Process Transformation for Reaching Agility: Chief Information Officer Role

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Abstract. *Rapidity of business change in business systems is driving a need for agility to respond more effectively to change. Business needs and technology needs can be related directly to one another to categorize agility impact points. Business system that aspires to respond in real time must have the ability to be agile when needed. Business process management (BPM) addresses how business systems can identify, model, develop, deploy, and manage their business processes, including processes that involve information technology (IT) systems and human interaction. Chief information officer (CIO) anticipates significant change entailing delivery of products, services and capabilities that support business strategies. Opportunities exist for CIO to lead IT unit to make a difference with distinctive solutions that use information and technologies in new ways. In this paper the role of CIO in seizing these opportunities by going to distinctive solutions that redefine IT's contribution to the business are investigated. As a result, the new approach and model within BPM discipline for reaching agility are proposed.*

Keywords. agility, business change, business process management, chief information officer.

1 Introduction

A business process is a real-world activity consisting of a set of logically related tasks that, when performed in the appropriate sequence, and according to the correct business rules produces a business outcome. The requirement for agility is not new, but IT-based agility is an emerging best practice. To deal with such change to business-as-usual, each business system must decide how it will achieve enough agility to compete in a world in which instant gratification has taken on a key meaning. Different business systems will have different needs for agility and different agility profiles. One way of addressing this complex demand for agility is to employ a technology strategy that seeks to achieve:

- Greater efficiency of operation (productivity)
- Greater availability of information (awareness)
- Increased options for handling known changes (flexibility)
- More-effective reaction to unanticipated changes (adaptability) [13, p. 4].

Business processes range from short-lived (taking minutes or hours) to long-lived (taking weeks, months, or even years). BPM has a long tradition, starting with early workflow systems and progressing up to modern Web services orchestration and choreography systems. Terms orchestration and choreography are sometimes used interchangeably, but they also may be distinguished according to internal and external use (i.e., choreography is sometimes distinguished from orchestration as being more appropriate for extended business-to-business interactions).

CIOs are investing in extensions of their core technologies, and they are creating platforms that support distinctive capabilities. Their technology priorities, in turn, concentrate on the core technologies that are platforms supporting distinctive capabilities. Information is a critical component of these new platforms, especially business activity monitoring (BAM) and business intelligence (BI) capabilities. The ongoing importance of information is driving expansion of the technical infrastructure, including servers, storage and modernization of legacy applications.

The factor driving CIOs toward IT modernization is need for process improvement, because of the lack of IT systems and services agility in responding to business requests for change. As the IT environment becomes more complex, it becomes less able to respond to business requests in a timely manner. IT modernization as a part of overall IT management also means increasing integration among projects and portfolios.

2 Business process management

The main goals and benefits of BPM include the following [8]:

- Reduce the impedance mismatch between business requirements and IT systems by allowing business users to model business processes and then having the IT department provide the infrastructure to execute and control these business processes.
- Increase employee productivity and reduce operational costs by automating and streamlining business processes.
- Increase corporate agility and flexibility by explicitly separating process logic from other business rules and representing business processes in a form that is easy to change as business requirements change. This allows business systems to be more agile, responding quickly to market changes and quickly seizing competitive advantages.
- Reduce development costs and effort by using a high-level, graphical programming language that allows business analysts and developers to quickly build and update IT systems within a particular problem domain.

Business process automation is the conversion of the activities of a business system from manual or partially computerized systems to business system-wide, highly automated systems. Business process automation involves the automation and tracking of business processes, in whole or in part, during which documents, information, and/or tasks are passed from one participant (any agent, including humans, business systems, and computer systems) to another for action according to a set of business rules.

All IT systems support and implement business processes in one form or another. What makes business process management unique is that it explicitly separates business process logic from other business rules (this contrasts with other forms of system development where the process logic is deeply embedded in the application code).

2.1 Business process management system

Whereas BPM is the discipline associated with defining, managing, and executing business processes as a corporate asset, business process management systems (BPMS) provide the technology that implements one or more of these core BPM functions. Most business process management systems (whether they are called workflow, process automation, process integration, EAI, B2B, service composition, orchestration, or choreography) provide a process modeling tool, which allows processes to be defined as a graph, where the nodes of the graph represent the tasks to be performed and the arcs of the graph represent control-flow or dataflow dependencies among the tasks. In addition, most process management systems allow the arcs of the graph to be annotated with rules that define, among other things, task pre-conditions, routing logic, escalation rules, time delays, and deadlines. A complete BPMS must do much more than simply execute a process. Figure 1. shows the basic components of a BPMS [9].

