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JOINT IMPACTS OF INTER-UNIT TASK INTERDEPENDENCE AND MANAGERIAL PERCEPTION ON THE ADOPTION OF RADICAL INNOVATION: A CONCEPTUAL FRAMEWORK

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Abstract. This conceptual paper attempts to integrate the fundamental concept of task interdependence into research on adopting radical innovation. The paper discusses some conceptual issues in innovation, innovation radicalness, task interdependence, and the role of managerial perception in adopting radical innovation. The paper argues for considering task interdependence, a concept in organization design literature, as an organizational variable that impacts the adoption of radical innovation. The paper emphasizes the role of managerial perception of innovation radicalness in moderating the impacts. The conceptual framework, the accompanied hypothesis, and possible ways of operationalizing the concepts involved are then presented in section 4. The paper contributes to the literature on the relationships between organizational context and innovation adoption.

Keywords: Task interdependence, adoption of innovation, innovation, managerial perception of innovation radicalness

1 Introduction

Organizations can generate or adopt innovations [1]. This paper focuses on the adoption of radical innovation in organizations. Previous studies have considered several external and internal factors as determinants of innovation adoption. However, task interdependence, an essential characteristic of organizations, has not been considered in research on radical innovation adoption. Since adopting radical innovation introduces significant changes into the adopting organization, task interdependence, which underlies the organization's stable routines and incentive system, can significantly impact the adoption.

The general objective of this conceptual paper is to relate the concept of task interdependence from the literature on organization design to the adoption of radical innovation. This paper emphasizes that task interdependence lies at the core of organizations. Task interdependence shapes the pre-existing organizational routines and organizational incentive distribution system and may constitute a solid organizational barrier to adopting

radical innovation. The paper proposes that task interdependence can substantially impact the adoption of innovation.

More importantly, the relationship is hypothesized to be complex, moderated by the managerial perception of innovation radicalness. This paper highlights the manager's role in their perception of innovation radicalness. The manager is conceived in this paper not as an individualistic decision-maker who deals with innovation adoption as a separate issue but instead as an organizational decision-maker who considers the expected effects of the innovation in the broader innovation context – the organization for which the manager is responsible.

In section 2, the paper critically reviews (i) some conceptual issues in the conception of innovation, i.e., the issue of value and newness, (ii) the factors that have been found in empirical research to affect the adoption of innovation, and (iii) radicalness as an essential dimension of innovation. In section 3, the paper discusses the relationship between inter-unit task interdependence and the adoption of radical innovation and highlights the role of managerial perception. In section 4, the paper proposes a conceptual framework for the joint impacts of inter-unit task interdependence and managerial perception on adopting radical innovation. At the end of section 4, the paper discusses a possible operationalization of the concepts involved. The paper concludes by discussing the proposed conceptual framework's significance and limitation and suggesting the issues for future research in section 5.

2 Theoretical background

2.1 Some conceptual issues

In the traditional conception of innovation, authors often associate innovation with progress or improvement, a positive bias tendency[2]. However, as Scott argues, innovation is not necessarily positive for the parties involved. He referred to the context of medical and mental health, "where, new technologies and treatments may be under-evaluated, oversold, or too quickly promulgated, or where benefits are likely to be overestimated and costs under-estimated" [3]. Moreover, introducing values, i.e., good or bad, into the innovation concept complicates the research. Because value issues are relative to the participant in question and organizations are composed of different groups, innovation can be regarded as a success by one party but as a mistake by another.

Hence, a more value-neutral concept, newness or novelty is often employed in defining innovation. The innovation literature's popular definitions of the innovation concept reflect the disposition. Nonetheless, an issue in associating innovation with newness is that saying "A is new" inherently presupposes a particular standard of comparison: A is new to what entity? Theorists differ widely in this regard. Some authors consider the past practices or routines of

the organization in question the criterion of newness. Zaltman et al., for example, define innovation as any ideas, practices, or material artifacts perceived to be new by the relevant unit of adoption [4]. In a similar vein, Damanpour defines organizational innovation as the process of changing the organization by introducing different methods of production or administration [5]. Van de Ven argues that "as long as the idea is perceived as new to the people involved, it is an innovation, even though it may appear to others to be an imitation of something that exists elsewhere" [6]. Others have anchored the standard of newness to the broader adopting context. Here, an innovation must be new to comparable organizations, for example, healthcare organizations within the healthcare industry. Therefore, Knight proposes that "an innovation is the adoption of a change which is new to an organization and to the relevant environment" [7]. Some even use the broader economy as the basis of comparison. For instance, Nelson refers to innovation as "the introduction of something new to the economy in the form of new technology or a new way of organizing a firm" [8].

