Contextual Factors associated with Management Information Systems in a Virtual Organization

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Abstract

The quasi-integration of information systems of different organizations is made possible by Internet technology but the implications for management information systems has received scant attention in the literature. This paper explores the concept of management information systems in a virtual organization. The exploration revealed contextual factors associated with management information systems in a virtual organization. These contextual factors were further explored to determine how they might be addressed. Finally further research that could be conducted is proposed.

INTRODUCTION

The explosion of information in all domains of the corporate world has been continuously driven by the penetration of information technology in organizations. The design, development and implementation of management information systems have continued unabated since the early 1970s. The term 'management information system' is used to describe the study of information systems with the focus on their use in business and management (Laudon and Laudon 2001). Information systems were traditionally synonymous with the data processing activities of organizations in which interrelated components would collect, manipulate and disseminate data and information with a feedback mechanism, to meet particular business objectives (Stair and Reynolds 1999). The types of information systems included strategic, management and operational and covered functional areas such as sales & marketing, manufacturing, finance, accounting and human resources (Laudon and Laudon 2001).

The background to the virtual organization is the recent developments in which there is a movement in the focus of systems towards the external parties, the customer and supplier. With these systems a business process can now be conducted across enterprises. Such developments had been dominated initially by electronic commerce systems, which permitted a customer to have access to product information, technical details and other

specialist services within an organization in additional to order enquiry and order placing (Kalakota and Whinston 1997). This integration across enterprises was expanded to permit suppliers direct access to inventory levels and sales volumes. Subsequent enhancements resulted in business-to-business systems called Supply Chain Management Systems and Customer Relationship Management Systems. These electronic business systems have been heralded as revolutionary as they present a new business model, which can change conventional relationships and transcend an enterprise's boundary and create a virtual organization. Organizations are now beginning to develop alliances with the enterprises they interact with in this virtual environment (Gurd 1993; Mowshowitz and Walsham 1994; Carroll 1996; Hochuli Shmeil and Oliveira 1997; Afsarmanesh, Garita et al. 1998; Bouras, C. Destounis et al. 1999; Burn and Barnett 1999; Dunn and Varano 1999; Zhano and Li 1999; Alt, Puschmann et al. 2000; Bressler and Grantham 2000; Chan and Davis 2000; Graham and Hardaker 2000; Marshall and McKay 2000). These alliances are represented by integrated systems that cut across enterprise boundaries in a seamless manner utilizing Internet technology. Some alliances may be project-based and of a temporal nature. But many alliances may be more long term in nature as enterprises cooperate to gain competitive advantage by delivering keenly priced, integrated products and services. The key factor in these systems is the information flows across the virtual organization.

CONCEPTS

The traditional objective of management information systems has been to provide the right information of the desired quality and quantity to the right person in a timely fashion. In the era of the virtual organization this traditional objective is under review. Current information systems store a static representation of an organization's information within its software systems and databases or data warehouses. Traditional systems are now considered to be inflexible due to the static nature of their information, which is unhelpful in the dynamic and changing environment of the virtual organization. Internet-based companies represented a paradigm shift that not only transformed business processes and workflows but also a radical rethinking of business models and information flows (Mathotra 2000). In this situation it is necessary to review the management information system paradigm in reaction to this dynamic and changing environment of the new millennium.

The application of Internet technology has enabled the development of three new platforms for information systems (IS): the Internet, the Intranet and the Extranet. An umbrella term used to cover these new systems is web-based information systems (WBIS). Dunn (1999) rightly adds a cautionary note that such systems are a relatively new phenomenon with many of the business issues uncertain and confusing (Dunn and Varano 1999). WBIS are an early sign of a gradual paradigm shift in how information systems are designed and developed. Allied to this paradigm shift is the problem of determining the requirements for such new information systems. The determination of requirements for information systems has always been a difficult task with varying degrees of success and is dependent on the experience of staff and their familiarity with the application area. This difficulty is deemed to be further compounded by the

characteristics of a virtual organization, which include being adaptable, flexible and responsive to changing requirements and conditions (Marshall and McKay 2000).

Virtual organizations are information dependant and their success depends on the efficient use of information and information systems (Gil-Estallo, Celma-Benaiges et al. 2000). A basic premise in a virtual organization is that the relevant information is available to all parties. But Marshall and McKay (2000) view a virtual organization as being problematic in terms of managing the relationships and the difficulty in defining the information systems requirements (Marshall and McKay 2000). An additional problem with many web applications, like the virtual organization, is that the information systems developers do not always know exactly who the users are going to be and what their information needs and expectations are (Russo 2000). The virtual organization could provide participants with access to multiple systems which raises concern about information exposure and whether participants within enterprises are adequately trained to exercise sound control practices (Khosrowpour and Nancy 2000; Russo 2000). Such concerns about security may discourage enterprises from participating in a virtual organization.

