Application of Structuration Theory and Activity Theory in Enterprise Resources Planning Systems Implementation for Universities

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Abstract: An integration of organization culture in the conceptualization and development of enterprise Resource Planning Systems (ERPs) is critical for an organization to reap potential benefits of the system. In this paper, the authors present an analytical approach through the Structuration Theory: How a university can assess its culture for the purposes of design and development of the ERPs. The authors extend the Structuration Theory by integrating it with the Activity Theory to provide the means of evaluating the activities that the system is to perform. The modified Orlikowski model is applied to depict the relationship between institutional properties, human agents, and technology in the university setup and how this offers a more inclusive approach to ERP systems development and implementation.

Key words: Structuration theory, activity theory, information systems, ERPs (resource planning systems), organization culture.

1. Introduction[1]

Organizational information systems literature suggests that the fit between the information system and organizational culture is critical for the organization to reap potential benefits promised by any system. For example, Ref. [1] notes that even good technology can be sabotaged if it is perceived to interfere with the established social network. Their finding supports [2], who suggest that when information technology (IT) conflicts with an organization's culture, the implementation will be resisted in one of the two ways—either the system will be rejected or it will be modified so that it matches the existing culture.

On the other hand, there is a strong body of opinion that culture can be consciously designed and

manipulated [3-4] and leadership is a necessary factor in this process [5-6]. Thus, leadership can enhance the chance of Enterprise Resource Planning (ERP) systems implementation success by fostering a desired culture, in addition to its direct effect on ERP adoption. Indeed, in the ERP literature, the role played by top management, its leadership in particular, is consistently identified as the most important factor affecting the ERP implementation [7-10], although the mediating role of culture is not stated explicitly.

Unfortunately, there is no study on the mediating role of organizational culture in the relationship between leadership and ERP implementation success and how leadership can foster an organizational culture conducive to ERP implementation. In this paper, ERPs is defined in section 2; the authors formulate a strategy that will mediate leadership and ERP implementation success through the use of Structuration Theory with the integration of the Activity Theory to describe

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organizational culture as discussed in sections 3 and 4 respectively. In section 5, the application of Structuration Theory and Activity Theory to explain the Duality of Technology is discussed and section 6 gives conclusions.

2. Defining ERPs

ERPs have been defined as comprehensive, packaged software solutions that seek to integrate the complete range of a business' processes and functions in order to present a holistic view of the business from a single information and information technology architecture. By integrating the business processes across the organization and the central database, ERP differs from earlier information systems in its capacity to disseminate information in real-time and increase organizational flexibility and agility [11-14]. In addition, embedded within the ERP package are best business models that their designers believe to represent best practices. Thus, ERP provides the organization the window of opportunity for strategic changes. Ref. [15] notes that ERPs have been known to be widely used by large corporations around the world, but lately universities have turned to these systems as a means of replacing existing management systems.

Organizations investing in ERP endeavour to accomplish a number of objectives. Firstly, they want to benefit from ERP's cross-functional integration and embedded best-practice capabilities, modular structure, and its flexible and scalable architecture [16]. Ref. [17] points out that enterprise systems seek to achieve a variety of benefits—operational: reduced operating costs, accurate demand forecasts; managerial: improved decision making and better resource management; strategic: greater support for business alliances, building business innovations and cost leadership; IT infrastructure: building business flexibility; reducing information and communications technology (ICT) costs; and organizational benefits: supporting organizational change, facilitating business learning and empowerment.

For their part, Ref. [18] indicates that institutions implement ERPs mainly for three benefits, that is, enhanced technology for the institution to help compete technologically; increased efficiency and effectiveness of processes; and integrating and streamlining information. ERPs also offer other benefits such as user friendliness of the system with easy access to data and reporting; ability to provide better customer service; increased functionality; better communications across the institution; and increased security of data.

However, due to the integration of large scale, ERP implementation is a complex and highly inter-dependent task [19]. Also, the possible conflicts between the existing organizational culture and the culture assumption embedded in the ERP system design and development escalates the difficulties of ERP implementation and makes ERP project prone to fail. Ref. [20] notes that ERP projects are, on average, 178% over budget, take 2.5 times longer than intended to implement; and deliver only 30% of the promised benefits. Due to the complexities in ERP implementation projects and resource demanding, a number of ERP project implementations are abandoned [16]. The authors expect that the possibility of adopting organizations' realizing potential benefits of ERP is even lower. With the proposed model for the conceptualization of ERP and eventual development, the authors aim to reduce the risks of ERP implementation failure.