The confusion can be resolved if we consider the explicit or implicit level of analysis involved. Innovation can occur at the personal, group, organizational, industry, or even higher level. Explaining innovation, March and Simon reason that much of what goes on in organizations occurs according to programs or habits and that innovation in programs occurs when the relevant organizational members feel that current programs are not satisfactory [9]. In other words, organizations prefer ongoing routines in which they do not incur sunk costs as they would if they engaged in finding and adopting new programs. Organizations only engage in innovation when they recognize problems or opportunities that indicate that the performance of the current programs is unsatisfactory. In light of this insight, something is an organizational innovation if it departs from the organization's pre-existing routines and incentive system.

2.2 The factors that affect the adoption of innovation

The innovation literature has found various variables associated with the adoption of innovation. In a remarkable attempt to synthesize the research, Damanpour & Gopalakrishnan categorized the structural variables into structural complexity (specialization, functional differentiation, and professionalism) and bureaucratic control (formalization, centralization, and vertical differentiation). Structural complexity has been found to positively impact innovation adoption, whereas bureaucratic control has been found to have negative impacts [1]. Damanpour & Gopalakrishnan also argue that environmental conditions shape the structure-innovation relationships and propose four stable configurations consisting of particular structural dimensions, innovation characteristics, and environmental conditions [1].

Dewar and Dutton added that a favorable managerial attitude toward change, the concentration of technical specialists, and the depth of the organization's knowledge resources facilitate radical innovations but have no association with incremental innovations [10]. They

also argued that centralization in decision-making positively affects radical and negatively affects incremental innovations [10]. Ettlie and colleagues found that radical innovations are more likely to occur in organizations with centralized and informal structures. In contrast, incremental innovations are more likely to occur in organizations with complex and decentralized structures [20].

As stated, task interdependence has not been emphasized as an organizational variable affecting radical innovation adoption in the literature. This paper attempts to argue for task interdependence as an additional significant factor in research on the adoption of radical innovation. The following section addresses the importance of innovation radicalness, forming the basis for the discussion in section 3 on the relationship between task interdependence and radical innovation adoption.

2.3 Radicalness as an essential dimension in innovation adoption

Damanpour argued that distinguishing innovation types is necessary because they do not relate equally to the same predictor variables [11]. In his extensive review of empirical studies, Downs and Mohr pointed out that empirical findings had been conflicting because the researchers were not investigating the same thing: determinants of adoption of product innovation are different from those of process innovation, for example [12]. Therefore, taking the variety of innovations into account helps make sense of many conflicting findings in innovation empirical studies and avoids the risk of generalizing from one type of innovation to another [3].

Many authors view innovation in terms of innovation content. Schumpeter classifies innovation into five types - product, process, the opening of the new market, the development of new sources of supply, and the new way of organizing business [13]. Knight distinguished four types of innovations - product, process, structure, and people [7]. Damanpour categorizes innovation in terms of technical and administrative innovation [14], which pertain to the dual-core model of organizational innovation by Daft [15]. Technical innovation includes new technologies, products, and services, whereas administrative innovation consists of new procedures, policies, and organizational forms. In this distinction, technical innovations are directly related to the organization's primary work activity and produce changes mainly in its operating systems.

In contrast, administrative innovations indirectly affect the organization's primary work activity and affect its management systems [10, 16, 17]. In Damanpour's classification, product and process innovations can be regarded as two forms of technical innovation. Greenhalgh and Rogers defined product innovation as "the introduction of a new product, or a significant qualitative change in an existing product" and process innovation as "the introduction of a new process for making or delivering goods or services" [18]. This distinction corresponds to that of Damanpour and Aravind [19].

Others view innovation in terms of radical-incremental distinction. Knight [7] and Nord and Tucker [20] distinguished between "routine and non-routine" innovations, depending on whether the innovation in question creates minor or major changes in the firm's product, process, structure, and people. Normann labeled innovation in terms of "variation" and "reorientation" [21]. The former refers to modifications and improvements, while the latter entails fundamental changes in existing practices. Despite differences in terminology, researchers often distinguish between radical and incremental innovations. The distinction is essential because incremental innovations have remarkably different antecedents and consequences. The adoption of radical innovation, by definition, implies significant consequences for the focal organization. Therefore, this paper focuses on the impacts of task interdependence on adopting radical innovation rather than incremental innovation.

