/IEC 9126 sub characteristics

The scale of weights is from 1 to 5 and can be selected from combo box in Weights Entrance Form (Fig 15). Since given weights are calculated by using weighted average method, the calculated scores are normalized.

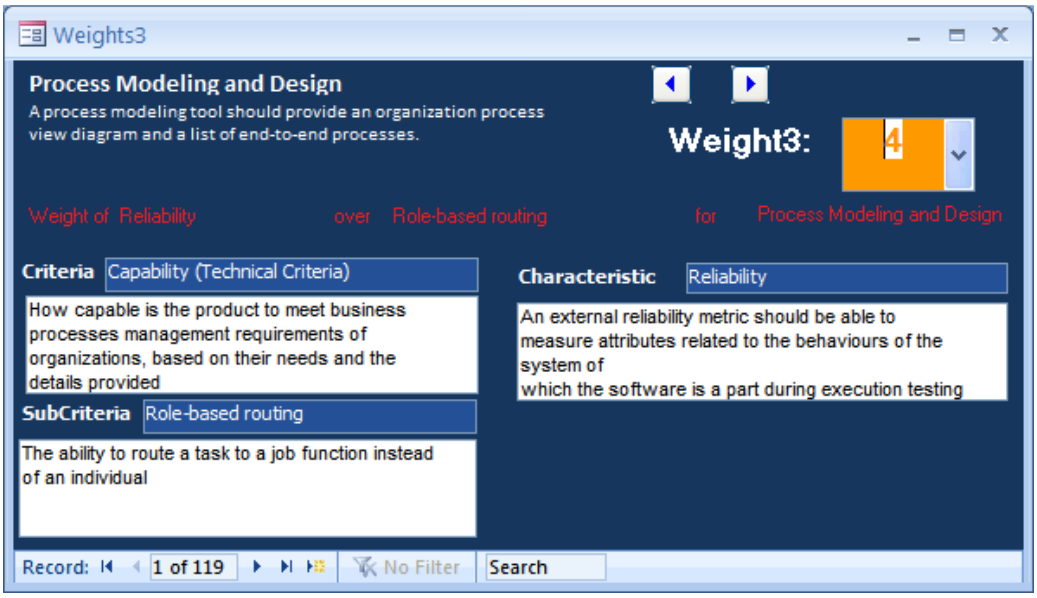


Fig 15 BPM Evaluation DSS - Weights Entrance Form

As shown in Fig 15, effect of fault tolerance of Reliability characteristic of Role-based routing of the PMD component's capability is the weight to calculate scores and all necessary information is given in the form.

Grade Entrance Form

Grade Entrance Form allows evaluators to insert appropriate grades for the questions determined in the BPM evaluation framework model. The Grade Entrance Form (Fig 16) in BPM Evaluation DSS supports:

- Selection of BPM components supported by the BPM product,
- Information for Technical and Marketing Criteria for the question being evaluated,

- Information for Technical and Marketing sub criteria for the question being evaluated,
- Information for ISO/IEC 9126 characteristics for the question being evaluated,
- Information for ISO/IEC 9126 sub characteristics for the question being evaluated,
- Question determined in the BPM evaluation framework model for the related match,
- For grade entrance field, scales for the grades are predefined and shown in a combo box for selection as suggested by TEC (2007). The following are the definitions:
    - "0" – Not Supported: If the BPM product does not support the feature,
    - "20" – Future Release: If the feature will be added and supported in future releases,
    - "40" – Customization": If a change in the source code is required to support the feature,
    - "60" – Third Party: If a third party product supports the feature,
    - "70" – Modification": If modifications such as screen configurations, reports and GUI tailoring are needed,
    - "80" – Add-on Products: If add on products are offered by partners to support the feature,
    - "95" - Integrated Partner Solution: If an integrated partner solution is provided,

- "100" – Supported: If product supports the feature..

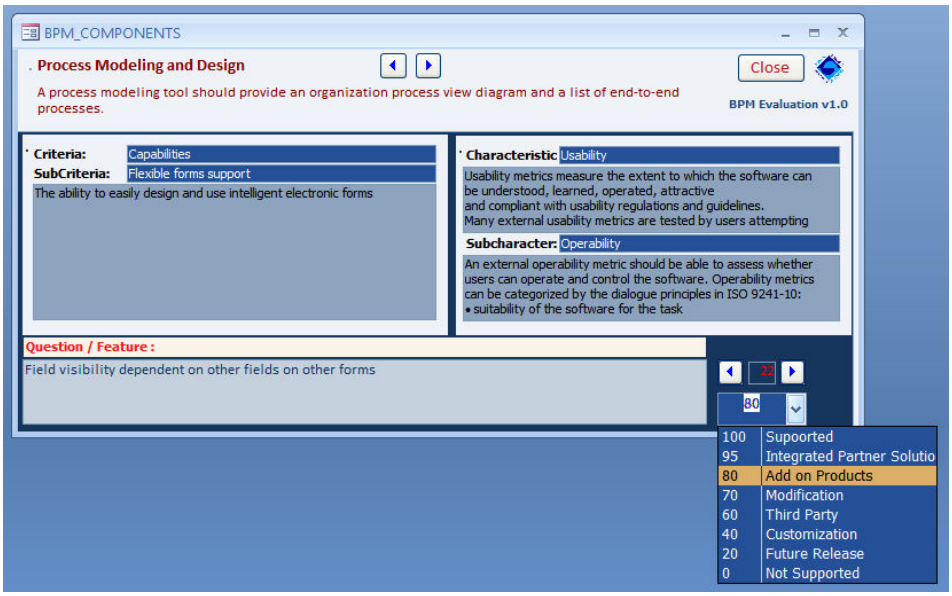


Fig 16 BPM Evaluation DSS – Grades for Questions

Another key point is to provide definition of evaluation criteria related to the goal question. The matching criteria, sub criteria, character and sub character for the goal question is also provided. It is important to read the descriptions before answering the questions, because goal questions are the suppressed version of all the matching. For example, the "Field visibility dependent on other fields on other forms" capability of a BPM product is matched with "Flexible Form Support" sub criteria, so that when answering these question "Flexible Form Support" capability should also be considered. Therefore, an evaluator must understand the "BPM Administration" sub criteria to accurately answer this question (Fig 16).

Calculation of Scores Form

After the grades and the weights are entered in to the database, the next step is to calculate final scores to find out where BPM Evaluation DSS fits in the matrix. To

calculate BPM scores, a form is available and users can calculate scores separately or calculate all scores with a button (Fig. 17)

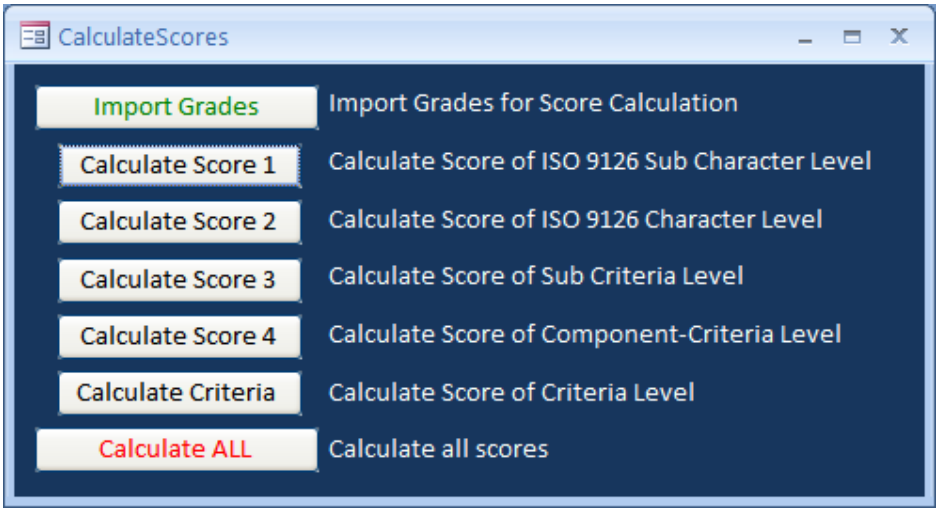


Fig 17 BPM Evaluation DSS – Calculation of BPM Scores

The calculation steps, which are illustrated in Fig 18, can be described, based on an example, as follows:

Step 1: The grade “60” is given for the question “Is there a form server for storing and managing form data which user easily use?”,

Step 2: The Average of questions is calculated to find sub character (“Understandability”) score of component (“Document Management System”) – criteria (“Capabilities”) - sub criteria (“Flexible Form Support”) – characteristic (“Usability”) - sub character (“Understandability”) relation. Since there is only one question, the result is 60 for sub character (“Understandability”),

Step 3: The Characteristic (“Usability”) score is calculated from the weighted averages of sub characteristics (“Understandability and Operability”). Since the Understandability score is “60” and the Operability score is “40”, the equally weighted average score for Usability is “50” (=[(40*5)+(60*5)]/(5+5)),

Step 4: Weighted average of characteristics (“Usability and Functionality”) for sub criteria (“Flexible Form Support”) is calculated. The Usability score is calculated as “50” and similarly the Functionality score is “40”. Therefore Flexible Form Support score is “44” (≅ [(50*3)+(40*4)]/(3+4)),

Step 5: The weighted capability score of the component (“Document Management System”) is calculated from the sub criteria (“Authentication and Security, and Flexible Form Support”). The Flexible Form Support score is “44”, and similarly the Authentication and Security score is calculated as “60”, so that the capability score of Document Management System is calculated as “55” (≅ [(44*2)+(60*4)]/(2+4)),

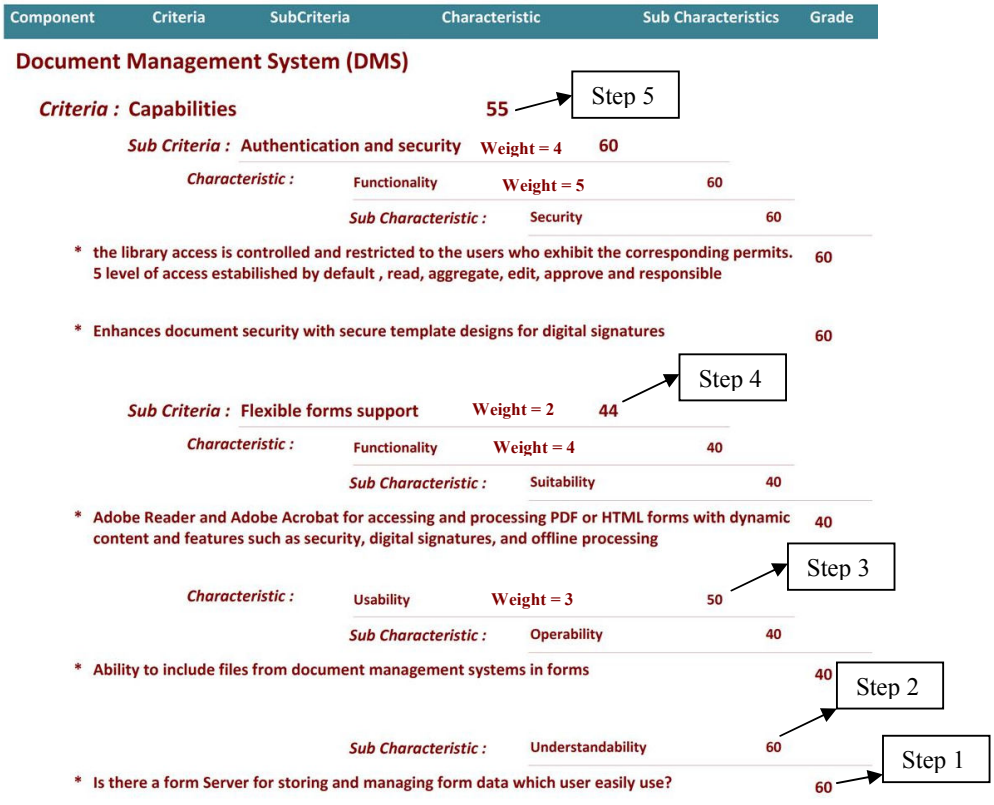


Fig 18 BPM Evaluation DSS – Score Calculation Steps

Furthermore, criteria scores for the BPM product are calculated using each component's score for each related criteria (Fig 19). For example, for the overall BPM product the completeness score can be calculated by the use of weight and scores for the respective component:

([(100*5)+(100*5)+(99*5)+(0*5)+(45*5)+(96*5)+(97*5)+(79*5)+(100*5)]/(5+5+5+5+5+5+5+5+5+5) ≈ 80)

Therefore, the completeness of the BPM system has approximately "80" points which can be positioned as Application Specific BPM or General Purpose BPM according to capability score it has.

BPM Evaluation

ISO 9126 - Characteristic Level Score

Component	Criteria		Score
Activity Based Costing (ABC)			
	Completeness	Weight = 5	100
Balanced Scorecard (BSC)			
	Capabilities	Weight = 5	100
	Completeness	Weight = 5	100
Business Activity Monitoring (BAM)			
	Capabilities	Weight = 5	91
	Completeness	Weight = 5	99
Business Rule Engine (BRE)			
	Capabilities	Weight = 5	96
	Completeness	Weight = 5	0
Document Management System (DMS)			
	Completeness	Weight = 5	45
	Capabilities	Weight = 5	5
Enterprise Application Integration (EAI)			
	Completeness	Weight = 5	96
	Capabilities	Weight = 5	99
Process (Workflow) Engine			
	Capabilities	Weight = 5	99
	Completeness	Weight = 5	97
Process Modeling and Design			
	Capabilities	Weight = 5	85
	Completeness	Weight = 5	79
Simulation			
	Capabilities	Weight = 5	86
	Completeness	Weight = 5	100
Marketing Aspect			
	Completeness of Vision		95
	Ability to Execute		78

Fig 19 BPM Evaluation DSS - Component Criteria Report

Reports of BPM Evaluation DSS

The reports are designed to provide evaluation results in a detailed manner and can be selected from the Reports Form (Fig 20). In this way, there are seven different reports:

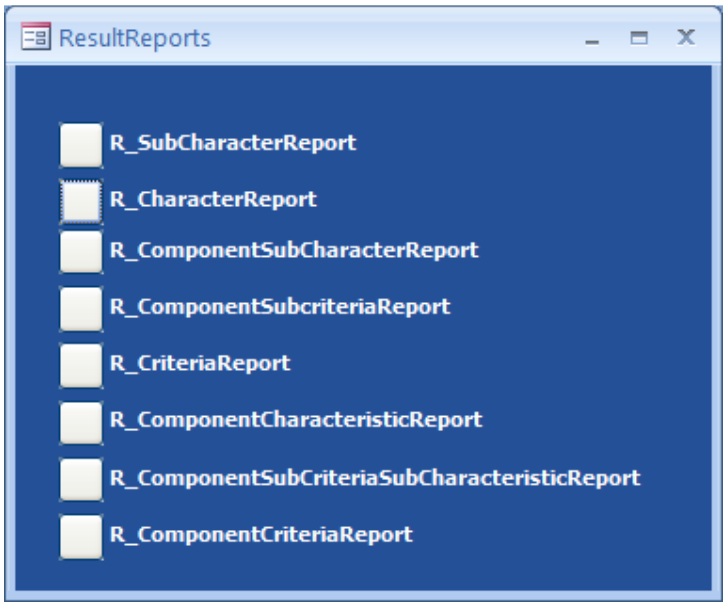


Fig 20 BPM Evaluation DSS – Reports

- R_SubCharacterReport: Indicates ISO/IEC 9126 sub characteristics level scores and number of questions related (Fig 21),
- R_CharacterReport: Indicates ISO/IEC 9126 characteristic level scores and number of questions related (Fig 22),
- R_ComponentSubcharacterReport: Indicates ISO/IEC 9126 sub characteristics level scores of each BPM system component number of questions related (Fig 23),
- R_ComponentSubcriteriaReport: Indicates sub criteria level scores of each BPM system component and number of questions related (Fig 24),

- R_CriteriaReport: Indicates criteria level scores of BPM system and number of questions related (Fig 25),
- R_ComponentCharacteristicReport: Indicates ISO/IEC 9126 characteristic level scores of each BPM system component and number of questions related (Fig 26),
- R_ComponentSubCriteriaSubCharacteristicReport: Indicates Sub Criteria and Sub Characteristic scores related to each BPM system component (Fig 18)
- R_ComponentCriteriaReport: Indicates criteria level scores for each BPM system component (Fig 29).

