

Analysis of Business Processes and Modeling Approach to Business Process Re-Engineering

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Abstract—This paper analyzes the various business processes and its modeling approach to business process re-engineering. It is basically study of a collection of related structured activities or tasks that produce specific service for a particular customer or customers. In this regard number of processes is covered and their modeling approach:

- 1-**Management Process:** That governs the operation of system, typical management processes include “corporate governance” and “strategic management”.
 - 2- **Operational Process:** That constitutes the core business and create primary value stream. Typical operational processes are purchasing, advertising, marketing and sales.
 - 3- **Supporting Process:** Which support the core business processes including accounting, recruitment, and call center technical support?
- Apart from the above point the researcher will try to optimize the business processes and its modeling approach for an enterprise or organization so that the current process may be analyzed and improved.

Keywords-BPR,BPM,BPMN,BPD,BPA,BPI,BPAF

I. INTRODUCTION

In the early 1990s, US corporations, and subsequently companies all over the world, started to adopt the concept of reengineering in an attempt to re-achieve the competitiveness that they had lost during the previous decade. A key characteristic of Business Process Reengineering (BPR) is the focus on business processes. Davenport (1993) defines a (business) process as:

”a structured, measured set of activities designed to produce a specific output for a particular customer or market. It implies a strong emphasis on how work is done within an organization, in contrast to a product focus’s emphasis on what. A process is thus a specific ordering of work activities across time and space, with a beginning and an end, and clearly defined inputs and outputs: a structure for action. ... Taking a process approach implies adopting the customer’s point of view. Processes are the structure by which an organization does what is necessary to produce value for its customers. ”Hammer & Champy’s (1993) definition can be considered as a subset of Davenport’s. They define a process

as”a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer.”

As we can note, Hammer & Champy have a more transformation oriented perception, and put less emphasis on the structural component – process boundaries and the order of activities in time and space.

Rummler & Brache (1995) use a definition that clearly encompasses a focus on the organization’s external customers, when stating that ”a business process is a series of steps designed to produce a product or service. Most processes (...) are cross-functional, spanning the ‘white space’ between the boxes on the organization chart. Some processes result in a product or service that is received by an organization’s external customer. We call these primary processes. Other processes produce products that are invisible to the external customer but essential to the effective management of the business. We call these support processes.”

Finally, let us consider the process definition of Johansson et al. (1993) [17] they define a process as:”a set of linked activities that take an input and transform it to create an output. Ideally, the transformation that occurs in the process should add value to the input and create an output that is more useful and effective to the recipient either upstream or downstream.”

This definition also emphasizes the constitution of links between activities and the transformation that takes place within the process. Johansson et al. also include the upstream part of the value chain as a possible recipient of the process output. Summarizing the four definitions above, we can compile the following list of characteristics for a business process.

1. **Definability:** It must have clearly defined boundaries, input and output.
2. **Order:** It must consist of activities that are ordered according to their position in time and space.
3. **Customer:** There must be a recipient of the process’ outcome, a customer.
4. **Value-Adding:** The transformation taking place within the process must add value to the recipient, either upstream or downstream.

5. **Embeddedness:** A process can not exist in itself; it must be embedded in an organizational structure.
6. **Cross functionality:** A process regularly can, but not necessarily must, span several functions.

Techniques to model business process such as the flow chart, functional flow block diagram, control flow diagram, Gantt chart, PERT diagram, and IDEF have emerged since the beginning of the 20th century. The Gantt charts were among the first to arrive around 1899, the flow charts in the 1920s, Functional Flow Block Diagram and PERT in the 1950s, Data Flow Diagrams and IDEF in the 1970s. Among the modern methods are Unified Modeling Language and Business Process Modeling Notation. Still, these represent just a fraction of the methodologies used over the years to document business processes [1].

The term "business process modeling" itself was coined in the 1960s in the field of systems engineering by S. Williams in his 1967 article "Business Process Modeling Improves Administrative Control"[2]. His idea was that techniques for obtaining a better understanding of physical control systems could be used in a similar way for business processes. It took until the 1990s before the term became popular.