3 Inter-unit task interdependence, managerial perception, and the adoption of innovation

3.1 Task inter-unit interdependence and the adoption of innovation

Interdependence lies at the core of organizations [22]. Because of the division of tasks among the organizational units and members, which is essential to any cooperative system, the problem of task interdependence arises. Task interdependence can exist at the individual, group, or unit level [22]. This paper focuses on task interdependence at the unit level, which can be defined as a condition where actions are taken within one unit affect another unit's actions and work outcomes [23]. Under the systems view, organizations are social systems whose parts are interrelated to various extents. The degree of task interdependence among organizational units has significant organizational consequences because it determines the pattern of coordination and associated costs. In organizations with highly interdependent units, a change in one unit requires adaptive changes in others. The degrees of interdependence among organizational units are different in different organizations. In other words, some organizations may be more tightly-coupled than others. For example, business units of a conglomerate are likely to be more loosely coupled than departments of a functional organization. In line with Aldrich [24], the effects of innovations on organizations should not be confined to such logical statements as "If A, then B," but also to such statements as "If A, then maybe B," or "If A, then eventually B" [24].

Emphasizing that both the rational and the natural models of complex organizations assume interdependence of organizational parts, James D. Thompson distinguishes between three types of task interdependence - pooled, sequential, and reciprocal interdependence [25]. Wageman notes that Thompson's conception of task interdependence is essentially at the unit level [22]. Thompson describes pooled interdependence as one "in which each part renders a discrete contribution to the whole, and each is supported by the whole" [25]. In other words,

units share common resources but are otherwise independent. An example of pooled interdependence is the multi-business organizations, whose business units work quasi-autonomously and are interdependent chiefly in terms of common corporate resources. Sequential interdependence features a higher degree of interdependency among the units, where the outputs of one task are the inputs of another, whose outputs are the inputs of another. Thompson notes that the sequential relationship is not symmetrical and that the direction of resource flow is essential. An often-cited example of sequential interdependence is the assembly line. In the third situation, reciprocal interdependence, each task receives inputs from and provides outputs to others [26]. Thompson illustrates reciprocal interdependence by referring to the airline, "The production of the maintenance unit is an input for operations, in the form of serviceable aircraft; and the product (or by-product) of operations is an input for maintenance, in the form of aircraft needing maintenance." [26]. As we move from pooled to sequential to reciprocal task interdependence, the degree of interdependency increases, requiring increasingly complex coordination mechanisms.

What is the implication of task interdependence for the adoption of radical innovation? The adoption of innovation, like any phenomenon in organizations, occurs within a set of organizational constraints. In the case of incremental innovation, the adopting organization can draw on and adjust its pre-existing knowledge and routines to accommodate the innovation. Often, the adjustments can happen in the behaviors of individual members or units. By contrast, because radical innovation can significantly disrupt and require fundamental changes in the pattern of task interdependence that underlies the existing structures, systems, and routines, the adoption of radical innovation demands collective inter-unit efforts and coordination in a new pattern in the focal organization. Since organizations have to establish complex coordinating mechanisms to regulate highly interdependent units, radical innovation is likely to impose high costs in re-configuring and re-instituting new routines and control and coordination mechanisms, rendering the adoption less attractive from a managerial perspective. For that reason, the pre-existing pattern of task interdependence in the organization can be a significant barrier to adopting radical innovation.

Moreover, inter-unit interdependence is often a source of inter-unit conflict. Although the classical view regards organizations as systems of cooperation for attaining common goals, organizations are also systems of conflict, consisting of different constituting groups, each having its interests. The potential inter-unit conflict is easy to see in large-scale, complex organizations, which consist of various interest groups. Organizations are constructed to pursue interests and create interests [3]. Lawrence and Lorch pointed out the critical differences among subunits within a single organization: they often exhibit significant differences in the formal structure, members' goal orientation, members' time orientation, and interpersonal orientations [27].

Simon argued that one of the salient characteristics of organizations is sub-goal identification: different subunits and participants pursue their narrow sub-goals rather than the broader organizational goals [28]. Starr pointed out that individual physicians and organized medicine long resisted the development of group practice organizations [29]. The adoption of radical innovation, by definition, is supposed to produce significant changes in the status quo of organizations. These changes are likely to upset the incentive structure within the focal organization; therefore, the protection of incentives has long been found in research as a significant source of resistance to adopting innovation.