BPM Evaluation

ISO 9126 - Sub Character Level Score

Number of Questions	Characteristics	Sub Characteristics	Weighted Average
7	**Efficiency**		
	3	Resource Utilisation	47
	4	Time Behaviour	25
100	**Functionality**		
	2	Func. Compliance	50
	7	Accuracy	86
	23	Security	69
	33	Suitability	64
	35	Interoperatability	53
42	**Maintainability**		
	3	Testability	0
	4	Stability	68
	14	Changeability	71
	21	Analyzability	40
45	**Marketing**		
	45		70
13	**Portability**		
	1	Adaptability	40
	1	Installability	100
	5	Replaceability	40
	6	Co-existence	30
10	**Reliability**		
	1	Fault tolerance	100
	4	Maturity	100
	5	Recoverability	60
99	**Usability**		
	5	Learnability	16
	9	Understandability	43
	20	Attractiveness	51
	65	Operability	68
	316		

Page 1 of 1

Fig 21 BPM Evaluation DSS: ISO/IEC 9126 Sub Characteristic Level Score Report

BPM Evaluation

ISO 9126 - Characteristic Level Score

Number of Questions	Characteristic	Average Score
7	Efficiency	34
13	Portability	37
42	Maintainability	48
99	Usability	50
100	Functionality	59
45	Marketing	70
10	Reliability	80
316		

Fig 22 BPM Evaluation DSS: ISO/IEC 9126 Characteristic Level Score Report

BPM Evaluation

BPM Component ISO 9126 - Sub Characteristic Level Score

Component	Characteristic	Number of Questions	Subcharacter	Average Score
Process Modeling and Design				
	Efficiency			
		1	Time Behaviour	100
	Functionality			
		3	Accuracy	100
		9	Interoperatability	71
		5	Security	92
		3	Suitability	100
	Maintainability			
		6	Analyzability	17
		3	Changeability	100
		1	Stability	100
		1	Testability	0
	Portability			
		1	Co-existence	0
		4	Replaceability	25
	Reliability			
		1	Fault tolerance	100
	Usability			
		12	Attractiveness	73
		2	Learnability	40
		21	Operability	88
		4	Understandability	55

Fig 23 BPM Evaluation DSS – BPM Component – ISO/IEC 9126 Characteristic Level Score Report

BPM Evaluation

BPM Component - Sub criteria Level Score

Component	Criteria	Number of Questions	SubCriteria	Weighted Average
Process Modeling and Design				
	Capabilities			
		2	Authentication and security	100
		1	Automation agents	0
		1	Custom views	40
		1	Distributed User administration	100
		37	Flexible forms support	44
		2	Role-based routing	100
		1	Sub-processes	100
	Completeness			
		1	Business metrics and monitoring	100
		2	Collaborative design	50
		25	Graphical designer	60
		2	Modeling	0
		2	Organization charts and directory integration	50

Fig 24 BPM Evaluation DSS – BPM Component – Sub Criteria Level Score Report

BPM Evaluation

Criteria Level Score

Number of Questions	Criteria	Criteria Score
163	Capability (Technical Criteria)	34
108	Completeness (Technical Criteria)	35
8	Completeness of Vision (Marketing Criteria)	48
37	Ability to Execute (Marketing Criteria)	57

Technical Criteria Matrix:

BPM Enabler :
Capability 0-50 Completeness 0-50

BPM Engines:
Capability 50-100 Completeness 0-50

Application Specific BPM:
Capability 0-50 Completeness 50-100

General Purpose BPM:
Capability 50-100 Completeness 50-100

Marketing Criteria Matrix:

Niche Players :
Capability 0-50 Completeness 0-50

Challengers:
Capability 50-100 Completeness 0-50

Visionaires:
Capability 0-50 Completeness 50-100

Leaders:
Capability 50-100 Completeness 50-100

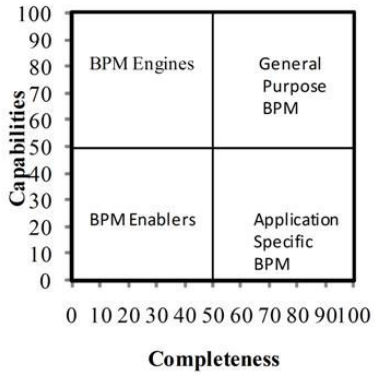


Fig 25 BPM Evaluation DSS – Criteria Level Score Report

BPM Evaluation

BPM Component - ISO 9126 Characteristic Level Score

Component	Number of Questions	Characteristic	Score
Process Modeling and Design			
	1	Efficiency	100
	20	Functionality	90
	11	Maintainability	37
	5	Portability	13
	1	Reliability	100
	39	Usability	61
Process (Workflow) Engine			
	2	Efficiency	20
	26	Functionality	76
	7	Maintainability	83
	3	Portability	67
	2	Reliability	50
	26	Usability	68
Business Rule Engine (BRE)			
	10	Functionality	49
	3	Maintainability	33
	5	Usability	39
Enterprise Application Integration (EAI)			
	1	Efficiency	0
	18	Functionality	27
	4	Portability	55
	2	Reliability	50
	3	Usability	33
Document Management System (DMS)			
	1	Efficiency	100
	3	Functionality	20
	2	Maintainability	0
	3	Usability	0

Fig 26 BPM Evaluation DSS – BPM Component - ISO/IEC 9126 Sub Characteristic Level Score Report

CHAPTER 4

EVALUATION OF TWO BPM SYSTEMS

In this chapter, the evaluation results of two different BPM systems are demonstrated with the generated reports from BPM Evaluation DSS.

One of the evaluated BPM systems is Bizitek's Netflow. Netflow is included in this study due to their interest in improvements in the BPM industry and their contributions during the design of the evaluation framework model.

Another BPM system being evaluated by BPM Evaluation DSS is the BEA BPM system. BEA is selected in this study since it has been evaluated in Gartner's Magic Quadrant and this provided the opportunity to compare results of the developed framework model with the existing evaluation of Gartner's Magic Quadrant.

Evaluation of Netflow Using BPM Evaluation DSS

Netflow is the BPM solution of Bizitek Company which was founded in 2000 as a subsidiary of Probil to provide companies with e-business end-to-end customer solution oriented software and consulting services. Since 2004 Bizitek has grown, providing business solutions to companies in Turkey and around the world.

Netflow is defined by Bizitek as a solution to help execute business processes according to the requirements. Netflow aims to minimize human errors, increases the quality of services, and insures prompt responses from decision makers through standardized workflows. As specified by Bizitek, Netflow presents modeling of related workflows according to companies needs to automate workflows, follow the action, check status reports, and see tangible results.

In order to understand Netflow capability, completeness, ability to execute and completeness of vision, the developed DSS is applied to the Netflow where all the related weights are assigned equally within the weight group. According to the results of reports generated from BPM Evaluation DSS:

- Accuracy, Security, Changeability and Operability sub characteristics of Netflow aspects are fair whereas Time Behaviour, Analyzability, Co-existence, Learnability aspects of Netflow are low (Fig 27),
- Reliability of Netflow is high whereas Efficiency and Portability of Netflow is low (Fig 28),
- Efficiency of PMD, DMS and ABC components are high whereas PE, BRE and EAI are low (Figures 29 and 45),
- Security of PMD and PE components is strong whereas Security of BRE and DMS are weak (Figures 30 and 46),
- Aspect of Business Metrics and Monitoring of Netflow's PMD component is high whereas it is low for BAM, ABC and BSC components (Figures 31 and 47),
- Technical Criteria scores are found to be low where as Marketing Criteria are fair for Netflow (Fig 32).

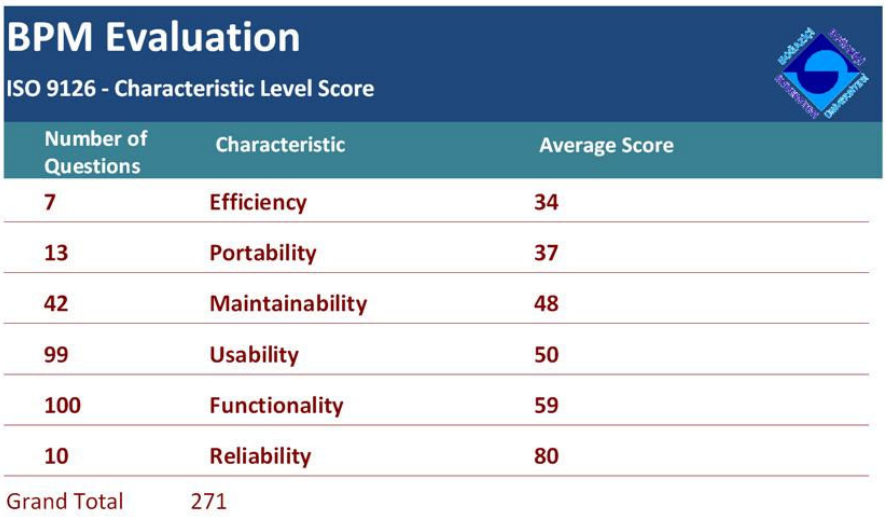
BPM Evaluation

ISO 9126 - Sub Character Level Score

Number of Questions	Characteristics	Sub Characteristics	Weighted Average
7	**Efficiency**		
	3	Resource Utilisation	47
	4	Time Behaviour	25
100	**Functionality**		
	2	Func. Compliance	50
	7	Accuracy	86
	23	Security	69
	33	Suitability	64
	35	Interoperatability	53
42	**Maintainability**		
	3	Testability	0
	4	Stability	68
	14	Changeability	71
	21	Analyzability	40
45	**Marketing**		
	45		70
13	**Portability**		
	1	Adaptability	40
	1	Installability	100
	5	Replaceability	40
	6	Co-existence	30
10	**Reliability**		
	1	Fault tolerance	100
	4	Maturity	100
	5	Recoverability	60
99	**Usability**		
	5	Learnability	16
	9	Understandability	43
	20	Attractiveness	51
	65	Operability	68
Grand Total	316		

Page 1 of 1

Fig 27 BPM Evaluation DSS – ISO/IEC 9126 Sub Characteristic Level Score Report (Netflow)
(The rest of the report is given in Appendix F)



BPM Evaluation

ISO 9126 - Characteristic Level Score

Number of Questions	Characteristic	Average Score
7	Efficiency	34
13	Portability	37
42	Maintainability	48
99	Usability	50
100	Functionality	59
10	Reliability	80
Grand Total	271	

Page 1 of 1

Fig 28 BPM Evaluation DSS – ISO/IEC 9126 Characteristic Level Score Report (Netflow)
(The rest of the report is given in Appendix F)

BPM Evaluation

BPM Component - ISO 9126 Characteristic Level Score

Component	Number of Questions	Characteristic	Score
Process Modeling and Design			
	1	Efficiency	100
	20	Functionality	90
	11	Maintainability	37
	5	Portability	13
	1	Reliability	100
	39	Usability	61
Process (Workflow) Engine			
	2	Efficiency	20
	26	Functionality	76
	7	Maintainability	83
	3	Portability	67
	2	Reliability	50
	26	Usability	68
Business Rule Engine (BRE)			
	10	Functionality	49
	3	Maintainability	33
	5	Usability	39
Enterprise Application Integration (EAI)			
	1	Efficiency	0
	18	Functionality	27
	4	Portability	55
	2	Reliability	50
	3	Usability	33
Document Management System (DMS)			
	1	Efficiency	100
	3	Functionality	20
	2	Maintainability	0
	3	Usability	0

Fig 29 BPM Evaluation DSS – BPM Component - ISO/IEC 9126 Characteristic Level Score Report (Netflow) (The rest of the report is given in Appendix F)

BPM Evaluation

BPM Component ISO 9126 - Sub Characteristic Level Score

Component	Characteristic	Number of Questions	Subcharacter	Average Score
Process Modeling and Design				
	Efficiency			
		1	Time Behaviour	100
	Functionality			
		3	Accuracy	100
		9	Interoperatability	71
		5	Security	92
		3	Suitability	100
	Maintainability			
		6	Analyzability	17
		3	Changeability	100
		1	Stability	100
		1	Testability	0
	Portability			
		1	Co-existence	0
		4	Replaceability	25
	Reliability			
		1	Fault tolerance	100
	Usability			
		12	Attractiveness	73
		2	Learnability	40
		21	Operability	88
		4	Understandability	55

Fig 30 BPM Evaluation DSS – BPM Component – ISO/IEC 9126 Sub Characteristic Level Score Report (Netflow) (The rest of the report is given in Appendix F)

BPM Evaluation

BPM Component - Sub criteria Level Score

Component	Criteria	Number of Questions	SubCriteria	Weighted Average
Process Modeling and Design				
	Capabilities			
		2	Authentication and security	100
		1	Automation agents	0
		1	Custom views	40
		1	Distributed User administration	100
		37	Flexible forms support	44
		2	Role-based routing	100
		1	Sub-processes	100
	Completeness			
		1	Business metrics and monitoring	100
		2	Collaborative design	50
		25	Graphical designer	60
		2	Modeling	0
		2	Organization charts and directory integration	50

Fig 31 BPM Evaluation DSS – BPM Component – Sub Criteria Level Score Report (Netflow)
(The rest of the report is given in Appendix F)

BPM Evaluation

Criteria Level Score

Number of Questions	Criteria	Criteria Score
163	Capability (Technical Criteria)	34
108	Completeness (Technical Criteria)	35
8	Completeness of Vision (Marketing Criteria)	48
37	Ability to Execute (Marketing Criteria)	57

Technical Criteria Matrix:

BPM Enabler :
Capability 0-50 Completeness 0-50

BPM Engines:
Capability 50-100 Completeness 0-50

Application Specific BPM:
Capability 0-50 Completeness 50-100

General Purpose BPM:
Capability 50-100 Completeness 50-100

Marketing Criteria Matrix:

Niche Players :
Capability 0-50 Completeness 0-50

Challengers:
Capability 50-100 Completeness 0-50

Visionaires:
Capability 0-50 Completeness 50-100

Leaders:
Capability 50-100 Completeness 50-100

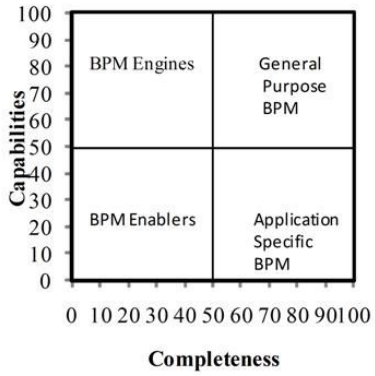


Fig 32 BPM Evaluation DSS – Criteria Level Score Report (Netflow)
(The rest of the report is given in Appendix F)

According to developed evaluation framework, Netflow's capability and completeness scores are calculated as 33 and 34. As a result, according to Khan (2004), Netflow can be categorized as a BPM enabler software which scores low in both capability and completeness. BPM enablers are considered infrastructure technologies and by adding code and logic they can be used as a BPM solution as discussed in literature survey studies (Fig 33).

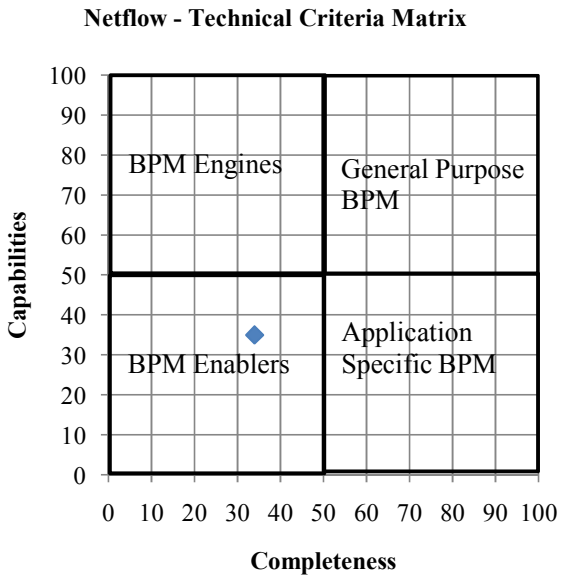


Fig 33 Netflow Technical Criteria Matrix

Furthermore, Bizitek's ability to execute and completeness of vision scores are calculated as 57 and 48. Therefore, Bizitek is positioned as a visionary company which is a new family member of BPM suite market and has less operation and less market visibility compared to leaders and challengers as previously explained in literature studies (Fig 34).