In the next section, the Structuration Theory that offers solid means of assessing the institutional cultures is presented so that they can be integrated in the design of ERPs.

3. Structuration Theory

Structuration theory in relation to the design and development of ERP plays an important role in the assessment of the social organization of institutions (universities). Structuration Theory is a meta-theoretical social framework developed by

Giddens [21] who argues that action and structure operate as a duality, simultaneously affecting each other; social structures are the medium of human activities. Through the Structuration Theory, Ref. [22] develops a structuration model of technology which makes the claim that technology is constituted by human agency and constitutes human practice. Ref. [23] further extends the structurational perspective on technology and develops a practice lens to examine how people, as they interact with a technology in their ongoing practices, enact structures which shape their use of the technology. This perspective views the use of technology as a process of enactment that enables a deeper understanding of the constitutive role of social practices in the ongoing use and change of technologies in the workplace.

For Ref. [24], structuration is the process whereby the duality of structure evolves and is reproduced over time and space. Agents in their actions constantly produce, reproduce and develop the social structures which both constrain and enable them. Therefore, the application of the Structuration Theory to understand how actions of objects in a university affect the existing information systems is critical to the development of an ERP framework that is responsive enough to give positive effects.

To acquire understanding and the nature of human knowledge about the current systems, different types of inquiry and alternative methods of investigation will be used. The appropriate research method will therefore be the action research due to its empirical component for testing the appropriateness of the development framework and the activity theory that supports the development of the framework. This research approach involves the analysis of what is said to exist in some world by employing ontological research techniques [24]. Information systems researchers have drawn on Structuration Theory to explain the interactions between technology and people embedded in social contexts, such as organizations [25]. The development and adoption of ERP for institutions is influenced by the knowledge society and digital economy [26]. Therefore a way of harnessing these two factors into the development of the ERPs for institutions is needed.

Structuration Theory informs the authors what sort of things that are out there in the world, not what is happening to, or between them [27]. It therefore deals with social phenomena at a high level of abstraction rather than their particular instantiation in a specific context; offering a way of seeing the world rather than an explanation of its mechanisms and this presentation of the Structuration Theory makes it difficult to grasp the significance of Structuration Theory in ERP context [26].

In this paper, the authors therefore make extensions on the Structuration Theory so as to make it more specific and accommodating to the university where the ERP is to be implemented by including Activity theory into its application in ERP developments. Specifically, the relationship between the Structuration Theory and the Activity Theory in the development of the ERPs is shown.

To understand fully the Structuration Theory, the authors firstly present a sketch of the key features of the theory as presented by Giddens and the implications of the features before considering the extensions. From the sketch (below), Structuration Theory may be seen as an attempt to resolve a fundamental division within the social sciences involving those who consider social phenomena as determined by the influence of objective exogenous social structures and others who see them as products of the action of human agents in the light of their subjective interpretation of the world [26]. This incongruity can be solved by viewing structures and agency not as independent and conflicting elements, but as a mutually interacting duality. The social structure that forms part of the Structuration Theory is therefore seen as being drawn on by human agents in their actions, while the actions of humans in social contexts serve to produce, and reproduce, the social structure. Structures are therefore not simply exogenous

Giddens's perspective of Structuration Theory
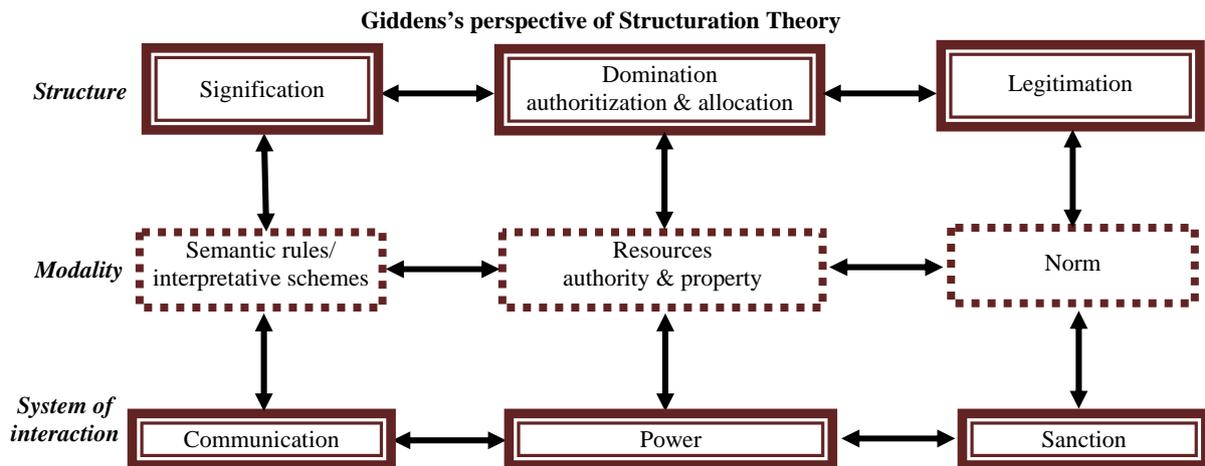
Fig. 1 The dimensions of the duality of structure [29].

restraining forces, but are also a resource to be deployed by humans in their actions: It is enabling as well as disabling [26].

