A Gap between Business Process Intelligence and Redesign Process

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Abstract- Business process management systems are introduced to change information system's traditional data driven approaches to process centric approaches. Benefits of process oriented approaches are reduction in operational complexity, change management and easy understanding of processes. Process oriented systems are very effective in identification of flow obstruction and bottlenecks through which improvement in business processes is identified. As the process activities increases identification and measurement of process weakness turns into a challenge. A lot of work has been done in the domain of process improvement and redesign. Researchers have proposed Business Process Intelligence (BPI) framework, which is based on Business Intelligence techniques and provides a multi dimensional way of information representation. Previous researches posses a gap in provision of act of improvement in redesign process. Therefore, this research aims to focus on a guided way of process improvement that can provide optimize redesign process. Process improvement also depends on the effective way of agent assignment and resources assignment to an activity. This research will also provide a discussion on need of methods for optimized agent and resources assignment.

Keywords- Business Process Management (BPM), Business Process Intelligence (BPI), Business Process Improvement (BPIm), Process Warehouse (PW).

I. INTRODUCTION

Business process improvement is the name of radical change in process design, before going to the improvement step there is to define the historical view. Frederick Tayor in 1911 starts it with 'scientific management' called First Wave, it defines "the one best method for performing a task is based on time and motion" [1,2]. Enterprises are more focusing on effective and efficient storage and retaining of their daily business transactions including financial, inventory, works, logistics and human resource planning [3]. It is believed that Computer based information systems (CBIS) provides a managed and reliable delivery of data and information. These systems have extremely huge data storage capacity and extraordinarily fast processing of data into information. These CBIS are widely uses in last decades and full filling the basic information process needs of small and medium organizations but with the passage of time world is becoming global village and CEOs need more integrated view of organizational information. CBIS lacks in provision of integrated view of information [3,4]. Large and medium organizations are moving towards implementation of ERP (Enterprise Resource Planning) systems to provide the more sophisticated and integrated way of information storage and reporting to compete in the market. "ERP comprises of a commercial software package that promises the seamless integration of all the information flowing through the company – financial, accounting, human resources, supply chain and customer information" [3,4]. Survey is conducted [5] on assessing potential changes after implementation of ERP in six organizations, process change management in ERP's systems require a lot of work to do; solution is to adopt process oriented approach [5].

Actual work in on business process improvement starts from the work of Devonport and short 1990 who brings revolution by introducing Business Process reengineering (BPR). In 1993 Hammer and Champy defines BPR as "the fundamental reconsideration and radical redesign of organizational process that is used to achieve drastic improvement of current performance in cost service and speed". Smith and Finger in 2002 with the third wave introduces Business Process Management (PBM), a continuous improvement with reuse facility of existing process designs [1]."Business process management is a process centric approach for improving business performance that combines information technology with governance methodology" [1]. BPM process is processed by following steps design, analysis, configuration, enactment, and evaluation. These steps are performed iteratively on any business case study. This is process oriented and cyclic approach which uses both structured and unstructured way to improve the process management. Structured approach focuses more on the process while un-structural on actors of process. After the completion of all steps the software team configures the system in accordance with process centric approach, but this is not the final stage of BPM.

Process improvement, reengineering and optimization are the complementary steps for BPM [3]. Essential is to monitor and redesign the whole process activities or a group of processes activates [1,7]. For this we need to continuously track and monitor the whole business processing activates and actors. Process Logs provides the whole process execution data, which is used to track the whole workflow of process. Depending on the size of enterprise, process logs produce a massive amount of data. It is very hard to analyze and provide information that can help in answering following questions. How I can improve the process execution by adding or dropping some process from implemented Process Model Notation (BPMN)? Where the process addition or removal can reduce the

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effects of bottlenecks and delays? Which process steps are essential for the identification of Key Performance Indicators (KPI's)? Even though some time it becomes very tough to cope the changing made, it is because most of process improvements techniques are based on What Exists Now? And what is going on now? [7,8,9,10] These techniques lead to do the deep measurements, analysis and aggregation of process activities logs information by you. It all requires ample amount of affords and time [8].Business process Intelligence (BPI) framework is suggested for properly structured and fully guided way to improve Business Process Management (BPM) [11]. BPI has a tendency to provide the statistically analyzed, deeply calculated and aggregated information of process activities and execution.