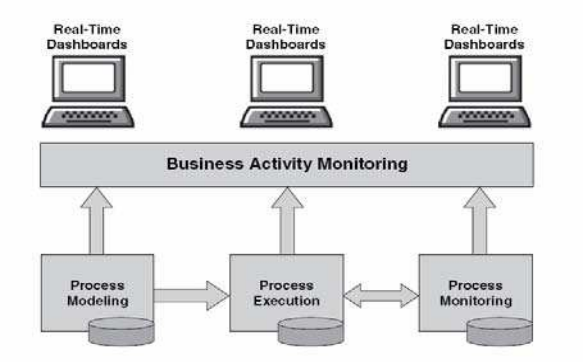

Figure 1. Components of BPMS

2.2 The structure of BPMS

Using BPM, service-oriented architecture (SOA), and Web services in combination gives some benefits which include a more flexible and agile implementation of a BPM system and the ability to more easily create, manage, and maintain composite applications. Most business systems have a diverse application and technology landscape. Typically there are numerous application silos (so named due to their stand-alone nature, which includes everything from application GUIs to application-specific business logic to application databases), and sharing information among applications is difficult due to differences in technology platforms and data models. Moving to an SOA and Web services introduces a services layer. The services layer consists of line of business services that are aligned to a particular business domain (including data models suitable for each business domain), reusable technical services that can be shared across multiple business domains, and the Web services platform, which allows services to be defined and utilized in a manner that is independent of the underlying application and technology platforms. The services layer provides the

ideal platform for the business process layer for the following reasons [9]:

- The line of business services provide coarse-grain business functionality that maps to the business tasks in a business process.
- The service contracts for the line of business services provide well-defined and unambiguous interfaces for accessing the services, and therefore the business process is not responsible for knowing any details of the underlying application and technology platforms.
- The service registry and service discovery facilities provided by the service layer ensure that the business process layer can dynamically locate and access services as necessary.
- The service-level data model is defined based on the business domain and is independent of the data model used by any particular application. Furthermore, XML is used as the canonical format for exchanging data between tasks in the business process and when a business task invokes a service because XML is independent of the internal data formats used by the underlying applications.
- The service-level security model provides single sign-on and role-based access control to ensure that process tasks are authorized to use services, and it protects the business process layer from having to deal with the various security interfaces provided by the underlying application and technology platforms.
- The service-level management model generates run-time statistics regarding service usage, which can be used by BAM tools that are part of the business process layer.

2.2.1 Process modeling

The goal of business process modeling is to capture business requirements at the initial design stage and then make them available to the rest of the development process. Business process modeling begins with business analysts defining their needs using a process-modeling tool. The process model defines dependencies among tasks, how tasks are sequenced, when and how tasks are enabled, who can perform each task, and other process-related business rules [8].

Process models are then given to technical specialists who map the process models to the business system's IT assets, or they are given to software developers who create new software components that fulfill the tasks defined by the business process. Business analysts and the IT unit may also use the process models to run simulations. Not only are the business processes simulated but also the people and systems related to them are included, too. Business analysts, for example, may use the simulations to look for bottlenecks in the processes, such as how many customer service representatives are required to handle a particular workload. Technical specialists may use the simulations to check performance characteristics, such as how increasing the transaction load will affect server performance

2.2.2 Process Execution

After the business process has been modeled, simulated, and mapped to new and existing IT assets, it is ready to be deployed. BPM suites include process execution engines that import the process models (typically defined using WS-BPEL) and then execute and manage as many instances of the business process as necessary for supporting the business system's operational requirements. The process execution engine is responsible for executing the process models and enforcing the business rules associated with the process, such as [9]:

- Invoking tasks or executing tasks in the correct order.
- Assigning and routing tasks to authorized users. In some cases, this also includes allowing the user to manage his or her work queue.
- Tracking the current status of the process, including which tasks have been completed, which tasks are eligible for execution, what deadlines are associated with the process and its tasks, and so on.
- Accessing local and remote IT systems to retrieve information needed by the process, to update information produced by the process, and to execute transactions defined by the process.
- Monitoring process execution, issuing alerts when business rules are violated (e.g., deadlines are missed), and escalating problems to supervisors and managers if they are not corrected on a timely basis.