CHARACTERISTICS

The determination of information systems (IS) requirements within a virtual organization may necessitate wider participation, than in the traditional organization, because of the cross-organizational dimension. However this wider participation could be more time consuming and may result in a less responsive system, which conflicts with a major characteristic of a virtual organization, responsiveness. Another possible concern regarding wider participation is that the creativity in determining the IS requirements might be constrained by concerns about the practicalities of implementing a system across several organizations.

The dynamic nature of a virtual organization may result in continual change requests to the IS requirements which may lead to system degradation. To determine the IS requirements of the virtual organization would require knowledge of the inter-organizational processes and the attributes associated with these processes. This would suggest the need to establish cross-organizational teams to determine the IS requirements.

A major problem facing the management within a virtual organization is the security of data to prevent the leakage of sensitive or confidential data. This infers that there also needs to be an awareness of the legal and confidentialities issues that may limit disclosure. Ultimately there is a need for trust amongst the enterprises within the virtual organization.

The timely access to information within a virtual organization is essential to achieve the desired synergies. This would suggest that each enterprise within a virtual organization would need to adapt and change to have uniform approaches in the creation, classification and retrieval of all information resources. Perhaps a modular approach would need to be

taken in which, a specification is created for each enterprise, within the virtual organization, that agrees what data they must provide and how it should be accessed.

Determining the information systems requirements for a virtual organization may entail dealing with a large volume of possible needs from all the enterprises. Associated with this volume could be an accompanying complexity due to the different perceptions of needs and the format in which needs are expressed. The characteristic of volume may be dealt with by the available technology, but the characteristic of complexity might be a much more subtle problem to address. To resolve, or prevent, this complexity might require a cross-organizational IS team and functional departments, within each enterprise, to work collectively to define the information needs. This collective working could be an example of the wider participation mentioned beforehand. In contrast to the traditional organization, this greater participation by functional managers, may suggest that they have a role in the formulation and facilitation of new strategic IS initiatives, within a virtual organization. This may be a sensible move in that the functional managers may have an awareness of the internal issues across the virtual organization.

It is probable that the enterprises within a virtual organization will try and leverage each other to gain access to pertinent information to gain the maximum benefits possible from the relationship. This leveraging would be dependant on good communications and trust amongst the enterprises. It is further suggested that the common objectives and interests of enterprises within a virtual organization will help create an environment in which innovative solutions or initiatives are proposed. However a possible drawback is that considerable efforts might be devoted to exploring these proposed innovative solutions or initiatives. Moreover it would be necessary to ensure that the available business processes can support any innovative activities. Also any innovative activities must be balanced against the need for adequate management information systems to be able plan and exercise control.

CONTEXTUAL FACTORS

Temporal Relationships

A virtual organization is a formation of Internet-based business alliances, which can provide empowerment to partner organizations. Participants within a virtual organization have the opportunity to gain a better understanding of how each partner operates and the sharing of large IS databases could offer better products and services to clients and do so whilst reducing their overall costs. However such business alliances may be limited to a degree that provide protection to a partner organization from being unduly exposed and vulnerable to exploitation by other partner organizations. The partner organizations may only agree to provide structured information, regarding normal transactions, to each other. Empowerment may only be achieved after all the implementation issues associated with the establishment of a virtual organization have been resolved. To achieve the benefit of empowerment would necessitate partner organizations undergoing a change in their particular business processes to allow more integration with other partner organizations. The empowerment may be limited because of security and confidentialities

concerns and thus access may be restricted. There would be a need to define what information was going to be exchanged between each partner organizations and mutual trust would be of paramount importance.

The virtual organization enables partner organizations to share information to improve the outcomes from planning activities. However this sharing may be limited, but sufficient, to enables the achievement of the agreed business objectives of the partner organizations. Partner organizations may not freely share information but only share what would benefit both parties and that confidential data may not be shared such as revenue and costs. It is likely that the partner organizations may hold back some information either because of the sensitivity of the information or as a form of self-protection. This withholding of some information could be a cause of concern as this may lead to implementation problem and the sharing of information may be essential to achieve optimum solutions. However it is probable that partner organizations would not request sensitive information not normally disclosed. A possible benefit of sharing information is that it would help to understand partner organizations difficulties and own difficulties. However the sharing of information may be prohibited if the partner organizations do not have particularly good relationships. The overall benefit of sharing information within a virtual organization is that partner organizations would enrich the overall management information system to improve the outcomes from planning activities.