Business Process Intelligence (BPI) relates to "a set of integrated tools that supports business and IT users in managing process execution quality" [11]. It provides analytical view to the business processes, which is very informative for automatic or real time monitoring, improvement and optimization of the BMP [18]. BPI framework as top down approach starts from the implementation of validated Business Process Model and configuration information systems. Process log are the event based detailed information of process activities. It includes the process time i.e. when the process starts and when process ends, process completion time, delay and ideal complication time, process successful and failed executions. Increase in process execution increases the Process log data size. Identification of the weak points both resources or agent based is very time consuming and complex. Solution for this problem is proposed to use an intelligent system. Automatically identify who is responsible for the process delay. Resource assignment problem can also be solved using this framework. Challenging task here is how to perform ETL (Extraction, Transformation and Loading) on process log data. A well structured Method can provide step by step process for BPI implementation. Different techniques are discussed in literature review with their limitations.

Another aspect of process improvement is the proper assignment of agent and resources to an activity. Agents are the actors who are responsible for performing activities of the process while resources are the equipments or tools for performing an activity [39] For instance in the example of leather cutting industry the cutting devices or cutting tools e.g. scissor, blade are the resources and agents are the person or individuals that are responsible for using the resources for the execution of process tasks. Tasks in this case will be cutting of leather. Proper and appropriate assignment of agent or resource is very critical for effective process execution, most of the time delays and obstacles are caused by inexperience agent or bad resources [37,38, 39].

II. LITERATURE REVIEW

A. Business Process Improvement

Business process improvement is an iterative approach and will continue to get an improved process for effective and efficient processing of business activities. Z. Gregor. (2011) review existing approaches for process improvements and proposed mandatory elements identification criteria. Most of it concentrates on what needs to be done after and before process crashes, but the actual act of improvement is missing. Griesberger, P. presents a review paper on the techniques of process improvement that supports "act of improvement". They consider 36 techniques and evaluate on considered success factors. They concluded that act of improvement is still required more work to do [25]. Moghdeb, F.A. (2011) proposed a theoretical and unstructured way of process improvement which is based on finding of key factors from the process user after interviewing and monitoring. Answering to research questions, researchers apply proposed model on Retail case study. For RQ1 it is suggested that it can be solved after making a suitable argument with stakeholders. Solution suggested to RQ2 and RQ3 is to identification of measurement indicators and finding relationship between these constructs [29]. C. Semih. (2008) proposed a process improvement approach WABPI. WABPI model is divided into four steps like start up, self analysis (finding weakness), making changes (improve weakness) and feedback. Weakness identification process starts with the observation of the performance with some defined criteria which may be based on some or any one of following like cost, time technique and tools, priorities, teamwork and talent and goals methodology [27,33]. Process improvement also depends on the effective way of agent assignment and resources assignment to an activity [34,35,36,37,38,39].

B. Business Process Intelligence

B .Mutschler(2005) Proposed a three layer Business process Intelligence (BPI) reference Architecture. In level one heterogeneous information system are implanted or configured after validation of Process modeling or workflow management. Event based executions are stored in a process log also called audit trails. Process logs keeps the massive collection of process trails data which is integrated after syntactical correction. ETL is performed at this integrated data and stored in a process warehouse. In addition to process log date simulation data is also stored for estimated references. In level two process unit work with process mining, security, notification and administration perform aggregation and calculation of KPI measures by administration. In level 3 a dashboard provides the structure for visualization of data into statistically analyzed and mined reports. A cost model is derived from Boehm's constructive cost model (which is used for the estimation of software development process (life cycle)). Direct costs include BPI Software, BPI Hardware, BPI Support and BPI customization. Indirect costs include end user costs. After analysis researchers found BPI is very beneficial to implement, but it causes a significant cost as well. Limitations of this research are i) process data integration is not clear ii) strategy to construct process warehouse is not mentioned iii) it is not mentioned that which schema model will be used iv) approach is limited in provision of information that how to perform OLAP .There is a need to