In the 1990s the term "process" became a new productivity paradigm. Companies were encouraged to think in processes instead of functions and procedures. Process thinking looks at the chain of events in the company from purchase to supply, from order retrieval to sales etc. The traditional modeling tools were developed to picture time and costs, while modern methods focus on cross-function activities. These cross-functional activities have increased severely in number and importance due to the growth of complexity and dependencies. New methodologies such as business process redesign, business process innovation, business process management, integrated business planning among others all "aiming at improving processes across the traditional functions that comprise a company".[3]

In the field of software engineering the term "business process modeling" opposed the common software process modeling, aiming to focus more on the state of the practice during software development. In that time early 1990s all existing and new modeling techniques to picture business processes were considered and called "business process modeling languages." In the Object Oriented approach, it was considered to be an essential step in the specification of Business Application Systems. Business process modeling became the base of new methodologies, that for example also supported data collection, data flow analysis, process flow diagrams and reporting facilities. Around 1995 the first visually oriented tools for business process modeling and implementation were being presented.

In this paper section 1 present an overview of the history of business process development and its modeling approach, where as Section 2 gives the effective foundation of existing developed process and its modeling approach. Section 3 briefly describes the current research and development. Section 4 and 5 describe the analysis of business process and its modeling approach to business process reengineering and

proposed work. Section 6 concluded the entire research process and its objectives.

II. BACKGROUND

Business process discovery (BPD) related to process mining is a set of techniques that automatically construct a representation of an organization's current business processes and its major process variations. These techniques use evidence found in the existing technology systems that run business processes within an organization [4].

Business Process Discovery Techniques

Business process discovery techniques embody the following properties:

- **Emergent paradigm** - Current methods are based on top-down structured manual interviews relying on second-hand representations of the business process/system behaviors. An automated discovery process relies on collecting data from the information system over a period of time. This data can then be analyzed to form a process model.
- **Automated process discovery** – By automating the analysis of the data, the subjectivity of current manual process analysis techniques is removed. The automated system has an ingrained methodology that — through repeated trials — has been shown to accurately discover processes and process variations without bias.
- **Accurate information-** Since the information is collected from the actual source it cannot be inaccurate, as opposed to gathering it from second party representation.
- **Complete information** - An automated process captures all the information that is occurring within the system and represents them by time, date, user, etc.... Since the information is collected from real-time interactions, it is not subject to lost or selective memory issues. This includes completeness regarding exceptions in the processes. Often, exceptions are treated as statistical "noise," which may exclude important inefficiencies in business processes.
- **Standardized Process** - The automated collection of information yields process data which can be grouped, quantified and classified. This supplies a basis for the development and monitoring of both current and new processes, to which benchmarks can be assigned. These benchmarks are the root of both new process design and the determination of problem root cause. Additionally, standardized process data can set the stage for efforts at continuous process improvement.

Application and Techniques

Business Process Discovery complements and builds upon the work in many other fields.

- Process discovery is one of the three main types of process mining. The other two types of process mining are conformance checking and model extension/enhancement. [4] All of these techniques aim at extracting process related knowledge from

event logs. In the case of process discovery, there is no prior process model; the model is discovered based on event logs. Conformance checking aims at finding differences between a given process model and event log. This way it is possible to quantify compliance and analyze discrepancies. Enhancement takes an a priori model and improves or extends it using information from the event log, e.g., show bottlenecks.

- Business process discovery is the next level of understanding in the emerging field of business analytics, which allows organizations to view, analyze and adjust the underlying structure and processes that go into day-to-day operations. This discovery includes information gathering of all of the components of a business process, including technology, people, department procedures and protocols.
- Business process discovery creates a process master which complements business process analysis (BPA). BPA tools and methodologies are well suited to top-down hierarchical process decomposition, and analysis of to-be processes. BPD provides a bottoms-up analysis that marries to the top-down to provide a complete business process, organized hierarchically by BPA.
- Business Intelligence provides organizations with reporting and analytics on the data in their organizations. However, BI has no process model, awareness or analytics. BPD complements BI by providing an explicit process view to current operations, and providing analytics on that process model to help organizations identify and act upon business process inefficiencies, or anomalies.
- Web analytics are a limited example of BPD in that web analytics reconstruct the web-user’s process as they interact with a Web-site. However, these analytics are limited to the process as is contained within the session, from the user’s perspective and with respect to just the web-based system and process.
- Business triage provides a framework for categorizing the processes identified by business process analysis (BPA) based on their relative importance to achieving a stated, measurable goal or outcome. Utilizing the same categories employed by military medical and disaster medical services, business processes are categorized as:
 - Essential/critical (red process) - Process essential for achieving outcomes/goals
 - Important/urgent (yellow process) - Process which speeds achieving outcomes/goals
 - Optional/supportive (green process) - Process not needed to achieve outcomes/goals
- Resources are allocated based on the process category with resources first dedicated to red processes, then yellow processes and finally green

processes. In the event that resources become limited, resources are first withheld from Green Processes, then Yellow Processes. Resources are only withheld from Red Processes if failure to achieve outcomes/goals is acceptable.