3.2 The managerial perception of radicalness

Although organizational innovation should not be reduced to managerial behavior, the role of managers should not be underestimated. After all, managers often have the authority to decide on adopting radical innovation in their organizations. While the literature has addressed the impacts of managerial psychological and behavioral dimensions, such as managerial attitudes toward innovation and environmental scanning of managers, on the adoption of innovation, these characteristics are essentially individualistic. However, we should not forget that the manager is exposed to various organizational influences, which enter into his or her decision-making. The manager does not deal with the adoption of innovation as a separate task but takes into account the expected effects of the innovation on his or her organization. The reasoning is built upon the argument of Herbert Simon in his remarkable work on the decision-making process in organizations, that "Every executive makes his decisions and takes his actions with one eye on the matter before him and one eye on the effect of this decision upon the future pattern – that is to say, upon its organizational consequences" (28).

Chester Barnard characterized organizations as cooperative groups with mechanisms for distributing incentives to members [30]. Later, Simon developed the Barnard-Simon inducement-contribution equilibrium to explain the participation of people in organizations: people participate and remain in organizations if the inducements they receive equal or exceed the contribution they make in return [28]. In their incentive theory of organizations, Clark and Wilson claim that the dominant organizational incentive system can be a barrier to organizational flexibility [31]. Therefore, managing incentive systems is a managerial function with significant organizational consequences. A radical innovation of any type may upset the pattern of the organizational incentive system. For example, a radical product innovation can make the company's revenue more dependent on marketing than before, taking away a great deal of power and incentives from the production function. Because the manager has to maintain an adequate incentive system to mobilize contributions from the participants, who are assumed in the incentive theory of organizations as "purposive," the manager would have to compensate for the loss or decline of incentives of the affected units. Otherwise, the upsetting of the organizational incentive system would become a source of internal conflict, whose

resolution is the manager's responsibility. Accordingly, the manager is expected to consider the effects of a radical innovation on their organizational incentive system before making the adoption decision.

The discussion above brings us to a managerial view of innovation radicalness: radicalness is conceived as the degree of disrupting the pre-existing organizational routines and incentive system of the organization in question. This conception of innovation radicalness aligns with the conception of radicalness as varying along a scale and relative to the party involved in section 2.3. Whereas high task interdependence is conceived in this paper as an organizational barrier to innovation, managers must perceive innovation radicalness before taking action. In other words, managers can perceive radicalness, i.e., the degree that an innovation in question disrupts the pre-existing organizational routines and the incentive system differently. The managerial perceived level of innovation radicalness may be or may not be congruent with the "actual" radicalness of the innovation in question.

Accordingly, the managerial perception of innovation radicalness plays a substantial role in the adoption of radical innovation. If the manager perceives an innovation as low in terms of radicalness, the adoption of innovation may not be inhibited as much by the degree of task interdependence as it would be if the manager perceived an innovation as high in radicalness. In the reversed manner, if the manager perceives an innovation as high in radicalness, the adoption may be further inhibited than it would be if the manager perceived an innovation as low in terms of radicalness. In short, managerial perception of radicalness may restrain or amplify the impacts of inter-unit task dependence on adopting radical innovation.

4 The proposed conceptual framework

This section presents the proposed conceptual framework of the joint impacts of task interdependence and managerial perception of innovation radicalness on radical innovation adoption. The framework is constructed out of the analysis above, and the hypothesis is as follows: *Managerial perception of innovation radicalness moderates the impacts of task inter-unit interdependence on the adoption of radical innovation*. Figure 1 illustrates the conceptual framework.

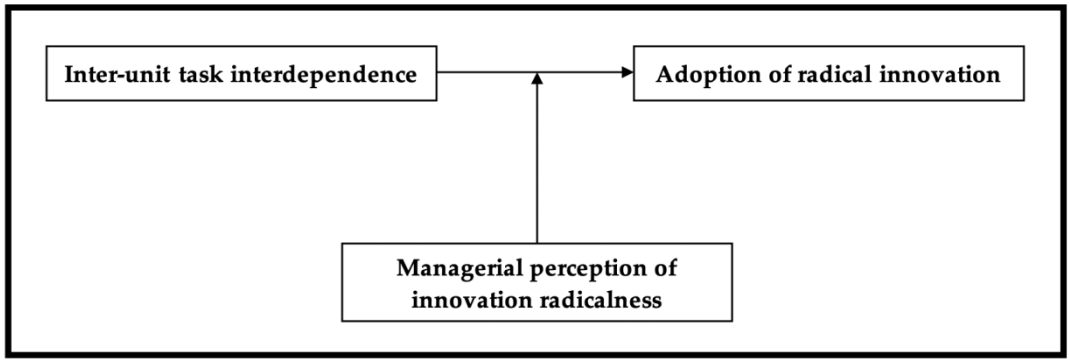

Figure 1. Joint impacts of inter-unit interdependence and managerial perception of innovation radicalness on the adoption of innovation