Because business processes may take weeks or months to complete, it is sometimes necessary for the process engine to simultaneously support multiple versions of the same process.

WS-BPEL is an XML language for defining business process behavior based on Web services. Processes in WS-BPEL consume and provide functionality by using Web service interfaces. WS-BPEL extends the Web services interaction model and enables it to support business transactions.

2.2.3 Process Monitoring and Business Activity Monitoring

BPM systems include process-monitoring tools that allow business users and IT administrators to monitor and control a business process. Process monitoring tools typically include multiple interfaces, such as graphical views, tabular views, and forms-based views.

BAM analyzes events generated by business processes and information collected about business processes to provide real-time feedback on higher-level business functions and business performance metrics. BAM is becoming a standard component of

business process management suites. BAM is aware of the context of the executing business processes because it can correlate the information and events it collects with the associated process models. Therefore, BAM has immediate knowledge of process deviations and can send alerts to interested parties. As part of a BPM suite, BAM has access to multiple systems involved in a given business process and can combine this information to create real-time digital dashboards that provide real-time feedback for the business system. A BAM dashboard gives stakeholders in a business system access to information that helps them track and manage key performance indicators (KPI). Business systems can provide different company stakeholders with BAM dashboards (sometimes called business system performance management dashboards) customized to their needs. A sales view, for example, could enable salespeople to see orders and related details. An operations view would show shipments and picking errors. The chief executive officer (CEO) could see daily and monthly totals, actual versus planned results, year-over-year comparisons of KPIs, and more in real time [9].

3 Agility

Business agility calls for quick decisions and action. Agility is the ability of a business system to sense environmental change and respond efficiently and effectively to that change. Any framework for agility must address issues that go well beyond selection of the latest technologies. Business system's willingness to be agile, its understanding of its own business system building blocks and its enablers of agility, and its adherence to an "agility cycle" are just as important as the judicious use of agility-influencing technologies. This research will discuss all five of these critical concepts.

The following four fundamental capabilities enable a business system to increase agile performance across the agility cycle. They are essential to being able to allocate corporate activities to measurable categories [13, p. 9]:

- Awareness (the right information through data and event monitoring mean knowing what is going on)
- Flexibility (the right options by rule modeling and simulation render possible confronting expected change)
- Adaptability (the right reactions by rapid rule modification enable confronting unexpected change)
- Productivity (the right policies, procedures and operations through automation for executing well day to day).

As such, the measurement of these enablers is key to the calculation of any agility measurements. A brief definition of each concept, in the context of agility, is provided below [13, pp. 9-10].

3.1 Awareness

Awareness is the knowledge that significant change is occurring in business conditions. Proactively identifying changes can provide a business system with more time to gather data and react accordingly to the problem or opportunity that presents itself. Determination of awareness levels poses questions such as:

- Do end users see the right information at the right time?
- Does the business system suffer from any internal or external barriers to awareness?
- Is this information easily accessible by the right people?

3.2 Flexibility and Adaptability

Flexibility is the ability to respond appropriately to expected changes in business conditions. Adaptability requires increasing flexibility through adding options to handle unexpected change. Financial viability, human capital and technical infrastructure are just a few examples of factors that will affect the flexibility and adaptability of a business system. Key questions include:

- Is the business system able to respond to expected (flexibility) or unexpected (adaptability) changes as they occur?
- If not, can the business system identify some of the problems that impede its flexibility and adaptability?
- Does the structure of the business system promote or prevent flexibility and adaptability?

3.3 Productivity

Productivity is the ability to operate effectively and efficiently. Business systems that can execute efficiently and cost-effectively can have a significant agility advantage over competitors. Determining productivity's impact on agility includes questions such as:

- How efficient are the business system's operations?
- Is the business system effective from day to day?
- Can business system identify any internal or external barriers that impede its productivity?

4 Process transformation

According to [16, p. 236] project management within the Department of Defense (DOD) is likely one of the most complex processes in the world. End-to-end (E2E) process improvements demand more sophistication in project and change management and possess a cross-functional scope involving process, technology and organizational models. Process design should reflect innovation and agility, in addition to

efficiency and effectiveness, thereby driving business system's maturity with process orientation. The goal of BPM is to increase operational performance but also to increase business agility [5].