use a multidimensional schema model (Star Model) after identification of Business Goals based on KPI's v). It is Not a systemic approach i.e. does not provided a step by step illustration vi) Potential areas of BPI are not mentioned [18]. Tan, W (2008) works on BPI methodology and implementation. The representation of performance management strategy consists of three steps i.e. Measurement, analysis and response. Process definition, process simulation and process measurement are the process measurement steps. Analysis follows process evaluation, process optimization and OLAP flows. Process monitoring, process tasks and process control are categories by response. Activity flow, information flow, Resource flow, cost flow and profit flow are the six ways proposed by the researchers. BPI system architecture is proposed which mainly woks on the PDW (Process Data Warehouse) which is extracted from process database by PWD loader. This process model is then validated in simulated environment on a prototype case study model of airplane. Process improvement is made on efficiency, speed, time, costs and four level scheduling strategies. In this paper researches mainly made their focus on defining the process steps, strategies and terminologies. This paper lacks in: i) providing detailed implementation of proposed framework ii) complete structure of PDW iii) mechanism of PDW loader working iv) identification of goals furthermore, Process evaluation is based on a dynamic method. [17,19].

Schiefer, J. (2004) worked on monitoring and improvement strategies of Business process management and workflow management systems. Process information Factory (PIF) is a process oriented improvement model which provides analyzed information of whole business process execution paths and bottlenecks. Information is based on aggregation of multidimensional and historical data of process execution. PIF gives the idea of implementation of process warehouse (PWH) with enterprise existing data ware house. PIF builder manages and integrates the process & workflow data in process data store repository directly. Process data store (PDS) contains both current and historical data of process running; this data is migrated into process warehouse which is a sub-unit of enterprise data ware house. Enterprise data warehouse is formed from the ETL of information systems and workflow event data provided by Event Processing Container (EPC). PWH characteristics are just like the traditional data warehouse such as subject orientation, time variant, non volatile and integrated, and also uses star model for designing activities start schema. EPC is used for pushing real time workflow activity data, it works as staging area for integration large no of workflow events data. Other staging environment is provided by PIF builder in PDS. BPI is used to improve the business process activities which are independent of enterprise information system, as process changes the flow on activities information also changes so integration of process warehouse with enterprise data warehouse is not a good idea. [30].D. Grigori(2004) Introduces a BPI architecture suite, a cockpit is provided which is extracted from the OLAP and mining of Process Data warehouse. Process data warehouse id created from process audit logs via PDW loader [11]. Applicability steps and detail of PWD is missing.

Carsten Felden (2010) gives the review of different BPI methodologies and provides BPI implication guidelines in favor of analytical view of process activities. Positive point of this paper is the descriptions of morphological box for business process intelligence which gives good relationship between BPI characteristics parameters and their types. They proposed a multi theory approach in H1 BPI effectively provide the historical and analytical view facts of rapidly changing environment. In H2, for a virtual process need is to find factors that can influence virtualization with BPI process flexibility; find the sense of cost efficiency. BPI can efficiently work for both H3 and H4. In this paper only the theoretical work is presented for imperial study and applicability of BPI does not seem to be justified [20]. Lodhi, A.,(2011) In business process improvement framework IS logs are converted into BP DW which is further used for decision support and data mining. Improvement is based on time, cost and quality parameters. A case study is used to evaluate the defined framework. Process activities are categorized into low, medium and high costs and same categories for operation time. Extension in BPMN is also suggested with performance based analysis activities notations. Cost, quality and time are not only the all aspects to identify process latency. Detailed process illustration is not provided especially how PB DW will be managed? [28]. Thomas,O et.al.(2006) use PBI for identifying fuzziness and risk rating from business process[31]. T.H, Lucineia (2008) proposed a method for process designing which is based on activities patterns analysis [32], designed model is then checked for deadlock and bottlenecks. W. Gaaloul (2005) proposed an intelligent process improvement suite which is based on set of mining techniques to discover transactional behavior from process logs [14]. Stefanov, V(2005) creates the link between business process and data warehouse and processed an event driven process chains for DWH [15]. L. Markus.(2010) Review different BPI techniques and find that most of them are not systemic and show the potential of applicability of BPI with Morphological box [21].