Process Modeling

The term process model is used in various contexts. For example, in business process modeling the enterprise process model is often referred to as the business process model. Process models are core concepts in the discipline of process engineering.

From a theoretical point of view, the meta-process modeling explains the key concepts needed to describe what happens in the development process, on what, when it happens, and why. From an operational point of view, the meta-process modeling is aimed at providing guidance for method engineers and application developers. [5]

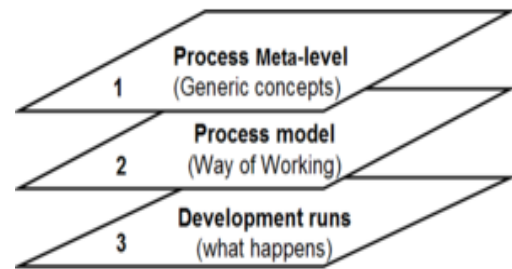


Fig: 1 Abstraction level of processes

Process models are processes of the same nature that are classified together into a model. Thus, a process model is a description of a process at the type level. Since the process model is at the type level, a process is an instantiation of it. The same process model is used repeatedly for the development of many applications and thus, has many instantiations. One possible use of a process model is to prescribe how things must/should/could be done in contrast to the process itself which is really what happens. A process model is roughly an anticipation of what the process will look like. What the process shall be will be determined during actual system development. [5]

The goals of a process model are to be:

- **Descriptive**
 - Track what actually happens during a process.
 - Take the point of view of an external observer who looks at the way a process has been performed and determines the improvements that must be made to make it perform more effectively or efficiently.
- **Prescriptive**
 - Define the desired processes and how they should/could/might be performed.
 - Establish rules, guidelines, and behavior patterns which, if followed, would lead to the desired process performance. They can

range from strict enforcement to flexible guidance.

- **Explanatory**
 - Provide explanations about the rationale of processes.
 - Explore and evaluate the several possible courses of action based on rational arguments.
 - Establish an explicit link between processes and the requirements that the model needs to fulfill.
 - Pre-defines points at which data can be extracted for reporting purposes.

Purpose of Business process Model

The activity of modeling a business process usually predicates a need to change processes or identify issues to be corrected. This transformation may or may not require IT involvement, although that is a common driver for the need to model a business process. Change management programmes are desired to put the processes into practice. With advances in technology from larger platform vendors, the vision of business process models (BPM) becoming fully executable (and capable of round-trip engineering) is coming closer to reality every day. Supporting technologies include Unified Modeling Language (UML), model-driven architecture, and service-oriented architecture.

Process modeling addresses the process aspects of an Enterprise Business Architecture, leading to an all encompassing Enterprise Architecture. The relationships of a business processes in the context of the rest of the enterprise systems, data, organizational structure, strategies, etc. create greater capabilities in analyzing and planning a change. One real world example is in corporate mergers and acquisitions; understanding the processes in both companies in detail, allowing management to identify redundancies resulting in a smoother merger.

Classification of Process Model

There are three types of coverage where the term process model has been defined differently: [6]

- **Activity-oriented:** related set of activities conducted for the specific purpose of product definition; a set of partially ordered steps intended to reach a goal. [7]
- **Product-oriented:** series of activities that cause sensitive product transformations to reach the desired product.
- **Decision-oriented:** set of related decisions conducted for the specific purpose of product definition.
- **Context-oriented:** sequence of contexts causing successive product transformations under the influence of a decision taken in a context.
- **Strategy-oriented:** allow building models representing multi-approach processes and plan different possible ways to elaborate the product based on the notion of intention and strategy. [8]

By Alignment

Processes can be of different kinds. These definitions “correspond to the various ways in which a process can be modeled”.