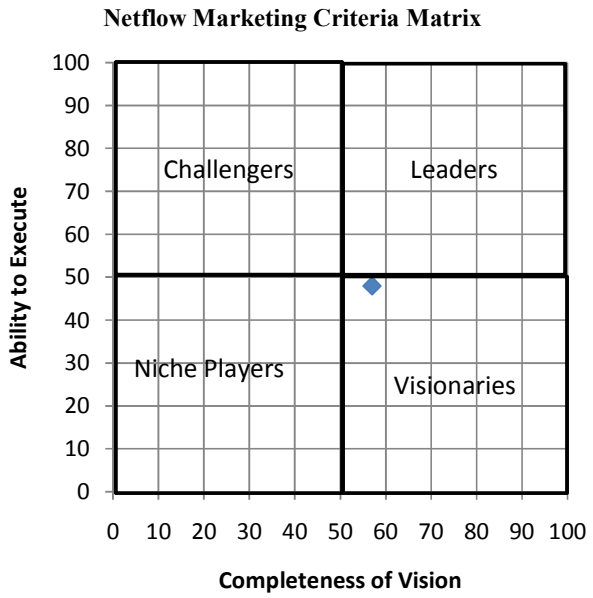


Fig 34 Netflow Marketing Criteria Matrix

Evaluation of BEA AquaLogic Using BPM Evaluation DSS

BEA Inc. is known for three middleware products which are Tuxedo, WebLogic, and the latest AquaLogic family of SOA products. In 2006, BEA Inc. acquired Fuego which was a leading "pure play" BPM system. BEA AquaLogic BPM Suite is an all-inclusive BPM system which combines modeling, implementation, execution, and monitoring of end-to-end business processes to sustain nonstop optimization of the whole business process lifecycle. In 2008, BEA was acquired by Oracle and aims to offer enhanced middleware products, letting customers to simply build, deploy, and manage applications in a secure environment

In order to understand BEA capability, completeness, ability to execute and completeness of vision, the developed DSS is applied to the BEA where all the

related weights are assigned equally within the weight group. According to the results of reports generated from BPM Evaluation DSS:

- Time Behavior, Accuracy, Security, Suitability, Changeability, Adaptability and Operability sub characteristics of BEA aspects are strong whereas Resource Utilization and Maturity aspects of BEA are fair (Fig 35),
- Portability and Functionality of BEA are high whereas Reliability is less strong (Fig 36),
- Efficiency of PMD, PE, BRE, BAM, ABC, and BSC is high whereas it is low for DMS component (Figures 37 and 49),
- Security of PMD, PE, BRE and BAM components is strong whereas it is weak for DMS component (Figures 38 and 50)
- Aspect of BPM Administration of BEA's PE and BAM components is high where it is low for DMS component (Figures 39 and 51),
- Technical aspects of BEA is strong and marketing aspect is also sufficient. However Ability to Execute features of marketing aspect can be improved (Fig 40).

BPM Evaluation

ISO 9126 - Sub Character Level Score

Number of Questions	Characteristics	Sub Characteristics	Weighted Average
7	**Efficiency**		
	3	Resource Utilisation	67
	4	Time Behaviour	100
100	**Functionality**		
	2	Func. Compliance	100
	7	Accuracy	86
	23	Security	83
	33	Suitability	91
	35	Interoperatability	88
42	**Maintainability**		
	3	Testability	100
	4	Stability	85
	14	Changeability	100
	21	Analyzability	78
45	**Marketing**		
	45		81
13	**Portability**		
	1	Adaptability	100
	1	Installability	100
	5	Replaceability	100
	6	Co-existence	90
10	**Reliability**		
	1	Fault tolerance	100
	4	Maturity	50
	5	Recoverability	100
99	**Usability**		
	5	Learnability	80
	9	Understandability	82
	20	Attractiveness	83
	65	Operability	88
	316		

Page 1 of 1

Fig 35 BPM Evaluation DSS – ISO/IEC 9126 Sub Characteristic Level Score Report (BEA)
(The rest of the report is given in Appendix G)

BPM Evaluation

ISO 9126 - Characteristic Level Score

Number of Questions	Characteristic	Average Score
10	Reliability	80
99	Usability	85
7	Efficiency	86
42	Maintainability	88
100	Functionality	89
13	Portability	95
271		

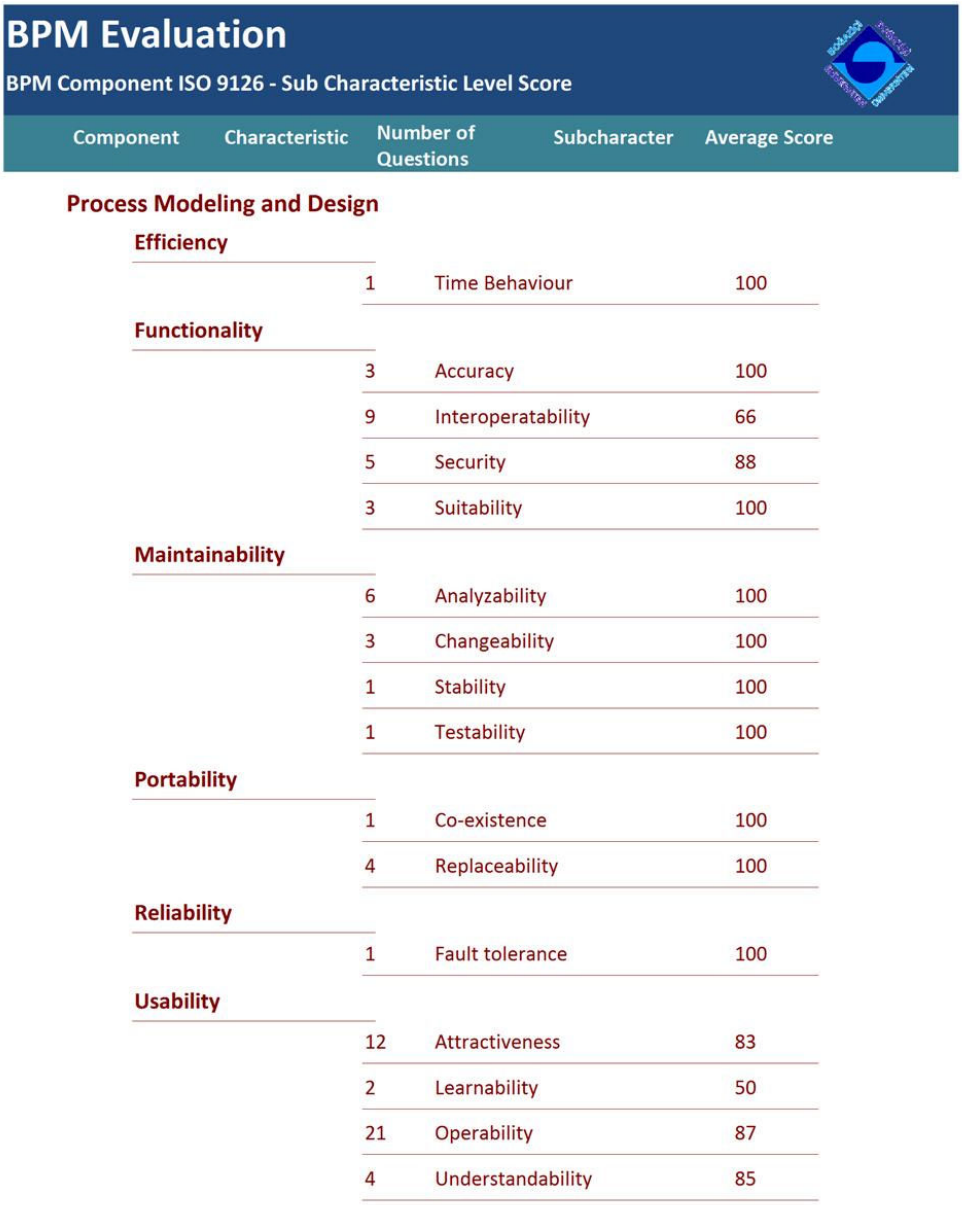
Fig 36 BPM Evaluation DSS – ISO 9126 Characteristic Level Score Report (BEA) (The rest of the report is given in Appendix G)

BPM Evaluation

BPM Component - ISO 9126 Characteristic Level Score

Component	Number of Questions	Characteristic	Score
Process Modeling and Design			
	1	Efficiency	100
	20	Functionality	85
	11	Maintainability	100
	5	Portability	100
	1	Reliability	100
	39	Usability	77
Process (Workflow) Engine			
	2	Efficiency	100
	26	Functionality	95
	7	Maintainability	100
	3	Portability	80
	2	Reliability	100
	26	Usability	98
Business Rule Engine (BRE)			
	10	Functionality	100
	3	Maintainability	67
	5	Usability	87
Enterprise Application Integration (EAI)			
	1	Efficiency	100
	18	Functionality	91
	4	Portability	100
	2	Reliability	100
	3	Usability	100
Document Management System (DMS)			
	1	Efficiency	0
	3	Functionality	0
	2	Maintainability	40
	3	Usability	47

Fig 37 BPM Evaluation DSS – BPM Component - ISO/IEC 9126 Characteristic Level Score Report (BEA) (The rest of the report is given in Appendix G)



BPM Evaluation

BPM Component ISO 9126 - Sub Characteristic Level Score

Component	Characteristic	Number of Questions	Subcharacter	Average Score
Process Modeling and Design				
	Efficiency			
		1	Time Behaviour	100
	Functionality			
		3	Accuracy	100
		9	Interoperatability	66
		5	Security	88
		3	Suitability	100
	Maintainability			
		6	Analyzability	100
		3	Changeability	100
		1	Stability	100
		1	Testability	100
	Portability			
		1	Co-existence	100
		4	Replaceability	100
	Reliability			
		1	Fault tolerance	100
	Usability			
		12	Attractiveness	83
		2	Learnability	50
		21	Operability	87
		4	Understandability	85

Page 1 of 7

Fig 38 BPM Evaluation DSS – BPM Component – ISO/IEC 9126 Sub Characteristic Level Score Report (BEA) (The rest of the report is given in Appendix G)

BPM Evaluation

BPM Component - Sub criteria Level Score

Component	Criteria	Number of Questions	SubCriteria	Weighted Average
Process Modeling and Design				
	Capabilities			
		2	Authentication and security	100
		1	Automation agents	0
		1	Custom views	100
		1	Distributed User administration	100
		37	Flexible forms support	92
		2	Role-based routing	100
		1	Sub-processes	100
	Completeness			
		1	Business metrics and monitoring	100
		2	Collaborative design	100
		25	Graphical designer	93
		2	Modeling	100
		2	Organization charts and directory integration	0

Fig 39 BPM Evaluation DSS – BPM Component – Sub Criteria Level Score Report (BEA) (The rest of the report is given in Appendix G)

BPM Evaluation

Criteria Level Score

Number of Questions	Criteria	Criteria Score
37	Ability to Execute (Marketing Criteria)	78
108	Completeness (Technical Criteria)	80
163	Capability (Technical Criteria)	83
8	Completeness of Vision (Marketing Criteria)	95

Technical Criteria Matrix:

BPM Enabler :
Capability 0-50 Completeness 0-50

BPM Engines:
Capability 50-100 Completeness 0-50

Application Specific BPM:
Capability 0-50 Completeness 50-100

General Purpose BPM:
Capability 50-100 Completeness 50-100

Marketing Criteria Matrix:

Niche Players :
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Visionaires:
Capability 0-50 Completeness 50-100

Leaders:
Capability 50-100 Completeness 50-100

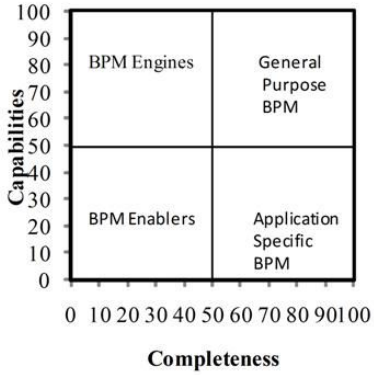

Fig 40 BPM Evaluation DSS – Criteria Level Score Report (BEA) (The rest of the report is given in Appendix G)

In accordance with developed DSS BEA's capability and completeness scores are calculated as 83 and 80. Thus, BEA can be classified as a general purpose BPM system which scores high at both capability and completeness. A General purpose BPM system focuses on the entire process lifecycle from the design phase to analysis and optimization (Fig 42).

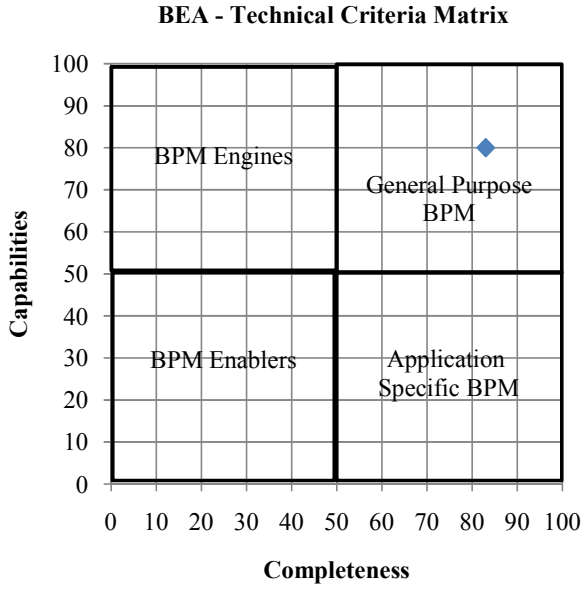

Fig 41 BEA Technical Criteria Matrix

Additionally, BEA's ability to execute and completeness of vision scores are calculated as 78 and 95. As a result, BEA is positioned as a leader BPM company particularly capable of providing high partnership between business users and IT professionals, both at the design and modeling phase and in the execution and optimization phases as clarified in literature studies (Fig 43).

Fig 42 BEA Marketing Criteria Matrix

Comparison of Netflow and BEA

This part illustrates the comparison results of Netflow and BEA BPM system and detailed score comparisons are also provided.

In order to see the difference explicitly, capability and completeness scores of Netflow and BEA are shown in the matrix. Netflow scores are low while BEA scores are high both in the capability and completeness criteria. As a result, Netflow is positioned as a BPM enabler solution while BEA is positioned as general purpose BPM solution (Fig 43).

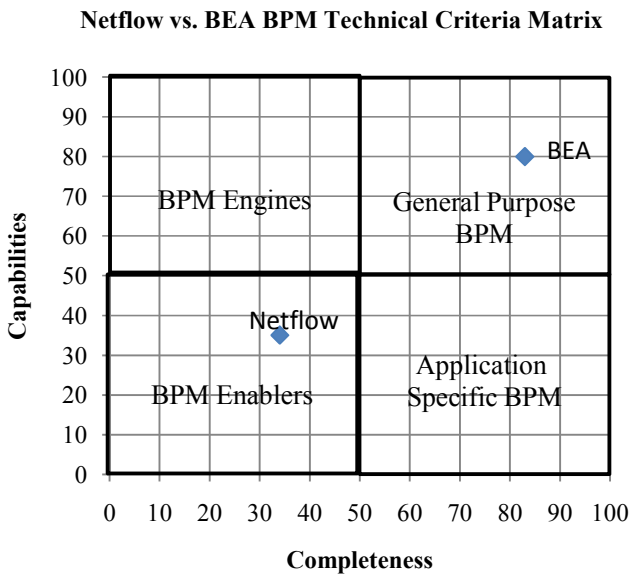

Fig 43 Netflow vs. BEA – Technical Criteria Matrix

Furthermore, the ability to execute and completeness of vision scores determine the position of Bizitek and BEA in Marketing Criteria matrix. BEA scores high on both criteria while Bizitek scores high in completeness of vision and low in ability to execute. As a result, BEA is positioned as leader BPM vendor whereas Bizitek is ranked as a visionary company (Fig 44). Another important point is that the position of BEA evaluated with the DSS is the same as Gartner's magic quadrant in 2008 (Figures 5 and 44).