III. Related Work

Sr.	Author	Paper main idea	Limitation
1.	D. Grigori (2004)	Introduces a BPI architecture suite, a cockpit is provided which is extracted from the OLAP and mining of Process Data warehouse. Process data warehouse id created from process audit logs via PDW loader.	Applicability steps and details of PWH structure is not proper addressed.
2.	Schiefer, J. (2004)	PIF (Process information Factory) architecture is an integrated model based on both data driven approach and process oriented approach. PIF integrate the PIF builder data which is available in the form of PDS , EPC container and information system data. Process warehouse is the part of enterprise data warehouse. PWH is designed	It gives the idea of integrated PWH with enterprise DWH, Which may not work for process data as Information flow in process based systems are independent of data.

		using star model. EPC tends to provide the real time workflow activities data and also provides staging environment. FIP Builder provides the transformation on data into PDS, which acts as staging area.	
3.	B. Mutschl er (2005)	Three layers Business Process Intelligence (BPI) reference Architecture is proposed, which integrates process log data and simulated process date into process warehouse. After mining, processing and administrating visualized reports are produced for process analyst. Then this model is evaluated using software cost estimation model.	Not a systemic approach i.e does not provided a step by step illustration
4.	Tan,W. (2008)	A six step model based on Activity flow, information flow product flow, resource flow, cost flow and profit flow is proposed for process measurement. A BPI framework is presented which is based on following steps like efficiency, speed, time, cost and scheduling strategies. A prototype of airplane case study is used for validation of proposed system architecture dynamically.	i). Proposed framework is not checked for applicability. ii). Detailed structured illustration of BPI system architecture is not provided.
5.	Carsten Felden (2010)	Give the morphological box for characteristics type relationships for BPI. Proposed a muliti Theory approach and check the applicability of BPI on 4 hypothetical case scenarios. BPI provides a managed way to identify process laps by providing analytical visual and historical process execution information [20]	Only theoretical work is presented for applicability of BPI
6.	Lodhi, A.,(2011)	In business process improvement framework IS logs converted into BP DW which is further used for decision support and data mining. Improvement is based on time, cost and quality. A case study is use to evaluate the defined framework. Extension in BPMN is also suggested for analysis.	i). Cost, quality and time are not the only aspects to identify process latency and weakness. ii). Detailed process illustration and how PB DW will be managed needs to be provided

Table 1: Summary of Literature review of BPI (Business Process Intelligence)

IV. RESEARCH PROBLEM

Following will be the research targets:

1. Non Optimized design :

   BPI needs an introduction of a method or framework, which can act as a guide for process improvements. It needs Step by step description of process change methods both for agent and resource assignment. Previous models mostly provided black boxed view. Previous research gaps lies in not providing the detailed structure of process warehouse (PW), inefficient in providing the log data transform structure information, not providing the information of data quality issues for ETL, adoption of multi dimensional schema and mainly the issues regarding data update. All these are critical issues in BPI implementation. This problem is causing immense confusion in the mind of BPI developers. Unstructured way of BPI is a big hindrance in an efficient implication of BI in Process management. If someone start with following steps i) identification of weakness in process management, ii).evaluations of process performance on well established BPM (Business process Management) dimensions iii) integration of process data into multidimensional way then provision of historical information based guided way of process improvement is very effective and efficient.