- **Strategic processes**
 - investigate alternative ways of doing a thing and eventually produce a plan for doing it
 - are often creative and require human co-operation; thus, alternative generation and selection from an alternative are very critical activities
- **Tactical processes**
 - Help in the achievement of a plan.
 - Are more concerned with the tactics to be adopted for actual plan achievement than with the development of a plan of achievement.
- **Implementation processes**
 - Are the lowest level processes.
 - Are directly concerned with the details of what and how of plan implementation.

By Granularity

Granularity refers to the detail level of the process model and affects the kind of guidance, explanation and trace that can be provided. High granularity limits these to a rather coarse level of detail whereas fine granularity provides more detailed capability. The nature of granularity needed is dependent on the situation at hand.

Project manager, customer representatives, the general, top-level, or middle management require rather large-grained process description as they want to gain an overview over time, budget, and resource planning for their decisions. In contrast, software engineers, users, testers, analysts, or software system architects will prefer a fine-grained process model for the details of the model deliver them with instructions and important execution dependencies such as the dependencies between people.

By Flexibility

It was found that while process models were prescriptive, in actual practice departures from the prescription can occur. [8] Thus, frameworks for adopting methods evolved so that systems development methods match specific organizational situations and thereby improve their usefulness. The development of such frameworks is also called Situational Method Engineering. Method construction approaches can be organized in a flexibility spectrum ranging from 'low' to 'high'. [9]

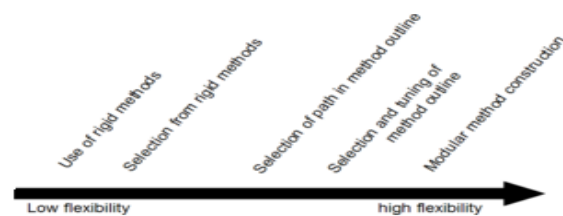


Fig: 2 flexibility of method construction approach [9]

Business Model

A business model is a framework for creating economic, social, and/or other forms of value. The term 'business model' is thus used for a broad range of informal and formal descriptions to represent core aspects of a business, including purpose, offerings, strategies, infrastructure, organizational structures, trading practices, and operational processes and policies.

In the most basic sense, a business model is the method of doing business by which a company can sustain itself. That is, generate revenue. The business model spells-out how a company makes money by specifying where it is positioned in the value chain.

Business Process Modeling Tools

Business process modeling tools provide business users with the ability to model their business processes, implement and execute those models, and refine the models based on as-executed data. As a result, business process modeling tools can provide transparency into business processes, as well as the centralization of corporate business process models and execution metrics. [10]

Modeling and simulation

Modeling and simulation functionality allows for pre-execution “what-if” modeling and simulation. Post-execution optimization is available based on the analysis of actual as-performed metrics. [10]

Business process modeling diagrams are:

- Use case diagrams created by Ivar Jacobson, 1992.Currently integrated in UML
- Activity diagrams, also currently adopted by UML

Some business process modeling techniques are:

- Business Process Modeling Notation (BPMN)
- Cognition enhanced Natural language Information Analysis Method (CogNIAM)
- Extended Business Modeling Language (xBML)
- Event-driven process chain (EPC)
- ICAM DEFinition (IDEF0)
- Unified Modeling Language (UML), extensions for business process such as Eriksson-Penker's

A business model, which may be considered an elaboration of a business process model, typically shows business data and business organizations as well as business processes. By showing business processes and their information flows a business model allows business stakeholders to define, understand, and validate their business enterprise. The data model part of the business model shows how business information is stored, which is useful for developing software code. See the figure: 3 for an example of the interaction between business process models and data models. [11]

Business process management

Business process management is a field of management focused on aligning organizations with the wants and needs of clients. It is a holistic management approach that promotes business effectiveness and efficiency while striving for innovation, flexibility and integration with technology. As organizations strive for attainment of their objectives, business process management attempts to continuously improve processes - the process to define measure and improve your processes – a "process optimization" process.

III RELATED APPROACH

Business Process Analytics provides process participants and decision makers with insight about the efficiency and effectiveness of organizational processes. [12]

There are three reasons why we might want to measure different aspects of business processes:

1. To evaluate what has happened in the past,
2. To understand what is happening currently, or
3. To build an understanding of what might happen in the future.