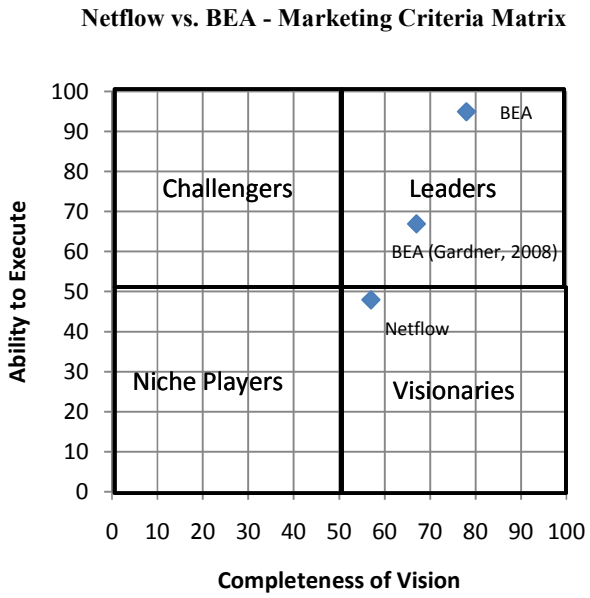

Fig 44 Netflow vs. BEA – Marketing Criteria Matrix

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Although the BPM industry is emerging rapidly, the acquisition of new BPM systems has resulted in confusion since not all implementations have resulted in an increase in performance and decrease in cost. Therefore, the organization should assess the BPM products based on standard criteria.

The aim of this study is to develop a DSS for evaluation of a BPM system. Therefore, previously used evaluation methods in literature and in the BPM industry, software evaluation standards, discussions with BPM system industry experts and existing BPM solution technologies available in the market were studied and researched to realize assessment process. After the research in above areas, it is clear that the BPM system consists of nine automated components. Therefore the framework model is based on the evaluation of these BPM system components. In respect to above research, three main evaluation criteria groups are identified, ISO/IEC 9126 Standards, capability and completeness criteria (Khan, 2004) and ability to execute and completeness of vision criteria (Hill et. al., 2006) for the assessment of BPM systems. After classification of these three criteria groups, it was observed that evaluation criteria used in assessments of BPM systems can be

categorized under Technical and Marketing Criteria. Furthermore, Technical Criteria is matched with ISO/IEC 9126 characteristics to increase sustainability of the model. However, the matching of several criteria are thought to be confusing. Therefore appropriate questions were determined in order to ease evaluation process and get more accurate results. Therefore, specific questions were researched for each component, sub criteria and sub character match, instead of relying on only the definition of criteria and characteristics in order to sustain accurate comparison of BPM products. The answers to the questions are also based on a comparable scale which eliminates subjective grades that may change from person to person. As a result, an evaluation framework model for BPM systems was designed which relies on the findings above.

In relation to outcome of this study, evaluation of BPM products should cover not only standard ranking but also the weighted average method. In addition, requirements of organizations may change due to business processes. Therefore, appropriate weights are considered in the framework before starting the evaluation of BPM.

Since the evaluation process is complicated, a BPM Evaluation DSS is developed with Microsoft Access to gather necessary data by developed forms and to present results to compare evaluated BPM systems. Before using the developed BPM Evaluation DSS, the user interfaces are re-designed several times, because sustaining user satisfaction and understanding the question is crucial to observe accurate results. It is also observed that the related sub criteria and ISO/IEC 9126 sub characteristic of the question should also be considered before answering the questions, in order to evaluate BPM products accurately and properly. Therefore, definitions of these sub

criteria and ISO/IEC 9126 sub characteristics related with each question are put on the grade input forms in BPM Evaluation DSS for the users to easily reach the information they need.

The developed BPM Evaluation DSS is applied to two different BPM systems used in market. The results are compared from technical and marketing aspects based on the questions answered. A comparison with Gartner's evaluation is also practiced to check reliability of the model. The reliability of the developed framework model is approved as the position determined is the same with Gartner's evaluation.

The main difference of this analysis from the prior studies is that the developed framework covers both Technical and Marketing Criteria. Technical Criteria deals with capability and completeness of the BPM system related to ISO/IEC 9126 standards while Marketing Criteria deals with the ability to execute and completeness of vision of the product.

Another important outcome of this study shows that in order to place highly in the Technical Criteria matrix, all of the BPM system components must be taken into consideration due to balanced improvement of BPM system. Optimization oriented features such as simulation, activity monitoring and cost analyses are also critical in providing a complete BPM solution.

This study is not free from limitations. First, regarding that it will be too difficult to evaluate the ISO/IEC 9126 sub characteristics in terms of the measurements of its metrics as given in the standard, these metrics are not used in the evaluation. Instead a grading method is chosen. Secondly, the BPM Evaluation DSS is applied to only two BPM systems. Although two evaluation results are reasonable

and satisfactory to compare BPM solutions, more evaluations of BPM system could be efficient to see deficiencies of the framework.

The DSS is very extended by the vendors due to the high number of questions. However organizations seeking for an appropriate solution may find it useful. Therefore, further research to improve evaluation framework may also include a factor analysis study which can be useful to eliminate some questions.

Moreover, a final matrix composed of the two matrices which are based on Technical and Marketing Criteria can merge into a single matrix where technical and marketing abilities form the x and y axis respectively.

APPENDICES

A. Capability Definitions of BPM System

Table 24 Capability of BPM System (Khan, 2004)

#	Capability	Description
1	Robust Business Rules	The ability to embed complex business logic in the business process definition that defines routing based upon real-time conditions and data without the need for programming
2	Role-based routing	The ability to route a task to a job function instead of an individual
3	Relationship routing	The ability to route tasks based upon reporting relationships is very important
4	Relative routing	The ability to be routed to a job function relative to the position of the initiator or some other person in a particular organizational group
5	Parallel routing	The ability to perform tasks parallel to reduce cycle time
6	Ad hoc routing	The ability to route a workflow task to a person or job function on an ad hoc basis. The BPM system must provide a dynamic method of assigning recipients that should include user input, database look up, call to a web service or some other application specific
7	Queues and Groups	The ability to route a task to shared queues, such as a shared inbox in the purchasing department. Any buyer can select a task from the queue based upon availability
8	Process rollback	The ability to call back a process to a known state where changes can be made and the process can then move forward with the new information
9	Sub-processes	The ability to transfer data when the sub-process completes execution
10	Escalation & Exceptions Handling	The ability to escalate a task if it is late is a basic requirement of BPM, and the ability to reassign a critical task from one user to another if the original user is absent and his computer is password protected
11	Flexible forms support	The ability to easily design and use intelligent electronic forms
12	Web-based architecture	The ability to easily reach all participants and provide connectivity
13	Automation agents	The ability to exchange information with other applications to perform tasks
14	Custom views	The ability to monitor, prioritize, and filter tasks
15	Simulation	The ability to test designed business processes on a single desktop
16	Process documentation	The ability to document a business process for maintenance and support purposes
17	Status monitoring	The ability to monitor the status of process incidents
18	Authentication and security	The ability to provide robust authentication and security features

19	Distributed User administration	The ability to manage and administer users from distributed locations so managers are aware of the workloads, priorities and schedules of those who work for them
20	Task delegation & conferring	The ability to assign task to others and confer with others

B. Completeness Definitions of BPM System

Table 25 Completeness of BPM System (Khan, 2004)

#	Completeness	Description
1	Graphical designer	The ability to graphically design workflow maps for business processes
2	Collaborative design	The ability to work on different steps of the same process and reusing existing processes, rules and forms by multiple users
3	Modeling	The ability to model the process and test its performance under various scenarios before it is developed and deployed
4	Organization charts and directory integration	The ability to be aware of the organizational structure of a business
5	Multiple client interfaces	The ability to provide multiple client interfaces , including support for common e-ail applications, portals and wireless devices
6	Business metrics and monitoring	The ability to produce BPM reports, perform real-time metrics and monitoring
7	BPM administration	The ability to provide process installation, version control, access rights and the overall management of business processes
8	Web services and integration	The ability to reduce task time by using web services, SOA
9	Database connectivity and transaction processing	The ability to provide secure, reliable and efficient server-side transaction processing
10	Scalable BPM Server	The ability to provide large number of participants or a large number of transactions to be processed

C. Quality Evaluation Metrics for BPM System

Table 26 Quality Evaluation Metrics for BPM (YeongSeok, 2005)

Quality Characteristics	Sub characteristics	BPM Component	Descriptions	Case Examples	Priority
Functionality	Correctness	BPM Modeler	Ability to model Business Process that conforms to BPEL[13] and BPML[14] specifications	Does BPM Builder provide the way to design Sequence Process and Parallel Process that defined in BPEL[13] specification?	A+
	Accuracy	BPM Server	Ability to execute Business Process Model accurately	Does BPM Server execute Designed Sequence Process Model and Parallel Process Model Accurately?	A+
	Interoperability	BPM Server	Extended Ability for Connecting to each BPM Server between organizations	Does Process Definition Language used by Server conform to BPEL Standard so that different systems interoperate with each other?	A+
	Security	BPM Server	Ability of data security in enterprise systems	Can BPM Server communicate with browser using encryption protocol?	A
Reliability	Maturity	BPM Server	Ability to endure various situations	How often problem occur during Month?	B
	Fault Tolerance	BPM Server	Ability to sustain whole systems in despite of particular problems	How often does BPM System break down during Year?	A
	Recoverability	BPM Server	Ability to handle bad situations	How much time is BPM System required to recover?	B
Usability	Understandability	Administration n Tool	Ability to easily manage Business Flow without additional explanation	Users can easily understand some functions such as “Undo” or “Resubmit”?	B
	Learn ability	Whole System	general perspective	general perspective	C
	Operability	Whole System	general perspective	general perspective	C
Efficiency	Time behavior	BPM Server	Speed of BPM Server	How much time is BPM Server required to decide next steps on Business Flow?	B
	Resource utilization	BPM Server	Resource Efficiency of BPM Server	How much resource is required to execute BPM System in a maximum?	B
Maintainability	Analyzability	Administration n Tool	Ability to help administrators resolve problems	Does BPM System notify users of the location of problems?	B
	Changeability	BPM Server's Agility	Ability to agilely change Business Process	Is it possible to change Business Process in runtime?	A+
	Stability	BPM Server's Agility	Ability to handle frequently occurred problems in unexpected situations	Does BPM System continue to operate even while Business Process is changed?	A+
	testability	BPM Server's Agility	Ability to simulate changed process before executing the process	Does BPM System provide Process Simulation Tool?	A

Quality Characteristics	Sub characteristics	BPM Component	Descriptions	Case Examples	Priority
Portability	Adaptability	Whole System	general perspective	general perspective	C
	Installability	Whole System	general perspective	general perspective	C
	Co-existence	Whole System	general perspective	general perspective	C
	Replaceability	BPM Server	Ability to replace the BPM Server with other servers	Does the BPM Server conform to BPEL Standard?	B
Integrability	Data Integration	BPM Server	Ability to integrate software that is considered Activity in Business Process Model through data exchange	Does the BPM System support EAI Function?	A
	Process Integration	BPM Server	Ability to integrate software that is considered Activity in Business Process Model through inter-function call	Does System support SOAP?	A
Domain Specific Needs	BAM (Business Activity Monitoring)	BPM Monitoring	Ability to monitor currently operating Business Process[12]	-	B+
	Development Environment	BPM IDE	Ability to support the development of software systems based on designed Business Process	-	B
	Industrial Template Supportability	BPM Builder	Ability to provide Best Practice Process templates	-	B

D. Definitions of Magic Quadrant Criteria

Table 27 Magic Quadrant Criteria

Ability to Execute	
Customer Experience	Relationships, products and services/programs that enable clients to be successful with the products evaluated. Specifically, this includes the ways customers receive technical support or account support. This can also include ancillary tools, customer support programs (and the quality thereof), availability of user groups, service level agreements, and so on
Market Execution	The clarity, quality, creativity and efficacy of programs designed to deliver the organization's message in order to influence the market, promote the brand and business, increase awareness of the products, and establish a positive identification with the product/brand and organization in the minds of buyers. This "mind share" can be driven by a combination of publicity, promotional, thought leadership, word-of-mouth and sales activities.
Market Responsiveness and Track Record	Ability to respond, change direction, be flexible and achieve competitive success as opportunities develop, competitors act, customer needs evolve and market dynamics change. This criterion also considers the vendor's history of responsiveness.
Operations	The ability of the organization to meet its goals and commitments. Factors include the quality of the organizational structure including skills, experiences, programs, systems and other vehicles that enable the organization to operate effectively and efficiently on an ongoing basis.
Overall Viability (Business Unit, Financial, Strategy Organization)	Viability includes an assessment of the overall organization's financial health, the financial and practical success of the business unit, and the likelihood of the individual business unit to continue investing in the product, to continue offering the product and to advance the state of the art within the organization's portfolio of products
Product / Service	Core goods and services offered by the vendor that compete in/serve the defined market. This includes current product/service capabilities, quality, feature sets, skills, etc., whether offered natively or through OEM agreements/partnerships as defined in the sub criteria
Sales Execution / Pricing	The vendor's capabilities in all pre-sales activities and the structure that supports them. This includes deal management, pricing and negotiation, pre-sales support and the overall effectiveness of the sales channel.
Completeness of Vision	
Business Model	The soundness and logic of the vendor's underlying business proposition. Whether the vendor is funded adequately and staffed with individuals who believe they can execute the product vision
Geographic Strategy	The vendor's strategy to direct resources, skills and offerings to meet the specific needs of geographies outside the "home" or native geography, either directly or through partners, channels and subsidiaries as appropriate for that geography and market.
Innovation	Direct, related, complementary and synergistic layouts of resources, expertise or capital for investment, consolidation, defensive or pre-emptive purposes.
Market Understanding	Ability of the vendor to understand buyers' wants and needs and to translate those into products and services. Vendors that show the highest degree of vision listen and understand buyers' wants and needs, and can shape or enhance those with their added vision
Marketing Strategy	A clear, differentiated set of messages consistently communicated throughout the organization and externalized through the Web site, advertising, customer programs and positioning statements.

Offering (Product) Strategy	The vendor's approach to product development and delivery that emphasizes differentiation, functionality, methodology and feature set as they map to current and future requirements.
Sales Strategy	The strategy for selling the product that uses the appropriate network of direct and indirect sales, marketing, service and communication affiliates that extend the scope and depth of market reach, skills, expertise, technologies, services and the customer base.
Vertical / Industry Strategy	The vendor's strategy to direct resources, skills and offerings to meet the specific needs of individual market segments, including verticals.

E. Questions Mapping with Component-Criteria-ISO/IEC/9126 Match

Table 28 Questions Mapping with Component-Criteria-ISO/9126 Match

Component	Criteria	SubCriteria	Character	SubCharacter	Question
Activity Based Costing (ABC)	Comple-teness	Business metrics and monitoring	Functional-ity	Operability	Ability to report incident based costs
Activity Based Costing (ABC)	Comple-teness	Business metrics and monitoring	Functional-ity	Suitability	Ability to calculate activity volume
Activity Based Costing (ABC)	Comple-teness	Business metrics and monitoring	Functional-ity	Suitability	Ability to calculate duration of each workflow step
Activity Based Costing (ABC)	Comple-teness	Business metrics and monitoring	Functional-ity	Suitability	Ability to calculate number of visits to each workflow step
Activity Based Costing (ABC)	Comple-teness	Business metrics and monitoring	Functional-ity	Suitability	Ability to calculate overdue duration
Activity Based Costing (ABC)	Comple-teness	Business metrics and monitoring	Functional-ity	Suitability	Ability to calculate overdue volume
Activity Based Costing (ABC)	Comple-teness	Business metrics and monitoring	Functional-ity	Suitability	Ability to calculate task closing rate
Activity Based Costing (ABC)	Comple-teness	Business metrics and monitoring	Functional-ity	Suitability	Ability to calculate task duration
Balanced Scorecard (BSC)	Capabil-ity	Custom views	Usability	Attractiveness	Ability to provide visual graphs
Balanced Scorecard (BSC)	Comple-teness	Business metrics and monitoring	Efficiency	Time Behaviour	Does BPM system automatically generates metrics when a process designer deploys a workflow?

