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# Learning from project monitoring feedback: A case of optimizing behavior of contractors

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**Abstract**

Monitoring is an essential part of construction project management and has typically been devised to guard against non-compliance. When contractors are subjected to regular performance feedback, instead of just taking remedial action, they may take the opportunities to enhance their operations in the light of the feedback. Thus, it has been advocated that responding to performance feedback has a learning element. This study takes on this notion and examined the performance change pattern of contractors that have been subjected to regular performance feedback. Longitudinal performance scores were fitted against five well established learning curve models using the Least Square Curve Fitting Analysis (LSCFA). It was found that the 3-parameter hyperbolic model is the 'best-fit' model in terms of effectiveness and stability. The LSCFA results also suggested that the contractors in the sample can be arranged in four clusters: Competent Learners, Incidental Learners, Indifferent Learners and Optimizers. The majority of them fall into the optimizing cluster. This suggests that these contractors may adjust their resources to maintain their performance at an acceptable level which do not deprive their future opportunities. With due caveat to the constraints and limitations of working sample, this finding is thought provoking for project managers in exercising project monitoring.


*Keywords:* Learning; Project monitoring

## 1. Introduction

Contractors have been recognized as the hub of construction supply chain and are responsible to convert design into practical reality (Dainty et al., 2001). Their performance directly affects the competitiveness of the entire supply chain (Wong and Cheung, 2005). Therefore, it makes good sense for contractors to explore ways to sustain performance improvement (Love et al., 2000; Wong and Cheung, 2005). One way to achieve this, as suggested in a number of reported studies (Crawford and Bryce, 2003; Franco et al., 2004; Orange et al., 2005), is to make use of feedback derived from Project Monitoring Systems (PMS). Based on a literature review of organizational learning in construction, Orange et al. (2005) identified that the provision of performance feedback can stimulate performance improvement of contractors. In a case study on the relationship between PMS and project performance, Franco et al. (2004) found that contractors' learning from regular performance feedback is imperative to performance improvement.

Nevertheless, some skeptics argued that performance improvement may not be exclusively attributed to contractors' learning from feedback (Greve and Audia, 2006; Audia and Brion, 2007). While pinpointing that performance feedback helps contractors to learn from the past, Love and Josephson (2004) argued that contractors may not readily take improvement action unless lack of action would result in further sanctions (Love and Josephson, 2004). Greve and Audia (2006) described that contractors may exhibit a perverse form of learning when their market

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positions are not challenged. They argued that contractors may adopt a 'wait and see' attitude and only take action when the feedback is worse than their anticipation (Greve and Audia, 2006).

As such, the aforementioned reported studies reveal that performance improvement is merely one of the possible contractors' responses to feedback derived from project monitoring. Notwithstanding, there seems to be a general view among researchers that performance change of contractors is not incidental (Jashapara, 2003; Love et al., 2004; Sense and Antoni, 2003). To certain extent, it may be an outcome of a subtle learning process (Greve, 1998; Greve and Audia, 2006). In this connection, it is not surprising that the interest in the concept of learning and in particular, the effect of learning on contractors' performance has been increasing (Kululanga et al., 1999, 2002; Love et al., 2004; Jashapara, 2003).

As for the concepts of learning, Wong et al. (2007) identified that Argyris and Schön's (1978) action-based theory, which has been recognized as the first deliberation of the organizational learning theory, is adopted in a number of studies to describe the learning process of the contractors (Kululanga et al., 1999; Love et al., 2000; Jashapara, 2003; Murray and Chapman, 2003; Wong and Cheung, 2008; Wong et al., 2008a,b, 2009). In these studies, contractors' learning is conceptualized as a process of imbibing knowledge uncovered from past experiences and/or information gathered from external sources (Wong et al., 2009). This conceptualization is in line with other definitions of organizational learning (Kululanga et al., 1999; Love et al., 2000; Jashapara, 2003; Murray and Chapman, 2003).

Regarding the effect of learning on performance, Love and Josephson (2004) based on some case studies conducted in Sweden and found that construction cost can be reduced if contractors could learn from previous operational errors. Jashapara (2003) extended Argyris and Schön's concept by using two learning types to describe the manners that contractors may use to imbibe knowledge: single-loop learning[1] (SLL) and double-loop learning[2] (DLL). Supported by views obtained from construction practitioners in the UK, he pinpointed that contractors' performance is significantly affected by their practice of DLL. Similar finding was also reported in a survey study conducted by Wong and Cheung (2008). They found that the level of project success is contingent on the contractors' practice of SLL and DLL.

Whilst the above reported findings in a board sense suggest a positive relationship between learning and performance, they are mainly based on the perceptive views of the practitioners. Moreover, these studies are not informative in illustrating the effect of learning on contractors' performance change over time. Can performance change of the contractors as the project progressed be viewed as an effect of learning? It seems that empirical evidences remain obscure and thus further quantitative research is desired.

In this aspect, some researchers advocated the use of historical performance data in tracing the evidence of contractors' learning (Thomas et al., 1986; Everett and Farghal, 1994; Couto and Teixeira, 2005; Wong et al., 2007,2008b). In these studies, the fitness of the learning curve models[3] in explaining the patterns of performance change of contractors was investigated (Thomas et al., 1986; Everett and Farghal, 1994; Couto and Teixeira, 2005; Wong et al., 2007,2008b). Based on a literature review, Wong et al. (2007) identified five learning curve models that may be effective to demonstrate the link between performance change and learning. A summary of these models is given in Table 1. Log-linear models, which were introduced by Wright (1936), had been identified in a number of studies as the 'best-fit' models in portraying the performance path of contractors (Thomas et al., 1986; Everett and Farghal, 1994; Nembhard and Uzumeri, 2000; Couto and Teixeira, 2005). Nevertheless, some researchers argued that log-linear models assume continuous performance improvement over time. The models seem unfit in depicting the 'plateau effect' of the contractors' performance (i.e. no or very little improvement after initial betterment) (Nembhard and Uzumeri, 2000; Wong et al., 2007). The use of the exponential and hyperbolic models that were introduced by Mazur and Hastie (1978) were thus proposed (Nembhard and Uzumeri, 2000; Wong et al., 2007). In these regards, there seems to be no consensus view among researchers about which particular learning curve model is more effective in portraying performance change of the contractors.

In view of the above, the following research questions for this study have been identified:

(1) Is performance change of contractors an effect of learning?
(2) If the answer of question (1) is yes, can specific pattern(s) of contractors' learning be tracked by the use of their historical performance data?

These research questions are formulated based on the hypothesis that performance change of the contractors is not incidental but an effect of learning. As proposed in previous studies, examining the fitness of the contractors' performance change patterns to the learning curve models is proposed as a possible way to test such hypothesis. That means learning effect is identified by fitting historical performance data of the contractors with established learning curve models (Everett and Farghal, 1997; Wong et al.,

[1] SLL refers to the detection and correction of errors without adjusting one's underpinning assumptions about performance requirements.

[2] DLL refers to improvement actions which are undertaken in response to the change of one's underpinning assumptions.

[3] Learning curve model can be defined as a graphic display of a particular pattern of performance change over time (Everett and Farghal, 1994, 1997).