Institutions of higher learning are a perfect description of the Structuration Theory where institutional policies are to be seen as the way of logically abstracting the structures, physical or otherwise [28]. These policies are considered to influence the actions of the personnel within these institutions.

In diagrammatically presenting the Structuration Theory, one needs to draw from Marx Weber's interpretation of the Social Theory which identifies substance, authority, and legitimacy as the ingredients of a society. These are linked with corresponding dimensions of agency, described as communication, power and sanctions, through modalities of interpretive schemes, facilities and norms as shown in Fig. 1 [26].

Modalities can thus be seen as the locus of interaction between the knowledgeable capacities of actors and the structural features of social systems. It therefore represents the institutional policies which influence the interaction or behavior within an institution and it further defines the type and characteristics of systems to be adopted by a university. The development of an ERP that can enjoy organizational acceptance requires the analysis of the institution's culture by applying the above

Structuration Theory as exemplified in the criteria set in Fig. 1.

3.1 The Character of Structuration Theory in Relation to Information Systems

To be able to understand the characteristics of Structuration Theory, the authors adopt the following definitions of the basic concepts associated with ERPs:

(1) Structures: Are the rules and resources organized as properties of social systems. The structures only exist as structural properties for any institution (university) and they determine the interactions of the agents thereof;

(2) Systems: These are the reproduced relations between actors or collectivities, organized as regular social practices that determine the routines for an organization;

(3) Structuration: This constitutes the conditions governing the continuity or transformation of structures, and ultimately the reproduction of social systems.

Considering the Structuration theory in respect to system development, the theory represents a reaction to the perceived deficiencies of the prevailing schools of sociological thought in an organization. The first reaction by the positivism described as naturalistic sociology by Ref. [29] in particular functionalism is when the systems are seen to be strong on structures,

but weak on action. Action provides the underplaying importance of human agency, and imputing purposes, reasons and needs to the system. The second interpretative sociologies argue that the system is strong on action, but weak on structure, having little to say on issues of constraint, power and large-scale social organization [29]. Structuration is thus seen as a means of breaking out of this unsatisfactory dualism of system action and structure and also that between the individual and society.

3.2 Utilization of the Duality of Structure in ERP Development

In this paper, the authors consider the combination of structures and systems as the means through which institutional policies are derived. Thus, Structuration Theory expresses the ways in which the policies define the interaction of the actors within an institution. The policies are considered allocative which involves transformative capacity generating command over objects, goods or material phenomena; and authoritative which involves transformative capacity generating commands over persons or actors. By considering these two, an all inclusive system can be developed which makes the implementation easy. Since the rules of social life generalize procedures applied in the reproduction of social practices and formulated rules in system conceptualization, an institutional customized ERP can be developed. Ref. [28] agrees with this school of thought when they note that access control systems need not be a collection of codes but rather a conversion of institutional policies into codified language that informs the interrelationship between systems and the operations thereof in the higher learning institutions.

Ref. [21] argues that Structuration is capable of explaining both individual and institutional features of social life and by extension offers an interfacing mechanism between structures and institutional cultures. Through Structuration, structure is seen as a virtual order of transformative relations that exists, in a

form of time-space presence, only in its instantiations in practices and as memory traces orienting the conduct of knowledgeable human agents. The implication of the Structuration can be seen in the case of the apparently material allocative resources, for instance, allocation of a room for computer installation which might seem to have a real existence but which become resources only when incorporated within processes of Structuration. This is an important point in the context of information systems research since it implies that, structure does not exist in material artifacts, such as technology, but only in human memory traces and through social practices which are transformed into technological artifacts like ERPs. These human memory traces and social practices are therefore critical in shaping the implementation strategies and associated challenges which constitute the major components influencing the acceptability of any technology-based system.

Focusing on the dependency of social structure on agency, Ref. [30] notes that in well-ordered institutions, social rules may dominate social reproduction, for instance, the development of ERP and that individual structurational agency is thus insignificant or even absent. However, Ref. [31] argues that all aspects of structure may not be equally amenable to agency, suggesting that there may be a differentiated topography for the exercise of agency rather than an endlessly recursive plain.