Component	Criteria	SubCriteria	Character	SubCharacter	Question
Balanced Scorecard (BSC)	Comple-teness	Business metrics and monitoring	Functional-ity	Suitability	Provides industry specific KPI library
Balanced Scorecard (BSC)	Comple-teness	Business metrics and monitoring	Maintain-ability	Analyzability	Ability to alert decision makers when a KPI moves out of a pre-defined range
Business Activity Monitoring (BAM)	Capabil-ity	Authenticati on and security	Functional-ity	Security	Ability to secure a dashboard so that it is only accessible to a specific set of users based on their defined roles and credentials.
Business Activity Monitoring (BAM)	Capabil-ity	Distributed User administrati on	Functional-ity	Suitability	Are managers able to manage and administer users from distributed locations so they are aware of the workloads,priorities and schedules of those who work for them?
Business Activity Monitoring (BAM)	Capabil-ity	Escalation & Exceptions Handling:	Maintain-ability	Changeability	Ability to manually override instance data
Business Activity Monitoring (BAM)	Capabil-ity	Escalation & Exceptions Handling:	Reliability	Recoverability	Ability to restart,delete and abort instances
Business Activity Monitoring (BAM)	Capabil-ity	Escalation & Exceptions Handling:	Reliability	Recoverability	Users are able to pause or resume instances
Business Activity Monitoring (BAM)	Capabil-ity	Status monitoring	Functional-ity	Accuracy	Ability to create thresholds and custom business rules to alert when certain limits are reached. For example, when the life cycle time for a workflow exceeds a certain period, a dashboard can alert you by sending an email or making a web service call.
Business Activity Monitoring (BAM)	Capabil-ity	Status monitoring	Functional-ity	Security	Provides audit trail of work items to determine, for example, who participated in the previous steps and how long they took
Business Activity Monitoring (BAM)	Capabil-ity	Status monitoring	Functional-ity	Suitability	Ability to provide audit trails for workflow events, user inputs on forms, users, escalation actions, notifications
Business Activity Monitoring (BAM)	Capabil-ity	Status monitoring	Maintain-ability	Analyzability	Ability to drill down to individual workflow instances from the graphical monitoring console
Business Activity Monitoring (BAM)	Capabil-ity	Status monitoring	Maintain-ability	Analyzability	Ability to drill down from the monitoring console to see workflow instances in a particular status
Business Activity Monitoring (BAM)	Capabil-ity	Status monitoring	Maintain-ability	Analyzability	Ability to integrate notification messages with desktop products (such as outlook or lotus)

Component	Criteria	SubCriteria	Character	SubCharacter	Question
Business Activity Monitoring (BAM)	Capabil-ity	Status monitoring	Maintain-ability	Analyzability	Ability to monitor the status of all workflow instances in a single view
Business Activity Monitoring (BAM)	Capabil-ity	Status monitoring	Maintain-ability	Analyzability	Ability to provide notification alerts participants responsible for workflow steps
Business Activity Monitoring (BAM)	Capabil-ity	Status monitoring	Maintain-ability	Analyzability	Ability to setup filters for easy review of incidents or steps
Business Activity Monitoring (BAM)	Capabil-ity	Status monitoring	Maintain-ability	Analyzability	Provides real-time monitoring of process instances which allow administrators to monitor overall process performance in real time and react to problems as they occur
Business Activity Monitoring (BAM)	Capabil-ity	Status monitoring	Reliability	Maturity	Ability to prevent users from switching notifications off
Business Activity Monitoring (BAM)	Capabil-ity	Status monitoring	Reliability	Maturity	Notifies or escalates overdue workflow actions
Business Activity Monitoring (BAM)	Capabil-ity	Status monitoring	Reliability	Maturity	Reminder notifications as scheduled task deadlines approach
Business Activity Monitoring (BAM)	Capabil-ity	Status monitoring	Usability	Operability	Users are able to manage state, data and life cycle of a workflow during its execution
Business Activity Monitoring (BAM)	Comple-teness	BPM administra-tion	Maintain-ability	Changeability	BAM Workbench for extending and customizing BAM functions and dashboards?
Business Activity Monitoring (BAM)	Comple-teness	BPM administra-tion	Maintain-ability	Stability	Automatically notifies administrator by e-mail for system events
Business Activity Monitoring (BAM)	Comple-teness	Business metrics and monitoring	Efficiency	Time Behaviour	Users can disable maintaining data to enable more efficient use of resources
Business Activity Monitoring (BAM)	Comple-teness	Business metrics and monitoring	Functional-ity	Interoperatabil-ity	A developer who is proficient in SQL can create complex dashboards to provide metrics based on real-time and historical data, or to correlate data from multiple systems. For example, you can create a dashboard for a supply chain process that tracks inventory in one database, customer information in another, and correlates that information with a purchase order process.

Component	Criteria	SubCriteria	Character	SubCharacter	Question
Business Activity Monitoring (BAM)	Comple-teness	Business metrics and monitoring	Functional-ity	Security	Allows process participants to monitor processes for auditing and optimization using the same environment through which they interact with processes with Integrated report dashboards, process monitoring and auditing
Business Activity Monitoring (BAM)	Comple-teness	Business metrics and monitoring	Functional-ity	Security	Automatically archive data from specific steps for review and auditing in the future
Business Activity Monitoring (BAM)	Comple-teness	Business metrics and monitoring	Functional-ity	Suitability	Automatic drill-down from aggregate dashboard data to detail by organizational unit and by process
Business Activity Monitoring (BAM)	Comple-teness	Business metrics and monitoring	Functional-ity	Suitability	Provides transaction queues and histories, including the date and time that transactions progress through a workflow
Business Activity Monitoring (BAM)	Comple-teness	Business metrics and monitoring	Maintain-ability	Analyzability	Ability to provide report user activities
Business Activity Monitoring (BAM)	Comple-teness	Business metrics and monitoring	Maintain-ability	Analyzability	Ability to report workload information
Business Activity Monitoring (BAM)	Comple-teness	Business metrics and monitoring	Maintain-ability	Analyzability	Is there a BAM server for storing and managing data used by the BAM dashborads?
Business Activity Monitoring (BAM)	Comple-teness	Business metrics and monitoring	Maintain-ability	Analyzability	Tracks and display workflow instance status, active step and current requirements
Business Activity Monitoring (BAM)	Comple-teness	Business metrics and monitoring	Maintain-ability	Changeability	Ability to customize report contents
Business Activity Monitoring (BAM)	Comple-teness	Business metrics and monitoring	Maintain-ability	Testability	Trigger processes directly from the dashboard. For example, when a bottleneck is identified, you can trigger a process to determine the root cause.
Business Activity Monitoring (BAM)	Comple-teness	Business metrics and monitoring	Usability	Attractiveness	Tabular and graphical reports
Business Activity Monitoring (BAM)	Comple-teness	Business metrics and monitoring	Usability	Attractiveness	What is the attractiveness of real-time,enterprise-wide visibility of business process performance and business metrics

Component	Criteria	SubCriteria	Character	SubCharacter	Question
Business Activity Monitoring (BAM)	Comple-teness	Business metrics and monitoring	Usability	Learnability	Users are able to adopt customizing dashboards and creating new ones
Business Activity Monitoring (BAM)	Comple-teness	Business metrics and monitoring	Usability	Operability	Ability to drill down from high-level key performance indicators to a specific workflow to identify the people involved with that workflow as well as the metrics related to it.
Business Activity Monitoring (BAM)	Comple-teness	Business metrics and monitoring	Usability	Operability	Ability to manage workload of staff
Business Activity Monitoring (BAM)	Comple-teness	Business metrics and monitoring	Usability	Operability	Ability to roll-up process statistics
Business Activity Monitoring (BAM)	Comple-teness	Business metrics and monitoring	Usability	Operability	Customized historical process reports for key performance indicators and other process data Allows process owners to track key performance indicators and other historical data from processes and use it to continuously improve processes. Process reports can be tailored by role and purpose.
Business Activity Monitoring (BAM)	Comple-teness	Business metrics and monitoring	Usability	Operability	Does software present the data through multiple visual objects such as pie charts, bar charts, and gauges?
Business Activity Monitoring (BAM)	Comple-teness	Business metrics and monitoring	Usability	Operability	Does BPM system provide out-of-the-box monitoring of generic metrics and complete access to all critical real-time and historical process data for analysis?
Business Activity Monitoring (BAM)	Comple-teness	Business metrics and monitoring	Usability	Operability	Provides a gannt graphic planning of tasks, based on forecasted and real dates
Business Activity Monitoring (BAM)	Comple-teness	Business metrics and monitoring	Usability	Understanda-bility	Provides the data through multiple visual objects such as pie charts, bar charts ang gauges
Business Activity Monitoring (BAM)	Comple-teness	Multiple client interfaces	Usability	Operability	Provides seperate workplaces/perspectives for business analysts and developers which enables business analysts and developers to use their preferred and most productive perspective to work on the shared process model
Business Rule Engine (BRE)	Capabil-ity	Robust Business Rules	Functional-ity	Accuracy	Ability to change a rule to a reference
Business Rule Engine (BRE)	Capabil-ity	Robust Business Rules	Functional-ity	Accuracy	Ability to use system values in rules

Component	Criteria	SubCriteria	Character	SubCharacter	Question
Business Rule Engine (BRE)	Capabil-ity	Robust Business Rules	Functional-ity	Interoperatabil-ity	Ability to create business rules with a point-and-click mechanism, using external rules integrated from other products or using an internal XML Path Language (XPath) rules wizard
Business Rule Engine (BRE)	Capabil-ity	Robust Business Rules	Functional-ity	Interoperatabil-ity	Ability to integrate with third party rule engines
Business Rule Engine (BRE)	Capabil-ity	Robust Business Rules	Functional-ity	Interoperatabil-ity	Provides shared rules Director
Business Rule Engine (BRE)	Capabil-ity	Robust Business Rules	Functional-ity	Security	Provides rule audits
Business Rule Engine (BRE)	Capabil-ity	Robust Business Rules	Functional-ity	Suitability	BPM provides designing different paths through conditional logic
Business Rule Engine (BRE)	Capabil-ity	Robust Business Rules	Functional-ity	Suitability	Driven by due dates
Business Rule Engine (BRE)	Capabil-ity	Robust Business Rules	Functional-ity	Suitability	Driven by process data
Business Rule Engine (BRE)	Capabil-ity	Robust Business Rules	Functional-ity	Suitability	Driven by process run-time information
Business Rule Engine (BRE)	Capabil-ity	Robust Business Rules	Maintain-ability	Changeability	Ability to Manage business rules separate from the process definition
Business Rule Engine (BRE)	Capabil-ity	Robust Business Rules	Maintain-ability	Changeability	Ability to disable enable rules
Business Rule Engine (BRE)	Capabil-ity	Robust Business Rules	Usability	Attractiveness	Visual creation and management of business rules
Business Rule Engine (BRE)	Capabil-ity	Robust Business Rules	Usability	Operability	Ability to copy rules
Business Rule Engine (BRE)	Capabil-ity	Robust Business Rules	Usability	Operability	Ability to search rules
Business Rule Engine (BRE)	Capabil-ity	Robust Business Rules	Usability	Operability	Provides nested logic
Business Rule Engine (BRE)	Capabil-ity	Robust Business Rules	Usability	Understanda-bility	Provides rule descriptions

Component	Criteria	SubCriteria	Character	SubCharacter	Question
Business Rule Engine (BRE)	Comple-teness	Modeling	Maintain-ability	Analyzability	Ability to test environment with break points Full Multi technology debugger that allows tracing business rules invoking at debug time components implemented in a diverse set of technologies (Java, COM, .NET, SQL, Web Services, etc).
Document Managemen t System (DMS)	Capabil-ity	Authenticati on and security	Functional -ity	Security	Enhances document security with secure template designs for digital signaturesEnhances document security with secure template designs for digital signatures
Document Managemen t System (DMS)	Capabil-ity	Authenticati on and security	Functional -ity	Security	the library access is controlled and restricted to the users who exhibit the corresponding permits. 5 level of access estabilished by default , read, aggregate, edit, approve and responsible
Document Managemen t System (DMS)	Capabil-ity	Flexible forms support	Functional -ity	Suitability	Adobe Reader and Adobe Acrobat for accessing and processing PDF or HTML forms with dynamic content and features such as security, digital signatures, and offline processing
Document Managemen t System (DMS)	Capabil-ity	Flexible forms support	Usability	Operability	Ability to include files from document management systems in forms
Document Managemen t System (DMS)	Capabil-ity	Flexible forms support	Usability	Understanda-bility	Is there a form Server for storing and managing form data which user easily use?
Document Managemen t System (DMS)	Comple-teness	BPM administra-tion	Maintain-ability	Stability	Does BPM system alert users included in the subscription list with a notification when a document is changed or modified?
Document Managemen t System (DMS)	Comple-teness	Collaborativ e design	Maintain-ability	Analyzability	Allows users to comment, discuss and add text to a document while it is being created?
Document Managemen t System (DMS)	Comple-teness	Multiple client interfaces	Usability	Operability	Ability to use multiple documentation templates to support different documentation needs
Document Managemen t System (DMS)	Comple-teness	Scalable BPM Server	Efficiency	Resource Utilisation	Unlimited number of documents capacity, up to 2 million documents or more and up to 2.000 libraries or more
Enterprise Application Integration (EAI)	Capabil-ity	Automation agents	Functional -ity	Interoperatabil -ity	Microsoft Excel Automation Agent
Enterprise Application Integration (EAI)	Capabil-ity	Automation agents	Functional -ity	Interoperatabil -ity	.NET Code Automation Agent

Component	Criteria	SubCriteria	Character	SubCharacter	Question
Enterprise Application Integration (EAI)	Capabil-ity	Automation agents	Functional-ity	Interoperatabil-ity	Adobe Acrobat Automation Agent
Enterprise Application Integration (EAI)	Capabil-ity	Automation agents	Functional-ity	Interoperatabil-ity	ASCII Automation Agent
Enterprise Application Integration (EAI)	Capabil-ity	Automation agents	Functional-ity	Interoperatabil-ity	BizTalk Automation Agent
Enterprise Application Integration (EAI)	Capabil-ity	Automation agents	Functional-ity	Interoperatabil-ity	BPM system can be easily deployed in an environment with many different operating systems, database technologies, and application servers.
Enterprise Application Integration (EAI)	Capabil-ity	Automation agents	Functional-ity	Interoperatabil-ity	BPM system can be easily integrated with existing IT architecture with automation agents?
Enterprise Application Integration (EAI)	Capabil-ity	Automation agents	Functional-ity	Interoperatabil-ity	Connect incompatible systems together, allowing them to communicate
Enterprise Application Integration (EAI)	Capabil-ity	Automation agents	Functional-ity	Interoperatabil-ity	Database Automation Agent
Enterprise Application Integration (EAI)	Capabil-ity	Automation agents	Functional-ity	Interoperatabil-ity	E-mail Automation Agent
Enterprise Application Integration (EAI)	Capabil-ity	Automation agents	Functional-ity	Interoperatabil-ity	File Automation Agent
Enterprise Application Integration (EAI)	Capabil-ity	Automation agents	Functional-ity	Interoperatabil-ity	Microsoft Exchange Automation Agent
Enterprise Application Integration (EAI)	Capabil-ity	Automation agents	Functional-ity	Interoperatabil-ity	Microsoft Word Automation Agent
Enterprise Application Integration (EAI)	Capabil-ity	Automation agents	Functional-ity	Suitability	Support JAVA, COM/DCOM, .Net, SQL, Corba, JNDI, JMS, JMX API integration. To be able to integrate APIs implemented in a diverse set of technologies enabling SOA exposed by not only Web Service enabled services.
Enterprise Application Integration (EAI)	Capabil-ity	Automation agents	Usability	Operability	Provides built-in support for application integration which enable smaller BPM projects to succeed without costly and time consuming use of separate application integration components. As projects grow, process specific application integration can transition to service-based connectivity.
Enterprise Application Integration (EAI)	Capabil-ity	Process documentation	Portability	Co-existence	Generate detailed process documentation using Microsoft Word