BPM discipline treat people, computer systems and information as equally important resources and advocate a more formal management of the business system's processes. A BPM-driven business system implements governance and structured methods, policies, metrics, practices and tools that ensure that it defines, manages and continually optimizes its business processes in a holistic, unified way. This approach is in direct contrast with the predominant approach of breaking processes up into constituent parts defined by functions and geographies and the resources aligned within these. With the more holistic approach of BPM, three key outcomes emerge that directly support business agility [6, p. 4]:

- The availability of real-time information delivered in context, which increases the business manager's level of confidence to make accurate and faster decisions
- Shortening the time to revise a business process through an explicit understanding of shared responsibility across business and IT professionals
- Fast adoption of process changes by process participants due to visibility, collaboration and consensus building.

4.1 CIO role

99 percent of CEOs say that IT is essential to business competitiveness, but only 31 percent of CIOs believe IT is sufficiently aligned with business objectives and strategy. Focusing the efforts of IT operations on business outcomes, the idea is that IT acts not only as a service providing business but as a fully engaged strategic partner taking actions to help the overall business achieve its goals. The emphasis for IT, then, becomes one of managing the overall health of business services - not only from a technical perspective, but also from the point of view of the business [4, p. 3].

The complexity of IT modernization demands a structured, experienced approach. When facing the challenges of moving entire mission-critical environments that support crucial business processes and have far-reaching business repercussions, the key to success is having a strategic combination of innovative tools, skilled manpower, and proven methodology. When used together, they must be appropriate for the business system's specific IT environment and business needs.

With a growing number of technology solutions capable to deliver greater business agility, some obstacle remains - outdated management practices that drag out the time for line management to act quickly. Newer BAM technology found in a business process management suite (BPMS) equips IT with alternative techniques to capture real-time business event data and present it to business users graphically in the context of the executing process so that it is more intuitive for the business professional to use [6, p. 5].

BPM implementations could be termed as the most cooperative effort of any IT projects ever attempted. Processes by nature contain wide elements of integration, especially when they're E2E initiatives. They need to be integrated with a multitude of functional legacy systems to achieve corporate objectives. The leadership managing the BPM implementation must align interests of the functional system owners with those of the team's, which is responsible for delivering the solution. The sponsor must articulate the vision and common purpose for this cross-functional cooperative effort. It's not uncommon in large corporations to underplay this. A lack of vision and cooperation will result in limiting the BPM solution's effectiveness and access to the existing infrastructure [14].

Bad leaders are especially dangerous to organizations not only because they jeopardize productivity but also because they put their organizations at risk of potentially costly legal action [17]. CIOs and IT executives must be models of transformation as their businesses capitalize on business processes, relationships, information flows and services. The next three years will be a period of advanced leadership, high experimentation, organizational flexibility and serious talent competition [10, p. 1].

Process design and testing effort migrate to business process owners working closely with process-centric developers. CIO and IT development staff must proactively encourage a progressive shift to shared responsibility along with business process analysts, business managers and process owners in performing needs analysis, process design and testing effort.

Modern business requires process centric approach, i.e. E2E management and control of business system [2, p. 38]. Integration is capable of delivering real value to the business, reducing latency and increasing the throughput capacity of the business system. These benefits come at a price of increased complexity in managing service delivery and maintaining the portfolios of assets needed to support the integrated business system. Analysis of business process with respect to costs must determine the true cost of and E2E process.

CIOs recognize the importance of raising IT effectiveness. Yet a gap in meeting business expectations exists because of the lack of IT's ability to execute high-impact initiatives. As business expectations rise, they must not only strengthen their operational results, but also must expand and evolve their role, addressing problems and opportunities by delivering distinctive solutions. CIOs typically expand their role beyond IT from the inside out. Responsibility for business process improvement is

the most common role addition. More than half (53%) of CIOs with outside responsibility oversee business process improvement [11, p. 44]. CIO is expected to drive the process transformation and IT modernization agenda directly, using the full resources of the IT management team. This issue is far too important and pervasive to be delegated to a side-office function. The staff of the IT team should be absolutely certain that CIO will hold them individually and severally responsible for wholehearted participation in the activity. CIO must manage the staff's skills gap. He/she should lead the longer term view on skills needs, doing so by insisting that the technology plan be reinterpreted as a skills plan with emphasis on skills that are becoming obsolete and skills that will replace them.