Structuration thus mediates not between objectivist and subjectivist accounts of social practices, but between hermeneutic, functionalist and structuralist accounts of the relationship between structure and agency.

3.3 Feature of Structuration Theory, Implication and Potential Issues

Due to the duality of structure of the Structuration Theory as discussed in section 3.2, structure and action are therefore seen to be inseparable and co-existent, hence structures exist only through action.

Structuration Theory lays emphasis on the fact that structure is a virtual order of transformative relations and that the rules and resources exist only in their instantiation as memory traces orienting conduct. Material resources, such as technology, influence social practices only through their incorporation in processes of structuration [32]. This is a critical factor if anticipated outcome is to be achieved since adoption of a new system into a university needs the corresponding change in institutional culture.

Through Structuration Theory, agents are seen to always have the possibility to do otherwise. Therefore, the structural constraint simply places limits upon the feasible range of options open to an actor in a given circumstance. Compliance with structural constraint implies choice to do so. Agents are also knowledgeable about their actions and continuously reflect on their conduct so as to achieve predictable outcome.

The importance of face-to-face interaction for social integration and the capability of technologies to facilitate integration at a distance are promoted. Structuration Theory therefore brings into the fore the ingredients necessary for social integration through technology.

3.4 Adaptive Structuration Theory (AST) as an Extension to Structuration Theory

Refs. [33-34] have sought to extend Structuration Theory to address the mutual influence of technology and social processes. They called the approach "Adaptive Structuration Theory" and it is based on a number of propositions [33]. One of the propositions is that social structures serve as templates for planning and accomplishing tasks; designers incorporate some of these structures into the technology with the result that the structures may be reproduced or modified, thus creating new structures within the technology [26].

AST suggests that the social structures provided by an advanced information technology can be described in two ways: structural features of the technology and the spirit of this feature set [33]. These features of

technology as presented to users can be identified by considering the values of the technology based on an analysis of

(1) The design metaphor underlying the system;

(2) The features it incorporates and how they are named and presented;

(3) The nature of the user interface;

(4) Training materials and on-line guidance materials;

(5) Other training or help provided with the system.

Because information technology is only one source of structure for groups, Ref. [33] argues that it is necessary to consider other sources of structure, such as work tasks and institutional policies (organizational environment), in analyzing the use of a particular technology.

4. Activity Theory

Ref. [35] has discussed the potential of Activity Theory as an analytical framework in understanding computer-based artifacts as instruments for work activities and materials for systems design for organizations. The Activity Theory is seen as a collective phenomenon, involving several actors. It is argued to be a philosophical and cross-disciplinary framework for studying different forms of human practices as development processes, with both individual and social levels interlinked at the same time [36]. The interaction in a social context and the dynamics and developmental aspects of the Activity Theory are some of the strengths of the theory upon which we propose to model the ERPs for institutions of higher learning.

The theory underpins the need to have an all inclusive approach in developing an information system. Ref. [37] notes that there is a need for an analytical model for work-oriented information system design that considers the requirement that people are doing in their everyday tasks and duties should have an opportunity to make an impact on the prospective information systems. Ref. [37] proposes that the

following requirements for designing an information system from the worker's perspective be considered:

(1) The starting point must be work activity as a systemic entity;

(2) Technology, including computer-based technology, must be seen as a tool to facilitate work, embedded in the work system;

(3) Both collective and individual aspects of work need to be taken into account;

(4) Work systems need to be studied in their organizational context;

(5) The analytical model must be based on a sound theoretical basis;

(6) The analytical model must be applicable to both descriptive studies and practical development;

(7) The analytical model must be applicable to both technological development by software and information system professionals and the development of work practice itself by the workers.

Since the theory emphasizes on work-oriented and participatory approaches to information systems development, the authors draw our framework for the ERPs implementation by not creating a method or methodology, but rather the authors collect usable methods under the activity-philosophical approach by creating an activity-philosophical model. This in effect will give individual institutions an opportunity to apply the proposed framework of designing or adopting ERPs that take care of the prevailing institutional circumstances.

5. Application of Structuration Theory and Activity Theory to Explain Duality of Technology

Technology has been considered as material artifacts, which does not preclude an exclusive focus on technology as a physical object [38]. It is also argued that the analytic decoupling of artifacts from human action, allows material artifacts as the outcome of coordinated human action and hence inherently social. This leads to the first premise of the Structurational

Model of Technology that technology is created and changed by human action defined by the Activity Theory, yet it is also used by humans to accomplish some action. This is termed the duality of technology. This duality characteristic of technology is empirical in the development and adoption of ERPs as shown in section 3.2.

