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Winter 12-9-2003

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Abstract

The rapid development of e-Business urges the need for online integrative partnership and collaborative business process management. These trends call for a new dimension of decision support: online multiplicitive decision interoperability. We define it as a decision support platform for e-Business, which facilitates inter-organizational decision making process allowing dynamic partnership. As it is not the common decision support system we familiar with, we propose a new architectural framework of this decision support platform. This framework carries a set of unique characteristics that should be incorporated in the design and development of such platform.

Keywords: decision support system, inter-organizational system, e-Business, platform

1. Introduction

World Wide Web revolutionizes business trading, from a reactive information based e-commerce portal in the early 1990's, to the interactive buy-sell e-commerce website of mid 1990's. At the beginning of the 21st century, business-to-business e-commerce further foretells the impact of Internet technology deep into the core business of every industry. A new dimension – integrative website – is beginning to emerge [15] [17]. Coupled with interactivity, websites seek to develop capability to integrate business processes online. This new integrative era witnesses the emergence of e-Business processes such as e-supply-chain-management, e-collaboration and e-reengineering. The online management of e-Business is needed. For example, a management e-Platform for the logistics industry is being proposed [15] [16]. One issue that is critical to the integrative era is how to enable decision making in the dynamic electronic environment where partnership is formed and collaborative management of cooperating business processes is conducted.

Online decision support system is still at its infancy for corporations. The design of an online decision support (DS) for e-Business requires a different approach to that of a stand-alone DSS [4] [23]. We believe that online DS is likely to play a significant role in the next phase of e-evolution. Particularly, DS is a key to the provision of online knowledge management and sharing, a critical e-Business process of the future. As companies leverage the knowledge-rich Web to conduct effective e-Business processes, websites with knowledge management capability will proliferate. Companies and industries will need to re-engineer their internal and external processes to tap into this powerful resource.

In this paper, we investigate the nature of decision making process in this new emerging era where online e-Business prevails. Online decision support takes on a different identity in the new electronic environment (e-environment) where needs and situations are dynamic. We call this new decision support apparatus the e-DSP. E-Decision Support Platform is a platform where decision support is enabled within this e-Business operating environment. In the following sections, we first describe the current business environment on the web and the needs that arise. We then develop the underpinning of the role of e-DSP. Characterization of e-DSP will follow with a proposed architectural framework for technical design consideration.

2. New e-Business requirements

As the development of e-commerce has become well established, the business world is now focusing on how to enable e-Business. With effective e-Business, a company can strengthen and improve customer relationships, streamline supply chain, automate processes, improve efficiencies, flexibility, scalability and availability [28]. Therefore, everyone is fascinated to join the e-environment. This accelerated participation quickens the emergence of new requirements in e-Business, especially in the decision support realm. A new dimension of decision support emerges – no longer as singular in nature as traditional DSS, but as a multiplicitive partnership in an e-Platform environment. An e-Platform is a virtual space where participants conduct any-to-any interactive activities. Two key contributing e-Business trends to this e-decision support platform, or e-DSP, will be discussed next.

2.1 Collaborative business model

In the 21st century, companies believe specialization and outsourcing is one way to make their business success and long lasting.. Thus, companies tend to emphasize on their core competencies and reduce operating costs by

outsourcing them to strategic partners who have top talent and state-of-the-art technology [2]. Closer collaboration among companies greatly increased with Web technology, creating a need for online management of business processes. This collaboration, working together with intellectual efforts, highlights the needs and difficulties of system integrations between different companies. This kind of system integrations becomes more complicated if they need to make decision together dynamically. There is no existing organizational management systems can support this new model of business practice.