CIO strategies must be based on proven practices and priorities. Delivering projects that enable business growth is top strategic priority of CIOs in 2008 [11, p. 15].

4.2 Business process platform (BPP), corporate performance management (CPM), BI and BAM

The business process platform is a model to describe how new software technology (e.g. BPMS) can be used to support a business. The value of BPP is to provide, first, business value and, second, IT productivity. Business systems need BPP strategy to coordinate IT resources across business intelligence, business applications and business process management. BPP includes an integrated set of technologies, a business service repository and the process component content that enables the creation and orchestration of business processes. BPP represents the approach that the IT department and business process owners should follow to manage better and reduce the costs of an ever-increasingly complex IT stack. Using a BPP model will help business system consider the process environment as a whole and apply the right sourcing model for IT-enabled processes. Integrated composition environments, BPM and business service repositories are emerging to assist users with managing their BPPs [3, p. 1].

Corporate performance management is used to describe the methodologies, metrics, processes and systems used to monitor and manage the business performance of an organization. The CPM framework is a set of applications that leverages existing BI infrastructure and information delivery systems to support a comprehensive CPM strategy. The aim of CPM is to combine the BI framework and tools with the various business applications already established in the organization. The heart of the CPM framework is a set of applications that deliver the following functionality [15]:

- Budgeting, planning and forecasting
- Profitability modeling and optimization
- Scorecard applications
- Financial consolidation
- Statutory and financial reporting.

Although online capabilities are increasing, both CPM (consolidation) and BI (analysis) typically have a batch-oriented structure. BAM (alerts in case of escalation) focuses on more operational management and is much closer to online technologies such as business process management and application integration. Many CPM suites heavily rely on BI technology, transporting typical CPM functionality such as scorecards and planning to BI infrastructure layers. On the other hand, some of the BI functionalities are becoming more real-time because of an emerging need for real-time scorecards and dashboards. To use BI to drive business transformation it will be necessary to change the way BI is integrated into business process management [15].

4.3 Process transformed for reaching agility

When the foundation based on business (complex) system's knowledge is built and relationships with key stakeholders exist a vision of how technology can improve, even revolutionize the system may be developed. The knowledge acquired has to be used to envision what business system could be like if it were using technology and information in the best possible way. What new growth opportunities would exist? What relationships would be strengthened? Whose productivity could be doubled, or even quintupled? What costs could be cut [1, p. 67]?

There are three categories of process improvement that manifest themselves in project types: 1) continuous improvement projects, 2) new process implementation projects, and 3) business model innovation projects [7, p. 1].

- The engagement model between IT and business within an business system differs considerably by the kind of E2E business process application project enlisted.
- The IT unit is no longer simply the execution partner of business processes. It needs to be involved in strategic decisions about E2E business processes and how the underlying application architecture will help drive or inhibit their success. This involves changes in project staffing and the scope of roles where IT is leveraged.
- The skills for IT project leaders within the enterprise will differ in all three emerging project types, even if the underlying business application architecture is common.

Business systems expect IT to make the difference with customers, markets and internal operations. Improving business processes is the top business priority for CIOs in 2008 [11, p. 13].

CIOs continue to invest in core technologies that can drive distinctive solutions. BI is the top technology priority for CIOs in 2008 [11, p. 26].

Based on the results of business process analysis, CIO as a leader of IT function in a complex system can and should initiate process change, streamline the processes or suggest introduction of the new processes if necessary, in order to improve overall business process. For example, transformation of the way the business is being done within complex system is achieved by introducing BI linked to BPM. BI looks information of the business system as an asset and is linked with the BPM, becoming it's constituent part, as follows:

- Gives the information about the business processes if they are performed correctly.
- Using CPM parameters and generates the triggers (events) for managerial decisions if the problem with the process performance occurs.
- Using existing data for BI purposes process mining as the ultimate concept in BPM is possible. It includes dynamic/animated views of how processes are performing, capitalizing on the past, optimize the present and anticipate the future behavior.

Figure 2 shows generic model of information system within a complex system.

