Consequences of Causal Ambiguity on Motivation in Lean Production System Adoption: The Role of Moderating Variables

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***Abstract*—This paper proposes that causal ambiguity can undermine motivation during the implementation of LPS. This is mainly because of the complexity of transferring knowledge in an LPS initiative. LPS has many inter-related components and their implementation requires changes to work processes and mindset. This is not easily understood by everyone in the organization. Instead, employees experience causal ambiguity and are not able understand well the expected changes. The literature on causal ambiguity also point out that there may be differences of understanding between top management and those lower in the organization on what the change entails. We also propose that individual differences will also shape their reaction to causal ambiguity and their motivation during the LPS initiative. These differences moderate the relationship between causal ambiguity and motivation during the initiative.**

***Index Terms*—causal ambiguity, motivation, role breadth self-efficacy, openness to experience, trust**

I. Introduction

The implementation of the Lean Production System (LPS) has met with mixed results [1]-[6]. While some firms experienced positive outcomes, some failed to achieve the desired outcomes. One reason for the failure of LPS adoption is the inability to transfer the knowledge on LPS to the adopters. This paper discusses the role of causal ambiguity in impeding LPS adoption. We argue that causal ambiguity has a negative effect on the motivation of employees in the recipient organization. We also propose that this relationship can be moderated by a number of variables.

II. Literature Review

A. Knowledge Transfer

LPS adoption is difficult because it is a complex system with many interdependent components. Various authors argue that the LPS consists of many components such as the just-in-time inventory system, total preventive maintenance, total quality management and HRM system [3]. It is also a product of history of learning and has many tacit elements [6]-[7]. Because of this, adopters do not necessarily have the full picture on LPS. Some opt to adopt only certain aspects of LPS. Researchers argue that adopters will only be able to realize the full potential of LPS when they adopt all the practices that are in the LPS [3].

One concept that is key in understanding knowledge transfer is the notion of stickiness of knowledge [8]-[9]. Knowledge is said to be sticky when the intended knowledge transfer fails to happen. Ref. [8] identify four sources of stickiness of knowledge as being related to characteristics of knowledge, characteristics of sources of knowledge, characteristics of recipients of knowledge and characteristics of the context of the transfer. One aspect of characteristics of knowledge that contributes to stickiness of knowledge is the causally ambiguous nature of the knowledge.

B. Causal Ambiguity

A review of the literature shows that causal ambiguity had been examined by a number of authors. According to [10], causal ambiguity refers to "ambiguity as to what factors are responsible for superior (or inferior) performance" or "ambiguity surrounding the linkage between action and performance". Causal ambiguity can be double edged knife. High inter-firm causal ambiguity can be a form of competitive advantage. Competitors will experience difficulties understanding and imitating a firm's competitive advantage. However, intra-firm causal ambiguity can impede knowledge sharing and internal transfer of technologies. Ref. [11] defines causal ambiguity as a "lack of understanding of the logical linkage between actions and outcomes, inputs and outputs, and causes and effects that are related to technological or process know-how". Ref. [11] conclude that the effect of tacitness on ambiguity is consistently significant across analyses in which learning capacity and collaborative know-how moderate the relationship between characteristic antecedents and causal ambiguity. Ref. [12] argue that causal ambiguity is "ambiguity about which performance criteria are valuable and how to achieve them, or which contingencies affect implementation". It concludes that causal ambiguity hinders learning and therefore performance. It also says that reducing causal ambiguity can help increase barriers to substitution and therefore sustain competitive advantage. Ref. [13]

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introduced the notion of linkage ambiguity and characteristic ambiguity. Linkage ambiguity is described as ambiguity experienced by decision makers about the linkage between a competency and competitive advantage. Characteristic ambiguity is inherent in the resource itself. It was found that characteristic ambiguity is positively correlated with firm performance but linkage ambiguity, particularly among middle managers is negatively correlated with firm performance.