2.2 Dynamic alliance

World Wide Web also gives companies opportunities to reach and contact companies and customers all over the world. In other sense, each company now also face with plenty competitors worldwide. Many companies realize that forming fixed partnership with few companies can no longer tackle the fast pace and on demand business environment. Instead, ad hoc companies tend to temporarily chain up to fulfill the requirement of an e-Business process so as to collaboratively satisfy the customer's needs and maintain their individual competitiveness in this market. Undoubtedly, during this partnership formation, decision making processes are plenty and diversified. Also, the membership of the partnership stabilized most likely after rounds of online strategic positioning and BCR evaluation (optimization steps individually and globally with respect to the partnership). The traditional DSS still can maximize the benefits for a single corporation, but no long can meet the demand of this new multiplicitive decision making in an electronic environment. Conclusively, the necessity of a new approach to facilitate consensual decision making among collaborating partners is needed. The approach must solve three key issues that we will describe next.

3. Multiplicitive decision making issues

The singular nature of traditional DSS can no longer be able to handle the multiplicitive needs of online e-Business management. There are three key issues that one needs to deal with:

3.1 Multiplicity of Business Processes Needs to be Managed

Due to the competitive nature of business world, people began to realize that it is definitely not enough to focus on their own solely. They recognized that collaboration - sharing resources with intellectual effort - between different parties is a very important practice for them to survive in this new economy. This collaborative measure allows companies to develop shared vision and build

interdependent system to address issues and opportunities [6] [12] [26]. As a result, many single business models are linked up and integrated to form a value chain in order to satisfy customer's needs – a chain of multiplicitive business processes. Moreover, the time lag between the downstream request and the upstream response has to be minimized. However, the reality is that different companies are running their own systems with totally different design and languages. This incompatibility makes integration online complicated, let alone integrative decision making. It takes designers and solution providers great deal of effort trying to link up different systems with success only in a few EAI and information systems [14] [22]. There is not yet any real-time and efficient inter-organizational system integration emerges. As most of the designers and solution providers are still struggling with the application integration; they are far from dealing with the online decision integration.

3.2 A Common Goal Needs to be Derived for Partners' Consensus

Today, things are no more as simple as one company face one type of customer with the support of one supplier. Many value chains are formed in e-Business practice. In this kind of chains, each party plays the role of a customer, a company and a supplier at the same time. Decisions involved in each role can be totally different and sometimes conflicting. This gives rise to a conflict of interests. First, all decision-making processes are inter-related in the value chain processes. Each process is affected by both its customers and suppliers. Next, it is also affected by its multiple roles playing in this chain. It becomes much more difficult to handle if the conflicts comes from each company is actually having different goals on the process. Therefore, a reliable conflict management tool across companies is needed to facilitate individual parties arrive at a mutually acceptable common goal. This idea also has similar view with Dr. Hua Lee's belief that an intelligent e-market, one kind of the e-Business processes, should have decision support systems to evaluate alternative contract terms, and facilitate both parties to come to agreements quickly [13].

3.3 An Integrative Partnership Needs to be Reached

With e-Business, the composition of partners is evolving online with the purpose of matching and optimizing of partnership. We address this as integrative partnership. This partnership needs collaboration with people and systems from various part of the world with different knowledge background. Such collaboration is required to occur towards real time, ad hoc, dynamic, multi-directional flows of data and information. Dynamic

collaboration also implies the partnership changes as the formulation of a business deal is in progress. Many processes involves a number of different partners participation, and most of the time they are making their own decision without knowing others decision. Therefore, a decision-making tool that facilitates various parties make decision collaboratively is critically necessary.

4. Defining of e-DSP

In here, we propose a platform for decision support in an electronic environment, or e-DSP, to provide the solution to a multiplicitive decision making need. An e-DSP is a virtual platform that allows participants in e-Business to individually and collectively to make the best decision. e-DSP provides the necessary tools and mechanism to facilitate this decision making process online, on-demand and real-time. e-DSP has these key features – 4th party, net-enabled web environment, collaborative business process management, integrated decision making process and integrative partnership.

First of all, it must facilitate various companies group together dynamically to make decision. Next, unlike the traditionally DSS [4] which only focus on individual benefits, it must help all the parties involved in the decision making process to arrive an agreement by providing choices which benefit everyone. At the same time, it also needs to help resolving inter-organizational conflicts brought on by the business in an e-environment. Such decisions sport a different identity and demands different attentions, creating a genre of its own. Considering the nature of such decisions making processes, it can be very complicated which definitely cannot be solved by a single DSS. Instead, as it requires different parties' involvement along the whole process, a platform design will be more appropriate.