Technology is thus seen as interpretively flexible, although it is argued that this is often neglected in the traditional information systems literature, which treats technology largely as a black box. In part, this is seen as being due to the time-space discontinuity of design and use of information systems which typically occur in different organizations, that is, at the vendor and customer. In this paper, the authors propose an all inclusive approach to ERP development and implementation, that is, an interfacing between the vendor and the customer.

It is worth noting that interpretive flexibility is not infinite, but is being constrained by the material characteristics of the technology and the institutional contexts of its design and use, and the power, knowledge and interests of the relevant actors. Thus initial designers of a technology have tended to align with managerial objectives with the result that many technologies reinforce the institutional status quo, emphasizing standardization, control and efficiency [38]. This approach has inherent challenges since it assumes a monolithic perspective which does not promote institutional system acceptability. It can promote resistance to the adoption and implementation of the system as it lacks participation from one or more key sectors of an organization.

The proposed modified Orlikowski's Structurational Model of Technology (Fig. 2) depicts the relationship between institutional properties, human agents and technology. The model offers a more inclusive approach to system development and implementation.

From the model, technology is identified as the product of human action identified by arrow **a**, coming into existence and being sustained through human action

Institutional (University) properties

(Explainable by Structuration Theory)

c

d

Technology

(ERP in university)

a

b

Human actions

(Explainable by Activity Theory)
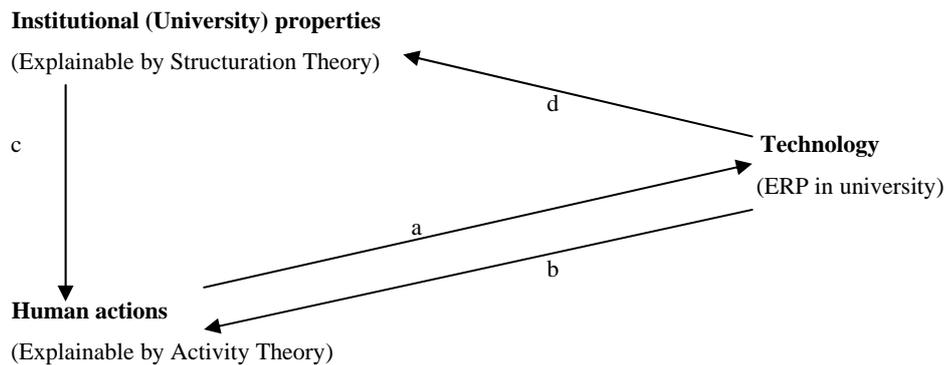
Fig. 2   The modified structurational model of technology [38].

defined by the Activity Theory, and being constituted through use. Only through the appropriation of technology by humans, therefore, does it exert influence. Orlikowski's actions are to be determined by the Activity Theory which will ensure the right actions that are in line with the institutional policies that are only admissible to influence the technology through the medium of human action, arrow **b.**

The Activity Theory conditions, rather than determines, the performance of social practices, both constraining and enabling them. The influence of institutional properties on human agents, arrow **c**, is a more conventional component of Structuration, although Orlikowski also slants this towards technology in emphasizing how the form and function of a specific technology will bear the imprint of the social and historical conditions under which it is built and used.

The last relationship of technology on institutional contexts, arrow **d**, reflects the influence of technology in transforming the institutional properties (culture) of organizations (universities).

5.1 Benefits of the Modified Orlikowski's Model

Due to the integration of institutional cultures through the application of Structuration Theory and the actions through the Activity Theory, the model brings on board the following benefits to universities that adopt ERPs utilizing the modified model in its design and development:

(1) Non off-setting of university culture, hence

limits technology adoption resistance;

(2) Promotion of collective participation, hence support for adoption and implementation of the system;

(3) Enhanced continuity of good practices;

(4) Alignment of ERP to university objectives/goals, hence promoting efficiency;

(5) Avoidance of system modification to match existing university culture.

6. Conclusions

Institutional structure is critical in the conceptualization of the properties to be included in the design, development and eventual acceptability of the system during implementation. The participation of the institutional (university) actors in the process of structural change through ERPs is important so as to avoid any failures.

The application of Structuration Theory alone in the analysis of the technology to be adopted by a university has inherent limitation, hence the need for integration of Activity Theory in the process of analyzing the system to facilitate participation of actors (users) which ultimately promotes acceptability of the ERP system. This will lead to ERP project implementation success.

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