This flexibility in the sharing and exchange of information, within a virtual organization would enable information to be used and exploited by other partners. However this could be a 'two-edged sword' with flexibility provided at the expense of a lack of clarity in the focus of the information provision. It is possible that too much information may cause more confusion than help and perhaps the flexibility would be restricted to the particular business domain within which the partner's organizations cooperate. In this latter case, the flexibility would be limited to the agreed business objectives and partners themselves may restrict the availability of certain information.

The data privacy and security considerations expressed earlier highlight that information is an important asset to an organization and the sharing may be normally be restricted to non-confidential and non-critical material. An overriding priority to carefully guard access to information would be to have agreed data formats with appropriate access rights defined to ensure the readily exchange of information that has been agreed in advance. Partner organization may not be willing to change their established standards but they may attempt to integrate standards. Although at the outset the information to be shared may be agreed this would need to be reviewed if the business strategies change.

Staff assembled from the partner organizations could conduct management information systems planning activities for a virtual organization. Participation by representatives from the partner organizations would be necessary to maintain a virtual organization as a viable entity and to enable the creation of mutual trust. Each partner organization would wish to participate in the management information systems planning activities to protect their interests and to gain the maximum benefits for their own organization. It is possible that this participation may result in loyalty conflicts between the virtual organization and

the partner organization and this type of conflict may prevent the achievement of optimum solutions. Staff from the partner organizations should share the same objectives, which may not be easy to achieve and therefore there is an onus on senior staff in each partner organization to communicate effectively to their staff the importance of the common business objectives in a virtual organization. It should be acknowledged that the aim of all partner organizations would be to exploit a virtual organization but this would be within the framework of the common business objectives. This participation in planning activities would not mean that a partner organization is bounded by the outcomes but all outcomes should ensure a 'win-win' situation for all.

The management information systems planning activities within a virtual organization must be adaptable, flexible and responsive to changing requirements and conditions. This may appear very similar to that of a traditional organization. However with a traditional organization there is less of a requirement to be adaptable, flexible and responsive to changing requirements and conditions as the organization may have existed, and continue to exist, within a relatively stable environment. The other differentiating factor identified is that the management information systems planning within a virtual organization must respond to changes that occur within the partner and customer organizations environments. The feasibility of a vision or mission within a virtual organization would not be known to be achievable unless it is attempted. The management information systems planning within a virtual organization would therefore need to provide feedback for any amendments to a vision or mission.

Partner organizations would need to co-ordinate their efforts to exploit each other's strengths and to support any weaknesses in the partner organizations.

Primarily Participants and Informational Needs

Management information systems planning for all partner organizations within a virtual organization should be conducted within a framework of business objectives and with the participation of the staff responsible for the implementation. This framework of business objectives would be the most important element in establishing a virtual organization and must be continuously reviewed by the partner organizations. The creation of organizational management information systems requirements for all parties within a virtual organization should be bounded by the purpose of the common business objectives. It should be acknowledged that the partners within a virtual organization would have their own common business objectives, which may differ from the business objectives of other partner. However each partner should agree to, and support, the common business objectives. It would be essential for the partner organizations within a virtual organization to have staff able to communicate effectively to other staff the common objectives of the virtual organization. The creation of management information systems requirements for all parties within a virtual organization would be a major task and would necessitate active participation by all partners to gain consensus and to make joint decisions.

A basic feature of management information systems planning within a virtual organization would be the emphasis on comprehensiveness in data collection, analysis and evaluation of alternative actions. However this would be premised on a number of