Component	Criteria	SubCriteria	Character	SubCharacter	Question
Enterprise Application Integration (EAI)	Capabil-ity	Process documentation	Usability	Operability	Paper-to-digital technology for capturing form data as XML, printing it, and using scanning technology to recapture the data electronically
Enterprise Application Integration (EAI)	Comple-teness	Database connectivity and transaction processing	Functional-ity	Interoperatabil-ity	Consolidate and present data from disparate sources as one unified and personalized workspace for higher productivity
Enterprise Application Integration (EAI)	Comple-teness	Database connectivity and transaction processing	Portability	Adaptability	Ability to work with different database systems (IBM DB2, Oracle, Microsoft SQL Server, and MySQL)
Enterprise Application Integration (EAI)	Comple-teness	Database connectivity and transaction processing	Portability	Co-existence	Multi-platform support Allows the BPM runtime environment to be deployed into the existing infrastructure without requiring new administrative skill-sets. ALBPM supports plain JVM deployment (for non-J2EE environments such as Windows) and J2EE application server deployment on BEA WebLogic Server® 9.2, IBM WebSphere and more.
Enterprise Application Integration (EAI)	Comple-teness	Database connectivity and transaction processing	Reliability	Maturity	Are data transfers are guaranteed to exchange without any corruption
Enterprise Application Integration (EAI)	Comple-teness	Database connectivity and transaction processing	Reliability	Recoverability	Supports X/Open Architecture (XA) transactions that guarantee the consistent state of critical business data and the ability to recover seamlessly from system failures.
Enterprise Application Integration (EAI)	Comple-teness	Web services and integration	Efficiency	Time Behaviour	Rapidly assemble composite objects based on a variety of previously non-interoperable backends
Enterprise Application Integration (EAI)	Comple-teness	Web services and integration	Functional-ity	Func. Compliance	Enables compliance with government accessibility requirements for online forms?
Enterprise Application Integration (EAI)	Comple-teness	Web services and integration	Functional-ity	Interoperatabil-ity	Does BPM system provides creating Web 2.0 interfaces quickly by visualizing, combining, and manipulating data from disparate sources ?
Enterprise Application Integration (EAI)	Comple-teness	Web services and integration	Functional-ity	Suitability	UDDI (Universal Description Discovery and Integration) support, for browsing and discovery of mservices managed in an enterprise service repository
Enterprise Application Integration (EAI)	Comple-teness	Web services and integration	Portability	Co-existence	Processes can connect easily to web services and can themselves be exposed as web services.
Enterprise Application Integration (EAI)	Comple-teness	Web services and integration	Usability	Operability	Easily Govern and manage Web services, both in design and run time

Component	Criteria	SubCriteria	Character	SubCharacter	Question
Process (Workflow) Engine	Capabil-ity	Ad hoc routing	Functional-ity	Accuracy	Does software provide accurate ad-hoc event handling which increases visibility and responsiveness?
Process (Workflow) Engine	Capabil-ity	Ad hoc routing	Usability	Operability	Ad hoc first step
Process (Workflow) Engine	Capabil-ity	Ad hoc routing	Usability	Operability	Ad hoc instance re-route
Process (Workflow) Engine	Capabil-ity	Ad hoc routing	Usability	Operability	Ad hoc instance reset
Process (Workflow) Engine	Capabil-ity	Ad hoc routing	Usability	Operability	Ad hoc instance restart
Process (Workflow) Engine	Capabil-ity	Ad hoc routing	Usability	Operability	Ad hoc next stop
Process (Workflow) Engine	Capabil-ity	Ad hoc routing	Usability	Operability	Ad-hoc instance backward
Process (Workflow) Engine	Capabil-ity	Ad hoc routing	Usability	Operability	Ad-hoc instance cancel
Process (Workflow) Engine	Capabil-ity	Ad hoc routing	Usability	Operability	Ad-hoc instance forward
Process (Workflow) Engine	Capabil-ity	Authenticati on and security	Functional-ity	Security	Control access to report creation and viewing
Process (Workflow) Engine	Capabil-ity	Authenticati on and security	Functional-ity	Security	JSR 168 compliant Users can access task lists and other process information through existing portals. There is no additional logins and the user experience is uniform and consistent
Process (Workflow) Engine	Capabil-ity	Authenticati on and security	Functional-ity	Security	Provides Role-based access control
Process (Workflow) Engine	Capabil-ity	Authenticati on and security	Functional-ity	Security	Support single sign-on and existing authentication systems
Process (Workflow) Engine	Capabil-ity	Authenticati on and security	Functional-ity	Security	Supports the Security Assertions Markup Language (SAML), enabling users to transparently log in from one web-based user interface to another without relogin or reauthentication.
Process (Workflow) Engine	Capabil-ity	Authenticati on and security	Functional-ity	Security	Unique user ID is never exposed to end users
Process (Workflow) Engine	Capabil-ity	Authenticati on and security	Usability	Operability	Ability to create global roles
Process (Workflow) Engine	Capabil-ity	Authenticati on and security	Usability	Operability	Ability to create process-specific roles
Process (Workflow) Engine	Capabil-ity	Automation agents	Functional-ity	Interoperatabil-ity	Ability to initiate a process with e-mail

Component	Criteria	SubCriteria	Character	SubCharacter	Question
Process (Workflow) Engine	Capabil-ity	Automation agents	Functional-ity	Interoperatabil-ity	Ability to initiate a process with files
Process (Workflow) Engine	Capabil-ity	Automation agents	Usability	Operability	Ability to initiate a process after form completions
Process (Workflow) Engine	Capabil-ity	Automation agents	Usability	Operability	Ability to schedule process initiation
Process (Workflow) Engine	Capabil-ity	Custom views	Functional-ity	Suitability	Allow users to create: - folders to organize their work list - bookmarks for work items of interest - interactive PDF and HTML forms as partof a task
Process (Workflow) Engine	Capabil-ity	Custom views	Usability	Attractiveness	Customizable work lists and process features based on roles Process activities and process actions (like creating new instances) can be surfaced in multiple views customized to the roles defined in the process.
Process (Workflow) Engine	Capabil-ity	Custom views	Usability	Attractiveness	Maintains separate to-do and watch lists for each user
Process (Workflow) Engine	Capabil-ity	Custom views	Usability	Learnability	Online help information is stored together with the process and automatically exposed as online help through workspace. This ensures consistency between process implementation and user documentation at all times.
Process (Workflow) Engine	Capabil-ity	Custom views	Usability	Operability	Allows process participants to create instance remarks and notes as well as attach files to process instances. Attachments support versioning.
Process (Workflow) Engine	Capabil-ity	Custom views	Usability	Operability	Provides Inbox, for accessing, managing, and organizing work lists
Process (Workflow) Engine	Capabil-ity	Custom views	Usability	Operability	Supports filters and search capabilities for user-specific to-do and watch lists
Process (Workflow) Engine	Capabil-ity	Escalation & Exceptions Handling:	Functional-ity	Interoperatabil-ity	User assignement made by email notification
Process (Workflow) Engine	Capabil-ity	Escalation & Exceptions Handling:	Maintain-ability	Changeability	Ability to Assign or Un-assign tasks to other users
Process (Workflow) Engine	Capabil-ity	Escalation & Exceptions Handling:	Maintain-ability	Changeability	Moving work items from the work list of one user to the work list of another user
Process (Workflow) Engine	Capabil-ity	Escalation & Exceptions Handling:	Usability	Attractiveness	Ability to send notifications to mobile phone
Process (Workflow) Engine	Capabil-ity	Escalation & Exceptions Handling:	Usability	Operability	Support for notifications and reminders of deadlines as well as escalation of process steps

Component	Criteria	SubCriteria	Character	SubCharacter	Question
Process (Workflow) Engine	Capabil-ity	Flexible forms support	Efficiency	Resource Utilisation	Provides forms caching for higher performance
Process (Workflow) Engine	Capabil-ity	Flexible forms support	Usability	Operability	Ability to add notes/memos to forms
Process (Workflow) Engine	Capabil-ity	Parallel routing	Functional-ity	Suitability	Provides parallel routing to decrease process completion time
Process (Workflow) Engine	Capabil-ity	Process rollback	Reliability	Recoverability	Ability to roll back processes
Process (Workflow) Engine	Capabil-ity	Queues and Groups	Usability	Operability	Provides access to user's work list and search for work items
Process (Workflow) Engine	Capabil-ity	Relationship routing	Functional-ity	Suitability	Ability to route task based on relationships
Process (Workflow) Engine	Capabil-ity	Relative routing	Functional-ity	Suitability	Ability to route tasks based on job function or organization group
Process (Workflow) Engine	Capabil-ity	Status monitoring	Functional-ity	Security	Allows tracking of workflow status
Process (Workflow) Engine	Capabil-ity	Sub-processes	Functional-ity	Suitability	Data inheritance/mapping
Process (Workflow) Engine	Capabil-ity	Sub-processes	Usability	Operability	Asynchronous linkage (child process runs independently)
Process (Workflow) Engine	Capabil-ity	Sub-processes	Usability	Operability	Synchronous linkage (wait for child Process completion)
Process (Workflow) Engine	Capabil-ity	Task delegation & conferring	Maintain-ability	Changeability	Activity re-routing with support for delegation, escalation, peer assignment Supports common collaborative work processes that would otherwise take place outside of the process environment and/or require more disruptive actions on process instances
Process (Workflow) Engine	Capabil-ity	Task delegation & conferring	Usability	Operability	Ability to monitore group queues, take ownership of work items, and delegate work items
Process (Workflow) Engine	Capabil-ity	Web-based architecture	Portability	Installability	Ability work on different operating systems (Microsoft® Windows®, IBM AIX®, Sun™ Solaris™, Red Hat® Linux®, and Novel SUSE Linux)
Process (Workflow) Engine	Comple-teness	BPM administra-tion	Functional-ity	Func. Compliance	System calendar distinguishes work days, holidays/vacation, and work day start/end times
Process (Workflow) Engine	Comple-teness	BPM administra-tion	Functional-ity	Security	Ability to exculede workflows from manual initiation
Process (Workflow) Engine	Comple-teness	BPM administra-tion	Functional-ity	Security	Ability to provide remote administration

Component	Criteria	SubCriteria	Character	SubCharacter	Question
Process (Workflow) Engine	Comple-teness	BPM administra-tion	Functional-ity	Security	Workflow administrator can delegate rights to users
Process (Workflow) Engine	Comple-teness	BPM administra-tion	Functional-ity	Security	Workflow interaction by client or e-mail can be determined based on whether or not a user is licensed
Process (Workflow) Engine	Comple-teness	BPM administra-tion	Functional-ity	Suitability	Ability to force completion of steps
Process (Workflow) Engine	Comple-teness	BPM administra-tion	Functional-ity	Suitability	Provides administration console for configuring system parameters
Process (Workflow) Engine	Comple-teness	BPM administra-tion	Maintain-ability	Changeability	Administration Console for configuring and maintaining the system
Process (Workflow) Engine	Comple-teness	BPM administra-tion	Maintain-ability	Changeability	Version control Integration with most popular Source Control Management tools such as CVS and ClearCase
Process (Workflow) Engine	Comple-teness	BPM administra-tion	Maintain-ability	Stability	Allow users to deploy new, updated versions of a process without disrupting existing running processes (Multi version process)
Process (Workflow) Engine	Comple-teness	Database connectivity and transaction processing	Functional-ity	Interoperatabil-ity	Control publishing of processes or process objects to different BPM Servers
Process (Workflow) Engine	Comple-teness	Database connectivity and transaction processing	Reliability	Recoverability	Provides Automatic Server startup and recovery
Process (Workflow) Engine	Comple-teness	Graphical designer	Maintain-ability	Changeability	Allow users to change process parameters at runtime without costly development and redeployment
Process (Workflow) Engine	Comple-teness	Multiple client interfaces	Usability	Understanda-bility	Support for different languages with translations of any natural language element that is part of the processs
Process (Workflow) Engine	Comple-teness	Organizatio n charts and directory integration	Functional-ity	Interoperatabil-ity	provides integration with LDAP Directory servers to authenticate users and to leverage the users, groups and roles defined within those Directory servers for routing decisions.
Process (Workflow) Engine	Comple-teness	Scalable BPM Server	Portability	Replaceability	Server platforms supported: IBM iSeries (AS/400) IBM mainframe Linux (such as SUSE, Red Hat, or Debian/Ubuntu) Novell Netware Unix (such as Solaris or AIX) Windows Server (such as NT/2003/Vista) Hosted solution (not installed on a customer server)

Component	Criteria	SubCriteria	Character	SubCharacter	Question
Process (Workflow) Engine	Comple-teness	Web services and integration	Efficiency	Resource Utilisation	Provides Network Load Balancing
Process (Workflow) Engine	Comple-teness	Web services and integration	Functional-ity	Interoperatabil-ity	Ability to initiate workflows through a link on an external web page
Process (Workflow) Engine	Comple-teness	Web services and integration	Portability	Co-existence	Microsoft Outlook Interface
Process Modeling and Design	Capabil-ity	Authenticati on and security	Functional-ity	Security	Ability to declare steps “private” for security reasons
Process Modeling and Design	Capabil-ity	Authenticati on and security	Functional-ity	Security	Control who can initiate processes, including anonymous users
Process Modeling and Design	Capabil-ity	Automation agents	Usability	Operability	Visual mapping of process data to all Automation Agents
Process Modeling and Design	Capabil-ity	Custom views	Usability	Learnability	Create custom process and step specific help to aid users
Process Modeling and Design	Capabil-ity	Distributed User administrati on	Functional-ity	Security	Ability to assign process owners
Process Modeling and Design	Capabil-ity	Flexible forms support	Functional-ity	Accuracy	Check for data validity
Process Modeling and Design	Capabil-ity	Flexible forms support	Functional-ity	Accuracy	Check required fields
Process Modeling and Design	Capabil-ity	Flexible forms support	Functional-ity	Accuracy	Form designers can create form designs with intelligence (calculation, validation, and required fields) to ensure that users fill out forms accurately.
Process Modeling and Design	Capabil-ity	Flexible forms support	Functional-ity	Interoperatabil-ity	Ability to create dynamic XML form templates that can be rendered as PDF or HTML
Process Modeling and Design	Capabil-ity	Flexible forms support	Functional-ity	Interoperatabil-ity	Ability to import forms created using HTML design tools
Process Modeling and Design	Capabil-ity	Flexible forms support	Functional-ity	Interoperatabil-ity	Ability to use web forms hosted in other applications
Process Modeling and Design	Capabil-ity	Flexible forms support	Functional-ity	Interoperatabil-ity	Action buttons can invoke server-side and client side scripts
Process Modeling and Design	Capabil-ity	Flexible forms support	Functional-ity	Interoperatabil-ity	Data fields on other forms
Process Modeling and Design	Capabil-ity	Flexible forms support	Functional-ity	Interoperatabil-ity	External databases

Component	Criteria	SubCriteria	Character	SubCharacter	Question
Process Modeling and Design	Capabil-ity	Flexible forms support	Functional-ity	Security	Action buttons can be enabled, disabed, hidden
Process Modeling and Design	Capabil-ity	Flexible forms support	Functional-ity	Security	Digital signatures for form security and integrity
Process Modeling and Design	Capabil-ity	Flexible forms support	Functional-ity	Suitability	Include attachments in forms
Process Modeling and Design	Capabil-ity	Flexible forms support	Functional-ity	Suitability	Users can click on buttons to initiate predefined actions
Process Modeling and Design	Capabil-ity	Flexible forms support	Maintain-ability	Analyzability	Display data tables that are mapped to data arrays
Process Modeling and Design	Capabil-ity	Flexible forms support	Maintain-ability	Analyzability	Notify users of specific data errors
Process Modeling and Design	Capabil-ity	Flexible forms support	Maintain-ability	Testability	Ability to test and debug forms during development
Process Modeling and Design	Capabil-ity	Flexible forms support	Portability	Replaceability	Can plug in user-created layout schemes
Process Modeling and Design	Capabil-ity	Flexible forms support	Usability	Attractiveness	Computed values
Process Modeling and Design	Capabil-ity	Flexible forms support	Usability	Attractiveness	Custom database queries and filtering in forms
Process Modeling and Design	Capabil-ity	Flexible forms support	Usability	Attractiveness	Data fields can be aligned, e.g., left, right, or center
Process Modeling and Design	Capabil-ity	Flexible forms support	Usability	Attractiveness	Field labels can have different fonts, display sytles, colors
Process Modeling and Design	Capabil-ity	Flexible forms support	Usability	Attractiveness	Forms can be laid out manually or automatically
Process Modeling and Design	Capabil-ity	Flexible forms support	Usability	Attractiveness	Graphically link form fields to database fields
Process Modeling and Design	Capabil-ity	Flexible forms support	Usability	Attractiveness	Save and reuse collections of form objects
Process Modeling and Design	Capabil-ity	Flexible forms support	Usability	Attractiveness	Support a wide variety of form elements to simplify user interaction
Process Modeling and Design	Capabil-ity	Flexible forms support	Usability	Attractiveness	Supports individualized, shared, multipage forms
Process Modeling and Design	Capabil-ity	Flexible forms support	Usability	Attractiveness	Supports multiple layout schemes
Process Modeling and Design	Capabil-ity	Flexible forms support	Usability	Operability	Field visibility dependent on other fields on same form
Process Modeling and Design	Capabil-ity	Flexible forms support	Usability	Operability	Ability to perform database updates and other actions from within forms