Inter-unit interdependence, as conceived in this paper, is transactional and can be measured using McCann & Ferry's six dimensions of transactional interdependence [23]:

(i) the number of different resources passed between the units;

(ii) the amount of resource exchanged per unit of time;

(iii) the frequency of transactions per unit of time;

(iv) the amount of time before the loss of a resource significantly impacts on work unit outcomes;

(v) the composite value of the resource to the unit; and

(vi) the direction of the resource flow.

While inter-unit interdependence can be measured objectively, managerial perception of the radicalness of the innovation in question is inherently subjective. The manager's perception of innovation radicalness can be measured as the degree to which he or she considers the innovation as disrupting the pre-existing organizational routines and incentive system of his or her organization.

A remaining issue is whether task interdependence is a form of structural complexity. The trigger of performance dissatisfaction - the recognition of problems or opportunities - implies the importance of initiating innovative ideas that come into the organization's relevant participants' attention and consequently into the organizational agenda. The explanation provided in those studies on structural complexity and innovation is two-folded. First, structurally complex organizations have more problems, demanding innovation of one type or another. Second, structurally complex organizations have large pools of professional experts, which offer ideas for innovation initiation and the knowledge required in innovation implementation. Therefore, the concept of structural complexity operationalized in terms of the

number of problems and the depth of technical expertise in the earlier studies is not congruent with inter-unit task interdependence conceived in this paper.

5 Conclusion

Society is calling for innovation in all kinds of sectors. Since organizations are the primary agents of modern society, particularly in developed economies, innovation is expected to occur in organizations. Innovation adoption in organizations has been intensively studied over the last decades. This conceptual paper attempts to relate the concept of task interdependence to the adoption of radical innovation. This conceptual paper discussed some conceptual issues in the literature on innovation, reviewed the internal and external factors that affect innovation adoption, and proposed the conceptual framework.

The paper emphasizes radicalness as an essential dimension of organizational innovation because radical and incremental innovations have different potential consequences for the pre-existing organizational routines and organizational incentive system, which are shaped by the underlying pattern of task interdependence. However, innovation radicalness is not simply "out there" but perceived by the manager in terms of its expected impacts on the organization. Organizational participants other than the manager have their own perceptions of innovation radicalness. Nevertheless, the manager's perception and opinions count, and others are attentive to how the manager makes sense of the innovation. Therefore, the paper emphasizes the role of managerial perception of innovation radicalness in mediating the effects of task interdependence on the adoption of radical innovation.

Empirical research needs to be conducted to test the hypothesis proposed in this conceptual paper. Testing these hypotheses would also provide insights into the relationships between task interdependence, a stable, essential organizational characteristic, and the adoption of radical innovation, which introduces significant changes to organizational functioning. Furthermore, understanding the joint impacts of task interdependence and managerial perception of radicalness on innovation would help better understand the relationships between organizational and managerial dimensions in adopting radical innovation. One implication of the paper is that the manager must keep an eye on innovation and the other on stability.

Because this paper focuses on the impacts of task interdependence on the adoption of radical innovation, it does not attempt to integrate all the other known determinants. However, variables such as organizational complexity, resources, and environmental conditions can act as controlling variables of the framework. Future studies can integrate those structural variables into a more comprehensive framework of organizational variables and the adoption of radical

innovation. It would further our understanding of the relative importance of internal and external variables in explaining the adoption of radical innovation.

One limitation of the proposed framework is that it does not consider the other two forms of internal interdependence – goal interdependence and knowledge interdependence. Raveendran et al. [32], in a recent paper on the role of organizational interdependence in organizational design, argue that those two forms of interdependence have become more important and salient in today's organizations. Therefore, future research should study the impacts of goal interdependence or knowledge interdependence on radical innovation adoption and consider investigating the joint impacts of all three forms of interdependence. Doing so would provide further insights into the relationships between internal interdependence and the adoption of radical innovation in today's organizations.

The paper focuses on the role of an individual manager whose perception may mediate the impacts of task interdependence on the adoption of radical innovation. However, there are organizations where power is more evenly divided among different managers or concentrated in the hands of professionals, as in the case of professional organizations [26]. A study on the interactive perception of innovation radicalness would better inform the inquiry of the interpersonal processes involved in the adoption of radical innovation in organizations.

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