conditions being satisfied. The comprehensiveness would be dependant on the objectives or vision of the partners within a virtual orgaanization. If the objectives were precise, concise and specific then the degree of comprehensiveness in data collection, analysis and evaluation of alternative actions could be reduced. Conversely if the objectives are of a more complex nature and data mining is necessary then the emphasis will be on comprehensiveness in all the activities with a greater emphasis on the evaluation task. It is suggested that the boundaries defined by the partner organizations would determine the degree of comprehensiveness necessary. It could be suggested that comprehensiveness in data collection, analysis and evaluation of alternative actions is ideal but it may not always be a realistic objective. The severity of the problem of comprehensiveness could be influenced by the extent of the existing information held by all partner organizations and perhaps could be partly addressed by delegating roles to partner organizations to collect particular data. Comprehensiveness infers thoroughness which is important factor in a planning activity, however within a virtual organization an equally, if not more important factor, might be, responsiveness to the market. To address both factors may necessitate making decisions when adequate information is available and to continuously collect and refine data to identify changes in the environment or to the key performance index. Partner organizations within a virtual organization would need to know when changes have occurred and comprehensiveness in the planning activity would necessary to detect these changes. This emphasis on comprehensiveness in management information systems planning within a virtual organization may be a difficult goal to achieve and insufficient data may prevent the planning activity from being effective in meeting its objectives.

The emphasis on comprehensiveness in data collection, analysis and evaluation of alternative actions in management information systems planning within a virtual organization might not necessarily be a major factor. Another possible element of complexity might be the degree of completeness of the data provided by the partner organizations. Although partner organizations might be willing to share data, the integration and aggregation activities may contribute to the complexity problem. The complexity might also be due to a number of factors including the conflicting nature of the data and subjective and divergent views of data due to the experiences and culture of each partner organization. Although partner organizations may have different database structures there would be a need for consistency in how the data is managed. With different software systems there is also a need for data to be filtered to be usable. A possible major problem could be the task of relating and merging the data collected from the partner organizations, which would be necessary to achieve the anticipated synergies, but much would depend on the how the data is presented and any legal impediments associated with data disclosure. This problem might be overcome by having predefined data definitions and a common information technology platform.

Potential Chaos

The common objectives and interests of partner organizations within a virtual organization may contribute to innovative solutions or initiatives but any innovative activities must be balanced against the need for adequate management control and

available business processes. The availability of a management information system across a virtual organization would provide timely information on the behavior of customers and markets and enable the formulation of solutions that otherwise may not have been possible. The development of innovative solutions or initiatives would be more likely within a virtual organization in contrast to traditional organizations. However a possible drawback might be the considerable efforts devoted to exploring proposed innovative solutions or initiatives.

A possible mandatory condition for a virtual organization is a low level of bureaucracy. However a certain degree of management control would be essential, although with an element of flexibility, to help ensure the achievement of the business objectives. To have this management control would necessitate a sufficient management information system to ensure appropriate checks and balances. Partner organizations wishing to protect themselves against the leakage of sensitive and critical information within a virtual organization would therefore insist on sufficient controls being in place. However although a virtual organization may have more flexible reporting structures, in contrast to the traditional organization, there should also be clear directives on the decision-making process, to enable staff to accept more responsibilities. If the reporting structures are too multi-layered the partner organizations may not be able to respond in a timely and responsiveness manner as expected in a dynamic Internet-based environment.

To achieve the anticipated synergies from within a virtual organization may require adherence, by partners, to uniform approaches to the creation, classification and retrieval of information. However although there should be adherence to standards in terms of format and contents, and consistent guidelines on the creation and collection of data, this might be difficult to achieve. However there is a need for clear data definitions. Having uniform approaches would be an ideal situation but the partner organizations may wish to make use of their existing resources to share information because of internal factors. However partner organizations may need to have some commitment to adherence and subsequent change. The anticipated synergies from a virtual organization may not be optimized until a certain degree of uniformity is achieved in order to have a coherent management information system.

DISCUSSION

This paper has discussed contextual factors associated with management information systems in a virtual organization. This type of management information system differs from the traditional as it is in a virtual organization. The partner organizations normal activities are primarily Internet based and this dynamic network of relationships collaborate to offer unique products or services in the timely and responsive manner expected in the new millennium. However the issues associated with management information systems in a virtual organization were identified as, the handling of temporal relationships, the determination of the informational needs of participants and the potential for chaos. These issues were discussed and possible remedies, or the minimization, of these issues were proposed.

Further research could be conducted to better understand these issues and to reveal other possible issues. With a management information system in a virtual organization the technology has not been revealed to be a problem. The issues are related to handling relationships and determination of information needs and minimizing possible chaos. There is need to have a better understanding of possible types of relationships within a virtual organization. Studies need to be conducted on how organizations participating within a virtual organization can manage cross-organizational teams who will establish and maintain a management information system to determine the critical organizational practices.

The synergy in management information systems and Internet technology can create a virtual organization. However there is not an established research base providing a theoretical framework to help organizations achieve the optimum benefits from such a synergy.

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