Component	Criteria	SubCriteria	Character	SubCharacter	Question
Process Modeling and Design	Capabil-ity	Flexible forms support	Usability	Operability	Field protection dependent on other fields on other forms
Process Modeling and Design	Capabil-ity	Flexible forms support	Usability	Operability	Field protection dependent on other fields on other forms
Process Modeling and Design	Capabil-ity	Flexible forms support	Usability	Operability	Field protection dependent on other fields on same form
Process Modeling and Design	Capabil-ity	Flexible forms support	Usability	Operability	Selectable options dependent on other fields on other forms
Process Modeling and Design	Capabil-ity	Flexible forms support	Usability	Operability	Selectable options dependent on other fields on same form
Process Modeling and Design	Capabil-ity	Flexible forms support	Usability	Operability	Supports sub-forms
Process Modeling and Design	Capabil-ity	Flexible forms support	Usability	Understanda-bility	Does BPM system provide creating robust forms that combine high-fidelity presentation with XML data handling?
Process Modeling and Design	Capabil-ity	Flexible forms support	Usability	Understanda-bility	Does software support Model Web form and interactions Easy Web form builder creation using a WYSIWYG interface that allows quick and rapid integration with backend catalogued services ?
Process Modeling and Design	Capabil-ity	Role-based routing	Reliability	Fault tolerance	Supports Master role directory for managing abstract process roles across multiple BPM projects. Ensures the avoidance of proliferating role names as multiple BPM projects are implemented
Process Modeling and Design	Capabil-ity	Role-based routing	Usability	Operability	Allows the modeler to easily and intuitively incorporate roles within the process design.
Process Modeling and Design	Capabil-ity	Sub-processes	Usability	Operability	Drag and drop creation of sub-processes
Process Modeling and Design	Comple-teness	Business metrics and monitoring	Usability	Operability	Ability to define key performance indicators while modeling the business process
Process Modeling and Design	Comple-teness	Collaborativ e design	Efficiency	Time Behaviour	Allowing members from business units to play a more active role in developing process-driven applications reduces the time and effort that developers need to build, deploy, and upgrade the applications.
Process Modeling and Design	Comple-teness	Collaborativ e design	Maintain-ability	Analyzability	Are business users able to identify specific operation which caused failure when designing processess?
Process Modeling and Design	Comple-teness	Graphical designer	Functional -ity	Interoperatabil -ity	Ability to Import/Export process definitions in XML format XML Utility Developing Automated Processes – High Level Capabilities
Process Modeling and Design	Comple-teness	Graphical designer	Functional -ity	Interoperatabil -ity	Allows import from other analytical modeling tools ranging from Visio to IDS Scheer ARIS, ProForma, ProActivity, Sigma Flow, or any BPMN-based tool exporting BPEL
Process Modeling and Design	Comple-teness	Graphical designer	Functional -ity	Suitability	Target dates and times can be assigned to individual workflow steps

Component	Criteria	SubCriteria	Character	SubCharacter	Question
Process Modeling and Design	Comple-teness	Graphical designer	Maintain-ability	Analyzability	Visual flow and bottleneck indicators during modeling
Process Modeling and Design	Comple-teness	Graphical designer	Maintain-ability	Changeability	Ability to make a copy of old process versions
Process Modeling and Design	Comple-teness	Graphical designer	Maintain-ability	Changeability	Allows access to user profile and location values for selection, filter, and update
Process Modeling and Design	Comple-teness	Graphical designer	Maintain-ability	Changeability	Does BPM system provide to rapidly design new processes and cost-effectively modify those processes as the business needs change?
Process Modeling and Design	Comple-teness	Graphical designer	Maintain-ability	Stability	Checks for sufficient user rights to execute workflow actions
Process Modeling and Design	Comple-teness	Graphical designer	Portability	Co-existence	Ability to include 3rd party objects in repository
Process Modeling and Design	Comple-teness	Graphical designer	Portability	Replaceability	Ability to use 3rd party editors for managing unique process objects
Process Modeling and Design	Comple-teness	Graphical designer	Portability	Replaceability	Provides an enterprise repository for reusable components and processes and supports the collaborative creation of workflows and forms.
Process Modeling and Design	Comple-teness	Graphical designer	Portability	Replaceability	Standards support: BPMN, BPEL, XPDL and more.
Process Modeling and Design	Comple-teness	Graphical designer	Usability	Attractiveness	Drill down view of objects in process repositories
Process Modeling and Design	Comple-teness	Graphical designer	Usability	Learnability	How much time is required for a user to draw processess with designer?
Process Modeling and Design	Comple-teness	Graphical designer	Usability	Operability	Ability to Assigns a mandatory or optional status to a workflow or workflow step
Process Modeling and Design	Comple-teness	Graphical designer	Usability	Operability	Ability to use junction steps to simplfy rule management
Process Modeling and Design	Comple-teness	Graphical designer	Usability	Operability	Are descriptions of elements in designer provided to user?
Process Modeling and Design	Comple-teness	Graphical designer	Usability	Operability	Can business users easily design business processes by drag-and-drop feature without need coding?
Process Modeling and Design	Comple-teness	Graphical designer	Usability	Operability	Detailed technical diagram (for implementers)
Process Modeling and Design	Comple-teness	Graphical designer	Usability	Operability	Does software provide visio-like application that users easily adopt designing processess?
Process Modeling and Design	Comple-teness	Graphical designer	Usability	Operability	Process templates repository for capturing process best practices and encouraging reuse across different BPM projects
Process Modeling and Design	Comple-teness	Graphical designer	Usability	Operability	Provide Easy activation/deactivation of processes

Component	Criteria	SubCriteria	Character	SubCharacter	Question
Process Modeling and Design	Comple-teness	Graphical designer	Usability	Operability	Supports multiple user roles in a workflow
Process Modeling and Design	Comple-teness	Graphical designer	Usability	Understanda-bility	Ability to create notes for any process object
Process Modeling and Design	Comple-teness	Graphical designer	Usability	Understanda-bility	Top-level status diagram (for business users)
Process Modeling and Design	Comple-teness	Modeling	Maintain-ability	Analyzability	Ability to simulate and debug processes during development
Process Modeling and Design	Comple-teness	Modeling	Maintain-ability	Analyzability	Multi-process simulation for analyzing and optimizing bottlenecks and overall process costs
Process Modeling and Design	Comple-teness	Organizatio n charts and directory integration	Functional -ity	Interoperatabil -ity	Provides Link to Active directory Organization Chart
Process Modeling and Design	Comple-teness	Organizatio n charts and directory integration	Usability	Attractiveness	Provides Graphical View of Organizational Relationships Organization Chart
Simulation	Capabil-ity	Simulation	Functional -ity	Interoperatabil -ity	Software compatibility: - Integration with spreadsheet packages, statistical packages, DBMS, ERP, WFM and BAM systems - Input data reading from files
Simulation	Capabil-ity	Simulation	Functional -ity	Suitability	Provides Workflow critical path analysis
Simulation	Capabil-ity	Simulation	Functional -ity	Suitability	Simulation component provides: -Animation -Type of animation (full animation or state-to-state) -Animation with visual clock - Warm-up period - Breakpoints - Speed adjustment -Automatic determination of run leght - Automatic batch run
Simulation	Capabil-ity	Simulation	Functional -ity	Suitability	Statistical facilities includes: - Therotical Statistical distributions - User-defined distributions - Random number streams - Output Data Analysis - Quality of Data Analysis Capabil-ity - Distribution fitting - Confidence Intervals
Simulation	Capabil-ity	Simulation	Maintain-ability	Analyzability	Supports - Logic checks - Error messages - Ease of debugging - Trace files
Simulation	Capabil-ity	Simulation	Maintain-ability	Testability	Check for infinite loops, circular references, ability to complete process, user's ability to complete task
Simulation	Capabil-ity	Simulation	Usability	Attractiveness	How friendly is the software interface

Component	Criteria	SubCriteria	Character	SubCharacter	Question
Simulation	Capabil-ity	Simulation	Usability	Learnability	Experience and education required for software use
Simulation	Capabil-ity	Simulation	Usability	Operability	Perform what-if analysis
Simulation	Capabil-ity	Simulation	Usability	Operability	Supports - Programming flexibility - Access to source code - Global variables - Built-in functions - Support of Programming concepts - Graphic library
Simulation	Capabil-ity	Simulation	Usability	Operability	Supports: - Quality and Understanda-bility of output reports - User defined output - Periodic simulation results - What if analysis - Conclusion making support - Optimization
Simulation	Capabil-ity	Simulation	Usability	Understanda-bility	Supports: - Documantation and tutorial - Demo models and libraries - Documentation notes - Online help - Expressiveness and quality of graphics
Simulation	Comple-teness	Modeling	Functional-ity	Suitability	Use calculations for more complex modeling scenarios
Simulation	Comple-teness	Modeling	Portability	Co-existence	The results may also be exported to MS-Excel for additional analysis if desired.
Simulation	Comple-teness	Modeling	Usability	Operability	Simulation parameters defined for each activity in the process include processing time (mean and standard deviation), resource assignment, workload distribution strategy (e.g. least cost), queuing strategy (e.g. LIFO, FIFO,priority), and likelihood of each possible transition
Simulation	Comple-teness	Modeling	Usability	Operability	Software provides developing multiple process scenarios for optimization
Marketing Aspect	Ability to Execute	Customer Experience	Marketing		Accessible from client extranet
Marketing Aspect	Ability to Execute	Customer Experience	Marketing		Classroom Training, On site Training, Web-based taraining,
Marketing Aspect	Ability to Execute	Customer Experience	Marketing		SLA includes multiple levels of support
Marketing Aspect	Ability to Execute	Customer Experience	Marketing		SLA supports localized pricing structure
Marketing Aspect	Ability to Execute	Customer Experience	Marketing		Standard or Custom SLAs for individual customer needs
Marketing Aspect	Ability to Execute	Customer Experience	Marketing		Supports integration with external systems

Component	Criteria	SubCriteria	Character	SubCharacter	Question
Marketing Aspect	Ability to Execute	Customer Experience	Marketing		Supports product customization
Marketing Aspect	Ability to Execute	Customer Experience	Marketing		Supports system administration
Marketing Aspect	Ability to Execute	Customer Experience	Marketing		Supports workflow design
Marketing Aspect	Ability to Execute	Market Execution	Marketing		The clarity, quality, creativity and efficacy of programs designed to deliver the organization's message in order to influence the market, promote the brand and business, increase awareness of the products, and establish a positive identification with the product/brand and organization in the minds of buyers. This "mind share" can be driven by a combination of publicity, promotinal, thought leadership, word-of-mouth and sales activities.
Marketing Aspect	Ability to Execute	Market Responsive ness	Marketing		Ability to respond, change direction, be flexible and achieve competitive success as opportunities develop, competitors act, customer needs evolve and market dynamics change. This criterion also considers the Marketing Aspect's history of responsiveness.
Marketing Aspect	Ability to Execute	Operations	Marketing		The ability of the organization to meet its goals and commitments. Factors include the quality of the organizational structure including skills, experiences, programs, systems and other vehicles that enable the organization to operate effectively and efficiently on an ongoing basis.
Marketing Aspect	Ability to Execute	Overall Viability	Marketing		Overall organization's financial health, the financial and practical success of the business unit, and the likelihood of the individual business unit to continue investing in the product, to continue offering the product and to advance the state of the art within the organization's portfolio of products
Marketing Aspect	Ability to Execute	Product / Service	Marketing		Acceptance testing on the installation of third party products
Marketing Aspect	Ability to Execute	Product / Service	Marketing		Access to on-line demonstrations of the solution for evaluation
Marketing Aspect	Ability to Execute	Product / Service	Marketing		ase product supports a feedback mechanism that allows the customer to report faults during the testing and acceptance phase
Marketing Aspect	Ability to Execute	Product / Service	Marketing		Base product can be installed client side hours,weeks,days,months
Marketing Aspect	Ability to Execute	Product / Service	Marketing		Base product supports a checklist for the customer to follow when testing the ECM

Component	Criteria	SubCriteria	Character	SubCharacter	Question
Marketing Aspect	Ability to Execute	Product / Service	Marketing		Base product supports documented processes for testing and accepting solution
Marketing Aspect	Ability to Execute	Product / Service	Marketing		Delivered in hardcopy format
Marketing Aspect	Ability to Execute	Product / Service	Marketing		Delivered on CD
Marketing Aspect	Ability to Execute	Product / Service	Marketing		End users can perform the installation
Marketing Aspect	Ability to Execute	Product / Service	Marketing		Installation can only be performed by the Marketing Aspect
Marketing Aspect	Ability to Execute	Product / Service	Marketing		Installation process documentation is available for the customer to perform the installation
Marketing Aspect	Ability to Execute	Product / Service	Marketing		Installation process documentation is available for third party consultants to perform the installation
Marketing Aspect	Ability to Execute	Product / Service	Marketing		List provided of all third party product licensing and pricing requirements
Marketing Aspect	Ability to Execute	Product / Service	Marketing		List provided of all third party products required to support the successful installation of the base product
Marketing Aspect	Ability to Execute	Product / Service	Marketing		Lists languages the installation documentation supports
Marketing Aspect	Ability to Execute	Product / Service	Marketing		Provides access to try a demo of the actual product on a live server
Marketing Aspect	Ability to Execute	Product / Service	Marketing		Marketing Aspect certifies components to work with products by other third party Marketing Aspects
Marketing Aspect	Ability to Execute	Product / Service	Marketing		Marketing Aspect certifies components to work with the product
Marketing Aspect	Ability to Execute	Sales Execution / Pricing	Marketing		Additional CPU licences
Marketing Aspect	Ability to Execute	Sales Execution / Pricing	Marketing		Additional Server licences
Marketing Aspect	Ability to Execute	Sales Execution / Pricing	Marketing		Additional User Licences
Marketing Aspect	Ability to Execute	Sales Execution / Pricing	Marketing		Additional Virtual Server Licances
Marketing Aspect	Ability to Execute	Sales Execution / Pricing	Marketing		Current instances licensing
Marketing Aspect	Ability to Execute	Sales Execution / Pricing	Marketing		Workflow software does not require purchase of additional licenses
Marketing Aspect	Comple-teness of Vision	Business Model	Marketing		Implementation engineers

Component	Criteria	SubCriteria	Character	SubCharacter	Question
Marketing Aspect	Comple-teness of Vision	Geographic Strategy	Marketing		The vendor's strategy to direct resources, skills and offerings to meet the specific needs of geographies outside the "home" or native geography, either directly or through partners, channels and subsidiaries as appropriate for that geography and market.
Marketing Aspect	Comple-teness of Vision	Innovation	Marketing		Direct, related, complementary and synergistic layouts of resources, expertise or capital for investment, consolidation, defensive or pre-emptive purposes.
Marketing Aspect	Comple-teness of Vision	Market Understandi ng	Marketing		supports Internationalization and Unicode
Marketing Aspect	Comple-teness of Vision	Marketing Strategy	Marketing		Product trials on CD or from a download site
Marketing Aspect	Comple-teness of Vision	Offering (Product) Strategy	Marketing		The Marketing Aspect's approach to product development and delivery that emphasizes differentiation, Functional-ity, methodology and feature set as they map to current and future requirements.
Marketing Aspect	Comple-teness of Vision	Sales Strategy	Marketing		Support matrix (overview of contracts, consulting fees, etc.) provided
Marketing Aspect	Comple-teness of Vision	Vertical / Industry Strategy	Marketing		The vendor's strategy to direct resources, skills and offerings to meet the specific needs of individual market segments, including verticals.