In this study, we define causal ambiguity as the perceived uncertainty arising from the inability to precisely identify what the factors of production are and how they interact to create the outcome [9], [14]. The literature on knowledge transfer points out that knowledge is causally ambiguous when the causal mechanism of the knowledge in creating the desired outcomes is not well understood. This ambiguity can be due to the complexity of the knowledge as well as because of the complexity of the organization's system. Sometimes the lack of an agreed definition can also contribute to causal ambiguity. Different people may desire the same outcome and adopt the same practice to achieve it. However, their understanding of the practice may differ. Causal ambiguity is also said to exists when the relationship between competencies and performance is unclear [15]. As a result, there is considerable confusion on what needs to happen with the adoption of a practice and what are the boundaries of the adopted practice.

Recent discussion on causal ambiguity highlights the nature of complex ambiguity [15]. Causal ambiguity is said to exists when a firms lacks experience with a competency [11]. Ref. [15] review of the literature shows that causal ambiguity can also exist in the form of different levels of understanding of an issue across the hierarchical levels. Firms where causal ambiguity is higher across the hierarchy are associated with lower performance than those that experience less causal ambiguity [15].

Causal ambiguity can also exist in LPS adoption. LPS is a complex system with many components. It is not always clear how these components interact to create the desired outcomes. As a result, this ambiguity can caused failure in the transfer of LPS knowledge [8], [9]. When employees experience high causal ambiguity and face difficulties in understanding the knowledge transferred, it can undermine their motivation. This lack of motivation can undermine the change initiative to implement LPS.

C. Causal Ambiguity and Motivation

In a change situation, such as in LPS implementation, the lack of clarity of what management aspires to achieve from the program can also create causal ambiguity. Members may not be clear of top management's expectations. The lack of long-term resource commitment, the gap between vision and action, poor communication and the prevalence of a short-term view all add up to create causal ambiguity on the LPS initiative [4].

Causal ambiguity can be a source of confusion that leads to frustration and other negative reactions. In a change situation, employees have to abandon the familiar and adopt the unfamiliar. This can happen in LPS adoption given the new tools that employees have to learn and use in implementing LPS. Besides learning new unfamiliar techniques, they are also expected to change their work practices. When this transition is not well managed, causal ambiguity is likely to be high. Employees are left on their own to make sense of the confusion.

This confusion can undermine motivation during the transfer of knowledge [8]-[9]. Employees will get demotivated when they find the new knowledge difficult to understand [16]. This becomes more pronounce when employees are unable to solve problems encountered during the LPS initiative. As a result of the low motivation the LPS initiative flounders. Motivation in LPS initiative can be defined as specific desire to learn the content of the LPS program and to fully embrace the program experience [17]. Employees able to solve problem if they have capabilities and are motivated to do so. We therefore argue that causal ambiguity is negatively related to motivation. We therefore expect:

Proposition 1:

Perceived causal ambiguity during LPS adoption will be negatively related to employees' motivation during the initiative.

III. Moderating Effects

The relationship between causal ambiguity and perceived outcome may be differentiated within an organization. The degree of causal ambiguity may be perceived differently by different people in the same situation. As a result the impact of causal ambiguity on motivation will also be differentiated in an organization. We propose that openness to experience, role breadth self-efficacy (RBSE) and competency-based trust moderates the relationship between causal ambiguity and motivation to change.

A. Role Breadth Self-Efficacy

Self-efficacy is defined as the judgment by someone on his ability to perform well in a particular task [18]. However, self-efficacy is role specific. A person can perceive himself as efficacious in performing a technical task but not so when asked to lead others. A related concept is Role Breadth Self-efficacy (RBSE). Ref. [19], defines RBSE the extent to which a person feels confident that he would be able to carry out a broader and more proactive role, beyond traditional prescribed technical requirements". RBSE is the product of earlier experience and learning. In a change situation, RBSE is related to the individual's belief of his/her ability to perform new or multi-task [20].