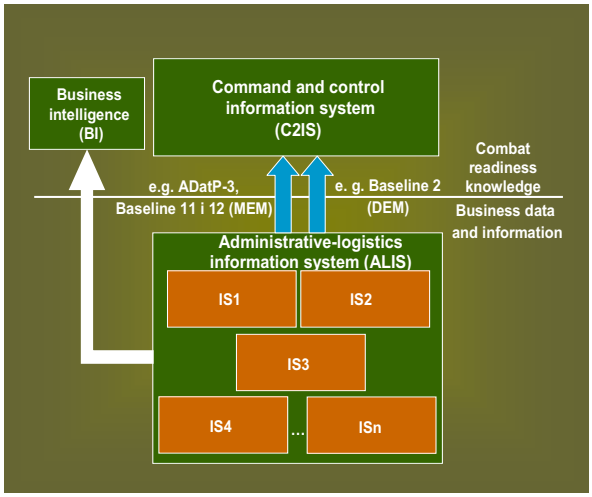

Figure 2. Generic model of complex system's information system incorporating BI, C2IS and ALIS

Interoperability of information is essential and an assured capability for this is vital. The successful execution of fast moving operations needs an accelerated decision-action cycle, increased tempo of operations, and the ability to conduct operations simultaneously within combined/multinational formations. Commanders require timely and accurate information. Also, supporting command and control (C2) systems need to pass information within and across national and language boundaries. Additionally, forces must interact with non-governmental bodies, and international and national aid organizations. Information technology must act as a force multiplier to enhance operational effectiveness at each level of command by enabling the sending, receiving, filtering, fusing, and processing of ever-increasing amount of digital information [12].

In complex system (e.g. military system) BI serves for generation of information which fall into the same category (classified) as information produced by the command and control information system (C2IS), based on inputs from administrative-logistics information system (ALIS). Ordinary, data from ALIS to C2IS may be transfered based on protocols of message exchange mechanism (MEM) or data exchange mechanism (DEM). Consequently, some categories of combat readiness data (classified) can be produced from business data (unclassified) by aggregation through BI algorithms, which results in transformation and improvement of C2 process.

5 Conclusion

Increased business agility is one of the many outcomes realized from adopting BPM. The concrete productivity gains realized through new BPM management practices and enabling technologies will propel agility throughout many facets of the business system. Empowering business leaders with renewed confidence to make faster, better-informed decisions will transform the business system's culture. Allowing employees a stake in the process changes generates consensus and ownership of the E2E process outcomes.

CIOs should identify closely with their business colleagues and think of themselves as business leaders first, and IT leaders second. Communications must be put in context to give people relevant information at the right time so they can act. Leading business systems should look to the most volatile, complex and dynamic processes to deliver potent improvements in business process efficiency.

Business systems should establish an information infrastructure to enable them to identify and act on the opportunities that would otherwise be missed. CIOs must take a more-strategic perspective of what business system is trying to achieve, and apply their knowledge to help achieve those goals. CIOs should look beyond their immediate domains and work to support the strategic goals of the enterprise. They should understand more about the business sector in which they operate, rather than simply the IT domain.

Business transformation is the capability of translating strategic business vision into a commitment and plan for execution. The focus is on transformative business processes, less on incremental improvement processes. Business process transformation generates such changes in a company's business processes that it changes the way the company does business and as a result changes the company's role or position in the market significantly.

Process transformation is not only about the technology supporting it. It is also about transforming the way the processes are executed and the business is done, treating the information as an asset. Consequently, using the BI process transformation is being performed. Information treated as an asset of the overall business system used by BPM can lead to the agility as an ability of business to react properly on the incentives coming from external environment (e.g. customers and markets, changing market conditions, competitive threats) and consequently to perform appropriate internal operations (business process change, streamline or development of the new ones). In such a way BI becomes constituent part of BPM.

A successful business system differentiates itself by providing services in unique and market-leading ways. CIOs are expected to lead the way in creating distinctive, unique solutions and practices enabling agility of the business system, focusing on customer and business processes.

Complex system must have the ability to be agile when needed. This paper investigates CIO role and responsibility in transformation of business processes in order to improve agility of the complex system by the means of IT. In this connection contributed generic model of information system is designed, proposing new approach to C2 process improvement for conducting near real time and real time operations within BPM-driven complex system.

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