During the initialization and execution of a process instance, multiple events occur which may be of interest to a business, including events that relate to the instantiation and completion of process activities, internal process engine operations and other system and application functions. Using BPAF-based information, a business can determine what has occurred in the business operations managed by a business process management system. BPAF is designed as an implementation-independent data format that enables the aggregation and correlation of audit data across multiple platforms. While we anticipate that the major sources for BPAF data will be business process management systems, the use of the standard is not limited to these systems and other information systems may publish events following the BPAF data structure to allow for easier integration with other process-related audit data .[12]

The goal of a Business Process is to achieve a business objective by following a fixed order of steps to turn input into output. The outcome of this process creates value for a company more efficiently than previous processes. Compared to other management techniques, business processes increase competitiveness by [13]:

- increasing efficiency,
- enabling quick reaction to changing environments,
- offering superior value to customers

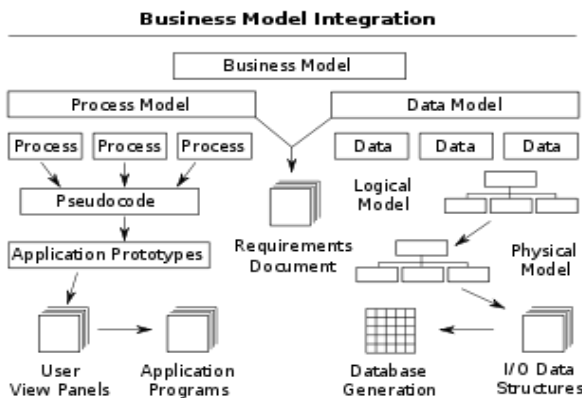


Fig: 3 Interaction between business process and data model [11]

Business Process Integration (BPI)

In their paper, the authors suggest that business process research can be divided into core research and applied research. The core research investigates the design, implementation and management of business processes, as well as the technologies used for BP implementation and management.

- **Design**

Designing a business process hinges on analyzing the company's business goals. Once this analysis has been performed, a process can be developed to achieve the business goals in the most efficient manner.

- **Implementation through technology**

Business processes can only be managed efficiently when they can rely on adequate technological backup. Advances in IT – including Enterprise Resource Planning (ERP), Service-oriented architecture (SOA) and web services – provide managers with a wider range of options when designing, implementing and managing BPs.

- **Implementation through organizational actions**

Analyzing the reasons for success or failure in BP implementation can highlight what management needs to provide or foster to implement BPs successfully. Research has identified several key aspects that make or break BP initiatives, including: organizational structure, interdepartmental communication, and change & project management skills, support from management, and IT and technological backup.

- **Management**

Once BPs have been designed and implemented, they require day-to-day monitoring to maintain continuous improvement. Six-sigma is a method for managing the quality of a process. The method originated in manufacturing, but its adoption has spread and the concept is now widely embraced in, for example, sales and purchasing.

This paper from IBM Research (in India and the US) presents an approach for automatically converting informal process diagrams – such as are done in Visio – to formal process models that can be managed in a BPMS. This requires two main tasks: inference of the structure that is, identifying the nodes and edges, and semantic interpretation to associate process modeling semantics.

Information process diagrams contain a lot of structural and semantic ambiguities that have to be resolved. Most of the existing process modeling tools use shape names to interpret the semantics when importing Visio diagrams, but often untrained process modelers will use a variety of shapes to mean a single element type, or use the same shape for multiple element types [14].

Process mining is a process management technique that allows for the analysis of business processes based on event logs. The basic idea is to extract knowledge from event logs recorded by an information system. Process mining aims at improving this by providing techniques and tools for

discovering process, control, data, organizational, and social structures from event logs. [15]

As of 2010[update] technology has allowed the coupling of BPM to other methodologies, such as Six Sigma. BPM tools allow users to:

- **Vision** - strategize functions and processes
- **Define** - baseline the process or the process improvement
- **Model** - simulate the change to the process.
- **Analyze** - compare the various simulations to determine an optimal improvement
- **Improve** - select and implement the improvement
- **Control** - deploy this implementation and by use of User defined dashboards monitor the improvement in real time and feed the performance information back into the simulation model in preparation for the next improvement iteration.
- **Re-engineer** - revamp the processes from scratch for better results
- This brings with it the benefit of being able to simulate changes to business processes based on real-life data (not assumed knowledge). Also, the coupling of BPM to industry methodologies allows users to continually streamline and optimize the process to ensure that it is tuned to its market need. [16]