As the purpose of this platform is to facilitate various parties make decision, it does not have real participation or interest on particular decision. Thus, we propose a 4th party e-Decision Support Platform (e-DSP), a decision infrastructure that allows online business process and decision integration so as to facilitate inter-organizational decision making with dynamic partnership.

To the best of our knowledge, there is no existing conceptualization of such a platform for decision support. There are ongoing research related to this approach by Leung [15] [16] [17]. In the next section, we will provide a guiding architectural framework for the technical design and implementation of such e-Platform.

5. Design of e-DSP – An Architectural Framework

Our e-DSP design is based on two aspects: DSS and inter-organizational environment with partnership

formation. First of all, it should inherit all the basic DSS functions. After studying the trend of DSS development [1] [7] [20] [21] [23] [27], the most similar model to e-DSP is the distributed DSS stated by Pinson in 1997. They included diversified expertises, multi-agent approach, global goal and sub goal concepts, conflict resolution mechanism which all are relevant to our study [20]. However, its target users are still within one organization or enterprise, their global goal and sub goals have similar aims and it is the top management to make the final decision. In addition, Markus[9] also suggested a organizational decision process pattern : Emergent Knowledge Process (EKP). It is an emergent process of deliberations with no best structure or sequence with highly unpredictable potential users and diversified information requirements [9]. Although there are some similarities between EKP and e-DSP, they are quite different from the design purpose. EKP is designed for organizational users with no prior knowledge, so the system must implicitly guide users to desirable direction based on general principles. While e-DSP is designed for inter-organizational decision makers with different level of prior knowledge and there is no restrictions or guides to the desirable solution. On the other hand, the use of AI tools was also mentioned by Nikos [11], who gave a more detailed description on how to combine AI tools and OR techniques in an open GDSS. Their findings provide us some understanding on how to combine various DSS tools into one enterprise context. Next, Saxton [25] and Paul B [18] suggested the third party roles play in the decision making and cyberspace respectively. Saxton suggested 3 roles: expert, provocateur and legitimizer [25]. Paul suggested 4 roles: cybermediaries, cybercommunication, reputation tracking and online mediation arbitration of disputes [18]. As the e-DSP is a 4th party platform, it should facilitate and support 1st to 3rd parties work on it. Thus, we include some of the roles suggested above into the e-DSP design, while for the other roles, we will make use of the existing 3rd party applications which provide those service.

e-DSP should also adopt the current technology and system design for inter-organizational e-Business [5] [8] [10] [19] [24]. Both Marielle[8] and Gyeung-Min[5] mentioned about architecture for inter-organizational coordination, but not inter-organizational collaboration. Later, Finnegan[3], suggested an inter-organizational System (IOS) planning proposal which clearly suggested how to form such kind of system and define individual organization's role, yet the incorporation of an essential element: DSS needed to be introduced. Thus, a new framework is proposed. The architectural framework is intended as a reference for technical design consideration, providing a guiding approach of key system components to implement.

5.1 The e-DSP Architectural Framework

e-DSP is formed by three components: a supportive data store, a analysis model and a collaborative and integrative decision model as shown in Figure 1. First, inherit the structure of traditional DSS and the characteristics of a decision supported by IT, e-DSP also consists of the basic data store and analysis models to support decision making process. It also can make use of the information and analysis model supplied by other companies. Whereas the most important and new component is the collaborative and integrative decision model. It comprises of three features: collaborative business process management, integrated decision making process and integrative partnership which is a optional part. In the next section, we will further characterize this new component.
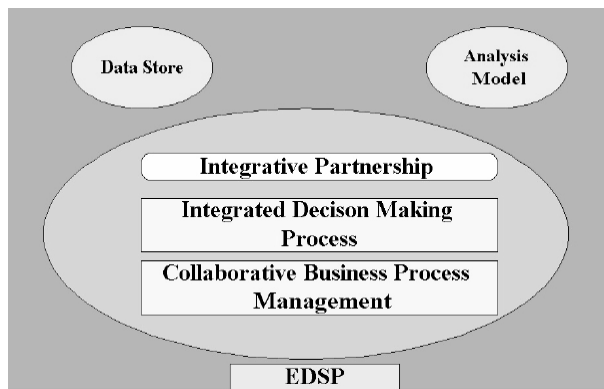