Individuals with low RBSE are more likely to perceive change as disruptive. This is because change often requires learning new ways to do work. Low RBSE individuals are more likely to feel less flexible and uneasy with the new requirements. On the other hand, individuals with high RBSE will more likely feel confident to adjust to changes in work requirements [19]. They have a broader inventory of skills to adapt to

change. This is especially the case in LPS adoption because it often involves changes to existing processes. The broader skill set they possess enables them to adapt faster to new work requirements than those with low RBSE. Individuals with high RBSE will also be better able to make sense of new requirements at work and feel less intimidated by any perceived causal ambiguity. They are able to rely on their prior learning to fill in any information gap that exists in the LPS initiative. We therefore propose:

Proposition 2:

The relationship between causal ambiguity and motivation in LPS implementation will be moderated by role breadth self-efficacy.

B. Openness to Experience

Openness to experience is defined as "breadth, depth, and permeability of consciousness, and in the recurrent need to enlarge and examine experience" [21]. Individuals differ considerably in their openness to experience. Openness to experience is a personality trait and is related to a person's tendency to be imaginative, intellectually curious, and open to trying new things [22]. When faced with a new situation, individuals with high openness to experience are more likely to view positively a change process. They are more curious and willing to learn new things. They creatively search for new alternatives. They are also able to gain insights in solving problems. Consequently, their open-minded view of the world and tolerance for ambiguity would be valuable in any fast changing or uncertain environment [22].

On the other hand, individuals with low openness to experience have a stronger preference for the familiar, routine, seek security, and simplicity. They are more tied down by tradition and social norms [22]. As such when faced with high causal ambiguity individuals with different levels of openness to experience react differently.

Therefore, we propose that when causal ambiguity is high, there is a greater willingness to learn. Those with openness to experience are more likely to be motivated to learn new things. People who have high openness to experience perceive change as a challenge that stimulates information search and learning [23]. Those who are low in openness to experience are more likely to prefer the familiar and resist changes to their work. We therefore propose:

Proposition 3:

The relationship between causal ambiguity and motivation in LPS implementation will be moderated by openness to experience.

C. Competency-Based Trust

A change program such as the implementation of LPS creates a lot of uncertainty. This is because of the complexity of the change and the time needed to execute the change. This can create a sense of uncertainty. Prolonged uncertainty, however, can have negative consequences for motivation. In such a situation, employees seek guidance and leadership from their superiors to help them navigate the ambiguities and uncertainties.

The effect of causal ambiguity on motivation can be lessened if employees trust that their superiors are competent and will be able to help them navigate the uncertainties. Researchers define trust as "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party" [24]. Some studies conceptualize trust as having two aspects [25]-[27] i.e. cognition-based trust (based on competence to perform a task, responsibility, reliability and dependability), and affect-based trust (based on emotional bonds and relationships). Ref. [28] argue that these two factors of perceived trustworthiness play different roles in teams. Cognition-based trust is similar to the notion of competence-based trust [29]-[30]. Competency-based trust is defined as trustor's belief about trustee's competency or ability to carry out obligations [30]. For this study, we chose competency-based trust as our moderating effect on the relationship between causal ambiguity and motivation.

Trust in management during a change process is about trust in their ability to guide implementation of changes process [20]. Trust will be low when top management is perceived as unsure of what and how to change. However, trust will be high when top management is perceived as confident and competent in executing change. When competency-based trust in superior is high, employees will feel more confident of their ability to make sense of the LPS initiative; overcome obstacles and this improve their motivation. Thus, we argue that:

Proposition 4:

The relationship between causal ambiguity and motivation in LPS implementation will be moderated by competency-based trust.

IV. Conclusion

The clarity of information is very important in change process. Yet, there are usually imperfections in information flow during change that creates ambiguities about the change and what it is supposed to achieve and how the change is supposed to be done. As a result, this can undermine the motivation of employees who are supposed to implement the change.

This paper proposed a number of moderators that will reduce the negative impact of causal ambiguity on motivation. Future research need to also address how to minimize causal ambiguity right from the beginning.

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