   Based on the literature review it is concluded that established dimensions for evaluation of Business Process are not being considered in BPI. According to [36] proposed devil's quadrangle four dimension i.e. cost, quality, time and flexibility are used for business process re-design. BPI also provides the guided way to the user for process re-design so same dimensions should be consider for calculation of process way. When the process is weighted inefficient it can lead the inefficient and inappropriate resource utilizations.

2. Agent and resource assignment problem:

   Process improvement also depends on the effective way of assignment of resources (tools) and agents (actors) to tasks .A structured way of resource or agent assignment can easily identify process weaknesses. For instance in the example of leather cutting industry the cutting devices or cutting tools e.g. scissor, blade are the resources and agents are the person or individuals that are responsible for using the resources for the execution of process tasks. Tasks in this case will be cutting of leather. In some cases if the wastage is reported then it is very difficult to identity either it is due to the improper use of resources or agents. So, it is mandatory to have a proper method that will identify who is responsible for the wastage. Optimized redesign is achieved only with the correct identification of process weaknesses. Previous research conducted in the domain of BPI ignored this factor.

V. METHODOLOGY

Keywords Business process improvement, business process intelligence, business process reengineering, and business redesign process are selected for this study. These key words are searched from scholar.google search engine. Approximately 200 papers filtered first from these 6 most

recent and popular papers selected and find the gap of process intelligence and redesign process.

Problem Description			
Main Problem	**Non Optimized Design**		
Solution	**Process improvement by Business Process Intelligence**		
Sub problems	Act of improvement missing	Inappropriate Resource Assignment	Inappropriate Agent Assignment
Proposed solutions	Method for redesign process	Method for optimization of agent assignment	Method for optimization of resource assignment
Proposed Methodology	Weakness identification + Evaluating criteria + Theories of decision making	Agent assignment policies + Work ability + Performance	Resources assignment policies + resource ability +

Table 2: Problem Description with Proposed Solutions

VI. WORK MODEL

It is believe that proposed model shown in figure 1 can be very helpful in optimized business process execution.

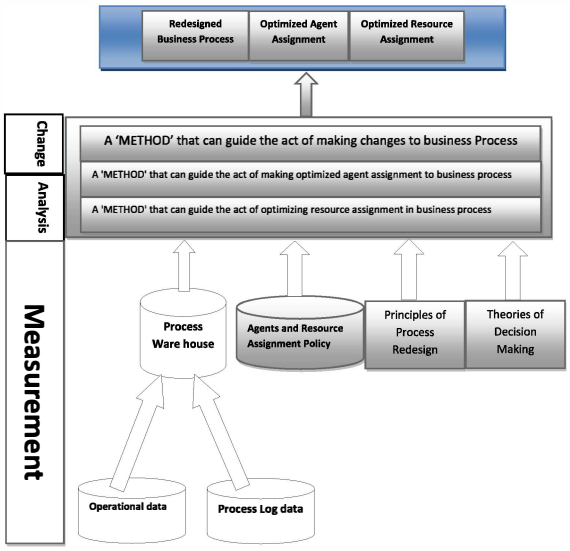

Figure1: Proposed Model for process improvement

Select a BPI model for process improvement that can provide the act of improvement i.e which transforms the design forms from as-is to the desired to-be state. Pre requisites for weakness identification are the classification of weakness variables and successful execution of process improvement CSF. And then build a method that provides optimized resources assignment. Last step can be a method that provides the act of optimized agent assignment.

VII. CONCLUSIONS

We suggest that the previous research lacking in providing the optimal way for redesign business process, therefore it is required to have a structured way of process improvement which focuses on the development of method for process weakness identification by defining process performance analysis variables and providing a guided way for improvement with optimized redesign, optimized agent and proper resource assignment. It is concluded proper agent and resources assignment can improve process task performance. In future work we will implement this model on real time case study and check the validity and applicability of model.

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