Figure 1. e-DSP architectural framework

5.2 Characterization of collaborative and integrative decision model

Here we characterize the new component according to the following three features: collaborative business process management which facilitate inter-organizational business and decision making process integration in a timely manner with reliable result; integrated decision making process which facilitate collaborative decision making with ability to perform integration and conflict resolution; integrative partnership which allow various companies group together dynamically to make decision by chaining up different companies and DSS with e-DSP dynamically.

1. Collaborative Business Process Management
This feature has the following characteristics:
- **Process Integration:** For some business processes which involve decision making, e-DSP should able to integrate with different decision and analytical tools from various DSS by understanding their decision and range of acceptance so as to know where can improve or adjust.
- **Process Synchronization:** With process synchronization, various systems or human can understand and coordinate with each other dynamically through the web in making the

decision. It also need to set stage parameters and attributes for decision making and keeps track of progress. Sometimes, e-DSP has to facilitate and mediate so as to help them arrive at a common decision.
- **Process automation:** Time has become very critical as customers are having high expectation and requirements on providers with very low tolerance on waiting. Therefore, process automation by standardization and agreement can accelerate the whole process.
- **Fulfillment Trust:** With such dynamic partnership building, all participants must build trust other partners in the group that each one has the capability to fulfill the task distribution based on the decision made. This trust establishment is very important because if only one of participants fail to complete the task, it brings to the failure of the whole chain. With this trust, we can ensure the reliability of the business decision making.

2. Integrated Decision Making Process
It includes a set of mechanisms which consists of two main parts:
- **Complex Goal-oriented:** the nature of problems that e-DSP helping to solve always comprises of global goal and sub goals which involved different parties' benefits. Therefore, it must have the ability to separate them by applying its knowledge and intelligence to identify their inter-relationship and dependence. In order to meet this need, it must equip with various decision tools and optimization methods to find out the best decision. With this, participants with different knowledge background can also make use of it to make decision together.
- **Guided Conflict Resolution:** It should adopt the various conflict management techniques, like those mentioned in [20], in order to solve problems produced by single goal and global goal towards a business process. It should be able to identify and detect the conflict areas with respect to different parties. It should also have a defined mechanism which set steps and stages for solving the conflict.

3. Integrative Partnership
This feature has the following characteristics:
- **Any-to-any Interaction**: Allow interaction among more than one and non-determinant number of parties by having an open public communication channel with the ability to uniquely identify each one dynamically on the web.
- **Dynamic Group Morphing:** With reference to IOS planning processes stated by Finnegan in [3], different parties can dynamically group up together on the web in order to serve specific customer's need. Each chain is unique and only valid for duration of particular business or job. Thus, a company can have different role in different business processes. e-DSP must support any number of participants, human or agents forming groups in various ways: sequential chains, webs or networks.

Besides the above characteristics, there are still other

points needed to take into considerations while designing and implementing such platform, they are mentioned in the next section.

6. Remarks

The neutrality nature of e-DSP is apparent from its 4th party structure. The role of each participant and their relationship with each other must be transparent to the e-DSP, and in some cases, for all partners. e-DSP is built for a web-based environment, it is assumed to equip with all the current computer and web technologies. These technologies facilitate e-Business activities and encourage collaboration and integrations between partners. Yet we need to further investigate so as to make improvements on the stability, interoperability and reliability of channel establishment, data communication between partners.

With a general understanding of e-DSP's characteristics we believe that it is indispensable to the development of e-Business by facilitating collaborative decision making with dynamic partnership. The framework provides technical design to develop such decision platform with respect to different industry needs. We will explore the current and emerging technology required to implement this platform.

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