IV ANALYSIS OF BUSINESS PROCESSES AND MODELING APPROACH

Business Process Model and Notation

Business Process Model and Notation (BPMN) is a graphical representation for specifying business processes in a business process model

BPMN is constrained to support only the concepts of modeling applicable to business processes. Other types of modeling done by organizations for non-business purposes are out of scope for BPMN. Examples of modeling excluded from BPMN include:

- Organizational structures
- Functional breakdowns
- Data models

In addition, while BPMN shows the flow of data (messages), and the association of data artifacts to activities, it is not a data flow diagram.

BPMN models consist of simple diagrams constructed from a limited set of graphical elements. For both business users and developers, they simplify understanding business activities' flow and process. BPMN's four basic element categories are:

Flow objects

Events, activities, gateways

Connecting objects

Sequence flow, message flow, association

Swim lanes

Pool, lane

Artifacts

Data object, group, annotation

These four categories enable creation of simple business process diagrams (BPDs). BPDs also permit making new types of flow object or artifact, to make the diagram more understandable.

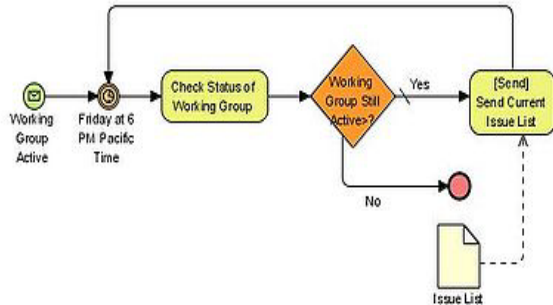


Fig4: Business process model and notation for a process with a Normal flow

Weaknesses of BPMN

The weaknesses of BPMN could relate to:

- ambiguity and confusion in sharing BPMN models
- support for routine work
- support for knowledge work, and
- converting BPMN models to executable environments

V. PROPOSED WORK

A business process can be decomposed into several sub-processes, which have their own attributes, but also contribute to achieving the goal of the super-process. The analysis of business processes typically includes the mapping of processes and sub-processes down to activity level. A business process model is a model of one or more business processes, and defines the ways in which operations are carried out to accomplish the intended objectives of an organization. Such a model remains an abstraction and depends on the intended use of the model.

It can describe the workflow or the integration between business processes. It can be constructed in multiple levels.

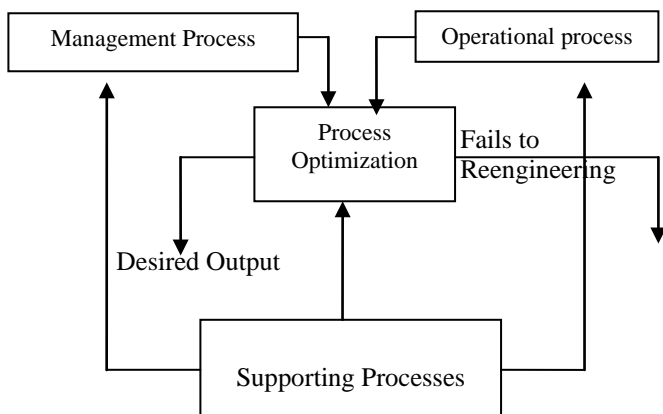


Fig 5: Flow work of business processes

A workflow is a depiction of a sequence of operations, declared as work of a person, work of a simple or complex mechanism, work of a group of persons, work of an

organization of staff, or machines. Workflow may be seen as any abstraction of real work, segregated in work share, work split or whatever types of ordering. For control purposes, workflow may be a view on real work under a chosen aspect. Process optimization includes retrieving process performance information from modeling or monitoring phase; identifying the potential or actual bottlenecks and the potential opportunities for cost savings or other improvements; and then, applying those enhancements in the design of the process. Overall, this creates greater business value

VI. CONCLUSION

In this paper the researcher optimizes the analysis of business processes and modeling approach to business process re-engineering, which include retrieving process performance information from modeling or information phase. When the process becomes too noisy and optimization is not fetching the desire output, it is recommended to re-engineer the entire process cycle. Business process re-engineering has become an integral part of organizations to achieve efficiency and productivity at work.

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