F. BPM Evaluation DSS Reports – Netflow

BPM Evaluation

BPM Component - ISO 9126 Characteristic Level Score

Component	Number of Questions	Characteristic	Score
Process Modeling and Design			
	1	Efficiency	100
	20	Functionality	90
	11	Maintainability	37
	5	Portability	13
	1	Reliability	100
	39	Usability	61
Process (Workflow) Engine			
	2	Efficiency	20
	26	Functionality	76
	7	Maintainability	83
	3	Portability	67
	2	Reliability	50
	26	Usability	68
Business Rule Engine (BRE)			
	10	Functionality	49
	3	Maintainability	33
	5	Usability	39
Enterprise Application Integration (EAI)			
	1	Efficiency	0
	18	Functionality	27
	4	Portability	55
	2	Reliability	50
	3	Usability	33
Document Management System (DMS)			
	1	Efficiency	100
	3	Functionality	20
	2	Maintainability	0
	3	Usability	0

Page 1 of 2

Component	Number of Questions	Characteristic	Score
Business Activity Monitoring (BAM)			
	1	Efficiency	0
	10	Functionality	51
	16	Maintainability	58
	5	Reliability	100
	13	Usability	34
Simulation			
	5	Functionality	0
	2	Maintainability	0
	1	Portability	0
	8	Usability	0
Activity Based Costing (ABC)			
	7	Functionality	82
	1	Usability	40
Balanced Scorecard (BSC)			
	1	Efficiency	0
	1	Functionality	0
	1	Maintainability	0
	1	Usability	0
Marketing Aspect			
	45	Marketing	70

Fig 45 BPM Evaluation DSS– BPM Component - ISO/IEC 9126 Characteristic Level Score Report (Netflow)

BPM Evaluation

BPM Component ISO 9126 - Sub Characteristic Level Score

Component	Characteristic	Number of Questions	Subcharacter	Average Score
Process Modeling and Design				
	Efficiency			
		1	Time Behaviour	100
	Functionality			
		3	Accuracy	100
		9	Interoperatability	71
		5	Security	92
		3	Suitability	100
	Maintainability			
		6	Analyzability	17
		3	Changeability	100
		1	Stability	100
		1	Testability	0
	Portability			
		1	Co-existence	0
		4	Replaceability	25
	Reliability			
		1	Fault tolerance	100
	Usability			
		12	Attractiveness	73
		2	Learnability	40
		21	Operability	88
		4	Understandability	55

Process (Workflow) Engine

Efficiency			
	2	Resource Utilisation	20
Functionality			
	1	Accuracy	100
	1	Func. Compliance	100
	6	Interoperatability	40
	11	Security	80
	7	Suitability	86
Maintainability			
	6	Changeability	83
	1	Stability	70
Portability			
	1	Co-existence	0
	1	Installability	100
	1	Replaceability	100
Reliability			
	2	Recoverability	50
Usability			
	3	Attractiveness	13
	1	Learnability	0
	21	Operability	83
	1	Understandability	100

Business Rule Engine (BRE)

Functionality

2	Accuracy	50
3	Interoperatability	46
1	Security	0
4	Suitability	100

Maintainability

1	Analyzability	0
2	Changeability	50

Usability

1	Attractiveness	0
3	Operability	46
1	Understandability	70

Enterprise Application Integration (EAI)

Efficiency

1	Time Behaviour	0

Functionality

1	Func. Compliance	0
15	Interoperatability	55
2	Suitability	0

Portability

1	Adaptability	40
3	Co-existence	60

Reliability

1	Maturity	100
1	Recoverability	0

Usability

3	Operability	33

Document Management System (DMS)

Efficiency			
	1	Resource Utilisation	100
Functionality			
	2	Security	30
	1	Suitability	0
Maintainability			
	1	Analyzability	0
	1	Stability	0
Usability			
	2	Operability	0
	1	Understandability	0

Business Activity Monitoring (BAM)

Efficiency			
	1	Time Behaviour	0
Functionality			
	1	Accuracy	100
	1	Interoperatability	0
	4	Security	50
	4	Suitability	60
Maintainability			
	11	Analyzability	68
	3	Changeability	33
	1	Stability	100
	1	Testability	0
Reliability			
	3	Maturity	100
	2	Recoverability	100
Usability			
	2	Attractiveness	50
	1	Learnability	0
	9	Operability	64
	1	Understandability	0

Simulation

Functionality

1	Interoperatability	0
4	Suitability	0

Maintainability

1	Analyzability	0
1	Testability	0

Portability

1	Co-existence	0

Usability

1	Attractiveness	0
1	Learnability	0
5	Operability	0
1	Understandability	0

Activity Based Costing (ABC)

Functionality

7	Suitability	82

Usability

1	Operability	40

Balanced Scorecard (BSC)

Efficiency

1	Time Behaviour	0

Functionality

1	Suitability	0

Maintainability

1	Analyzability	0

Usability

1	Attractiveness	0

Component	Characteristic	Number of Questions	Subcharacter	Average Score
Marketing Aspect				
	Marketing			
		45		69

Fig 46 BPM Evaluation DSS– BPM Component – ISO/IEC 9126 Sub Characteristic Level Score Score Report (Netflow)

BPM Evaluation

BPM Component - Sub criteria Level Score

Component	Criteria	Number of Questions	SubCriteria	Weighted Average
Process Modeling and Design				
	Capabilities			
		2	Authentication and security	100
		1	Automation agents	0
		1	Custom views	40
		1	Distributed User administration	100
		37	Flexible forms support	44
		2	Role-based routing	100
		1	Sub-processes	100
	Completeness			
		1	Business metrics and monitoring	100
		2	Collaborative design	50
		25	Graphical designer	60
		2	Modeling	0
		2	Organization charts and directory integration	50

Process (Workflow) Engine

Capabilities

9	Ad hoc routing	96
8	Authentication and security	42
4	Automation agents	50
7	Custom views	66
5	Escalation & Exceptions Handling:	90
2	Flexible forms support	20
1	Parallel routing	100
1	Process rollback	100
1	Queues and Groups	100
1	Relationship routing	100
1	Relative routing	100
1	Status monitoring	100
3	Sub-processes	50
2	Task delegation & conferring	100
1	Web-based architecture	100

Completeness

10	BPM administration	75
2	Database connectivity and transacti	50
1	Graphical designer	100
1	Multiple client interfaces	100
1	Organization charts and directory i	0
1	Scalable BPM Server	100
3	Web services and integration	13

Business Rule Engine (BRE)

Capabilities

17	Robust Business Rules	46

Completeness

1	Modeling	0

Enterprise Application Integration (EAI)

Capabilities

15	Automation agents	14
2	Process documentation	20

Completeness

5	Database connectivity and transacti	63
6	Web services and integration	50

Document Management System (DMS)

Capabilities

2	Authentication and security	30
3	Flexible forms support	0

Completeness

1	BPM administration	0
1	Collaborative design	0
1	Multiple client interfaces	0
1	Scalable BPM Server	100

Business Activity Monitoring (BAM)

Capabilities

1	Authentication and security	0
1	Distributed User administration	40
3	Escalation & Exceptions Handling:	50
14	Status monitoring	78

Completeness

2	BPM administration	50
23	Business metrics and monitoring	28
1	Multiple client interfaces	100

Simulation

Capabilities

12	Simulation	0

Completeness

4	Modeling	0

Component	Criteria	Number of Questions	SubCriteria	Weighted Average
Activity Based Costing (ABC)				
	Completeness			
	8	Business metrics and monitoring		61
Balanced Scorecard (BSC)				
	Capabilities			
	1	Custom views		70
	Completeness			
	3	Business metrics and monitoring		0
Marketing Aspect				
	Ability to Execute			
	9	Customer Experience		100
	1	Market Execution		20
	1	Market Responsiveness		40
	1	Operations		60
	1	Overall Viability		60
	18	Product / Service		80
	6	Sales Execution / Pricing		33
	Completeness of Vision			
	1	Business Model		100
	1	Geographic Strategy		20
	1	Innovation		20
	1	Market Understanding		100
	1	Marketing Strategy		0
	1	Offering (Product) Strategy		20
	1	Sales Strategy		100
	1	Vertical / Industry Strategy		20

Fig 47 BPM Evaluation DSS – BPM Component – Sub Criteria Level Score Report (Netflow)

G. BPM Evaluation DSS Reports – BEA

BPM Evaluation

BPM Component - ISO 9126 Characteristic Level Score

Component	Number of Questions	Characteristic	Score
Process Modeling and Design			
	1	Efficiency	100
	20	Functionality	85
	11	Maintainability	100
	5	Portability	100
	1	Reliability	100
	39	Usability	77
Process (Workflow) Engine			
	2	Efficiency	100
	26	Functionality	95
	7	Maintainability	100
	3	Portability	80
	2	Reliability	100
	26	Usability	98
Business Rule Engine (BRE)			
	10	Functionality	100
	3	Maintainability	67
	5	Usability	87
Enterprise Application Integration (EAI)			
	1	Efficiency	100
	18	Functionality	91
	4	Portability	100
	2	Reliability	100
	3	Usability	100
Document Management System (DMS)			
	1	Efficiency	0
	3	Functionality	0
	2	Maintainability	40
	3	Usability	47

Component	Number of Questions	Characteristic	Score
Business Activity Monitoring (BAM)			
	1	Efficiency	100
	10	Functionality	90
	16	Maintainability	81
	5	Reliability	60
	13	Usability	91
Simulation			
	5	Functionality	86
	2	Maintainability	100
	1	Portability	100
	8	Usability	81
Activity Based Costing (ABC)			
	7	Functionality	100
	1	Usability	100
Balanced Scorecard (BSC)			
	1	Efficiency	100
	1	Functionality	100
	1	Maintainability	100
	1	Usability	100
Marketing Aspect			
	45	Marketing	81

Fig 48 BPM Evaluation DSS – BPM Component - ISO/IEC 9126 Characteristic Level Score Report (BEA)

BPM Evaluation

BPM Component ISO 9126 - Sub Characteristic Level Score

Component	Characteristic	Number of Questions	Subcharacter	Average Score
Process Modeling and Design				
	Efficiency			
		1	Time Behaviour	100
	Functionality			
		3	Accuracy	100
		9	Interoperatability	66
		5	Security	88
		3	Suitability	100
	Maintainability			
		6	Analyzability	100
		3	Changeability	100
		1	Stability	100
		1	Testability	100
	Portability			
		1	Co-existence	100
		4	Replaceability	100
	Reliability			
		1	Fault tolerance	100
	Usability			
		12	Attractiveness	83
		2	Learnability	50
		21	Operability	87
		4	Understandability	85

Process (Workflow) Engine

Efficiency			
	2	Resource Utilisation	100
Functionality			
	1	Accuracy	100
	1	Func. Compliance	100
	6	Interoperatability	100
	11	Security	88
	7	Suitability	100
Maintainability			
	6	Changeability	100
	1	Stability	100
Portability			
	1	Co-existence	40
	1	Installability	100
	1	Replaceability	100
Reliability			
	2	Recoverability	100
Usability			
	3	Attractiveness	87
	1	Learnability	100
	21	Operability	100
	1	Understandability	100

Business Rule Engine (BRE)

Functionality

2	Accuracy	100
3	Interoperatability	100
1	Security	100
4	Suitability	100

Maintainability

1	Analyzability	0
2	Changeability	100

Usability

1	Attractiveness	100
3	Operability	60
1	Understandability	100

Enterprise Application Integration (EAI)

Efficiency

1	Time Behaviour	100

Functionality

1	Func. Compliance	100
15	Interoperatability	91
2	Suitability	50

Portability

1	Adaptability	100
3	Co-existence	100

Reliability

1	Maturity	100
1	Recoverability	100

Usability

3	Operability	100

Document Management System (DMS)

Efficiency			
	1	Resource Utilisation	0
Functionality			
	2	Security	0
	1	Suitability	0
Maintainability			
	1	Analyzability	40
	1	Stability	40
Usability			
	2	Operability	70
	1	Understandability	0

Business Activity Monitoring (BAM)

Efficiency			
	1	Time Behaviour	100
Functionality			
	1	Accuracy	0
	1	Interoperatability	100
	4	Security	100
	4	Suitability	100
Maintainability			
	11	Analyzability	73
	3	Changeability	100
	1	Stability	100
	1	Testability	100
Reliability			
	3	Maturity	33
	2	Recoverability	100
Usability			
	2	Attractiveness	100
	1	Learnability	100
	9	Operability	67
	1	Understandability	100

Simulation

Functionality

1	Interoperatability	100
4	Suitability	75

Maintainability

1	Analyzability	100
1	Testability	100

Portability

1	Co-existence	100

Usability

1	Attractiveness	0
1	Learnability	100
5	Operability	100
1	Understandability	100

Activity Based Costing (ABC)

Functionality

7	Suitability	100

Usability

1	Operability	100

Balanced Scorecard (BSC)

Efficiency

1	Time Behaviour	100

Functionality

1	Suitability	100

Maintainability

1	Analyzability	100

Usability

1	Attractiveness	100

Component	Characteristic	Number of Questions	Subcharacter	Average Score
Marketing Aspect				
	Marketing			
		45		81

Fig 49 BPM Evaluation DSS – BPM Component – ISO/IEC 9126 Sub Characteristic Level Score Report (BEA)

BPM Evaluation

BPM Component - Sub criteria Level Score

Component	Criteria	Number of Questions	SubCriteria	Weighted Average
Process Modeling and Design				
	Capabilities			
		2	Authentication and security	100
		1	Automation agents	0
		1	Custom views	100
		1	Distributed User administration	100
		37	Flexible forms support	92
		2	Role-based routing	100
		1	Sub-processes	100
	Completeness			
		1	Business metrics and monitoring	100
		2	Collaborative design	100
		25	Graphical designer	93
		2	Modeling	100
		2	Organization charts and directory integration	0

Process (Workflow) Engine

Capabilities

9	Ad hoc routing	100
8	Authentication and security	92
4	Automation agents	100
7	Custom views	100
5	Escalation & Exceptions Handling:	93
2	Flexible forms support	100
1	Parallel routing	100
1	Process rollback	100
1	Queues and Groups	100
1	Relationship routing	100
1	Relative routing	100
1	Status monitoring	100
3	Sub-processes	100
2	Task delegation & conferring	100
1	Web-based architecture	100

Completeness

10	BPM administration	98
2	Database connectivity and transacti	100
1	Graphical designer	100
1	Multiple client interfaces	100
1	Organization charts and directory i	100
1	Scalable BPM Server	100
3	Web services and integration	80

Business Rule Engine (BRE)

Capabilities

17	Robust Business Rules	96

Completeness

1	Modeling	0

Enterprise Application Integration (EAI)

Capabilities

15	Automation agents	98
2	Process documentation	100

Completeness

5	Database connectivity and transacti	100
6	Web services and integration	92

Document Management System (DMS)

Capabilities

2	Authentication and security	0
3	Flexible forms support	10

Completeness

1	BPM administration	40
1	Collaborative design	40
1	Multiple client interfaces	100
1	Scalable BPM Server	0

Business Activity Monitoring (BAM)

Capabilities

1	Authentication and security	100
1	Distributed User administration	100
3	Escalation & Exceptions Handling:	100
14	Status monitoring	64

Completeness

2	BPM administration	100
23	Business metrics and monitoring	97
1	Multiple client interfaces	100

Simulation

Capabilities

12	Simulation	86

Completeness

4	Modeling	100

Component	Criteria	Number of Questions	SubCriteria	Weighted Average
Activity Based Costing (ABC)				
	Completeness			
		8	Business metrics and monitoring	100
Balanced Scorecard (BSC)				
	Capabilities			
		1	Custom views	100
	Completeness			
		3	Business metrics and monitoring	100
Marketing Aspect				
	Ability to Execute			
		9	Customer Experience	88
		1	Market Execution	100
		1	Market Responsiveness	100
		1	Operations	100
		1	Overall Viability	0
		18	Product / Service	72
		6	Sales Execution / Pricing	83
	Completeness of Vision			
		1	Business Model	100
		1	Geographic Strategy	100
		1	Innovation	60
		1	Market Understanding	100
		1	Marketing Strategy	100
		1	Offering (Product) Strategy	100
		1	Sales Strategy	100
		1	Vertical / Industry Strategy	100

Fig 50 BPM Evaluation DSS – BPM Component – Sub Criteria Level Score Report (BEA)

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