

Theory of Planned Behavior in Lean Manufacturing Training

Subjects: [Engineering](#), [Manufacturing](#)

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The Theory of Planned Behavior (TPB) is a useful framework that helps explain people's behavior across a wide range of settings. Lean manufacturing is one of the most successful continuous improvement methods to increase a manufacturing organization's productivity and efficiency. It has been considered a practical methodology to help manufacturing organizations improve production quality and cost.

learning intention

training

lean manufacturing

1. Introduction

The roots of lean manufacturing can be traced back to the Toyota Production System (TPS), which Taichi Ohno developed to improve the manufacturing competitiveness of Toyota factories in Japan at the end of the Second World War ^{[1][2]}. There has not been a standardized definition for lean manufacturing used in the field. However, some of the lean concept's key characteristics can be traced back to the book *The Machine that Changed the World* ^[3]. Lean production is "an integrated socio-technical system whose main objective is to eliminate waste by concurrently reducing or minimizing supplier, customer, and internal variability" ^[4]. Lean manufacturing is also seen as a customer-value-focused approach to production which can bring remarkable productivity increases ^[5]. Therefore, implementing lean manufacturing, including addressing the human aspects of lean manufacturing, has become a priority for many manufacturing organizations ^{[6][7]}.

2. Workers' Impact on Lean Manufacturing Innovations

Workers have a significant impact on lean manufacturing implementation, especially in labor-dependent manufacturing industries. Direct workers fundamentally are an essential part of the manufacturing process in such industries, and the performance of operations relies heavily on their involvement and abilities. Womack, widely acknowledged as a key authority on the lean concept, had even considered that workers' work teams are at the very heart of the lean factory ^[3]. This is also in line with other researchers' views that lean manufacturing implementation success depends on workers' cooperation and full participation ^{[6][8][9][10]}. Without workers' contribution, not only will the continuous improvement effort fail, but operations and production may even come to a halt. Past studies have also highlighted the importance of workers' commitment to successful lean manufacturing implementation in organizations ^{[11][12][13]}. Others have highlighted the risk of worker resistance as a threat to be

considered for any lean manufacturing implementation effort [14]. Addressing workers' fear of new methods or procedures taking over their jobs will be an issue when planning for improvement and innovation in a manufacturing environment [15][16]. There have been indications that workers may fear that lean manufacturing implementation may lead to job losses, and therefore they may resist any changes required [17]. Consequently, it is hard to assume that workers will openly accept any continuous improvement effort, even if it is for the good of the organization.

Conversely, a continuous improvement effort pursued through the lean manufacturing methodology will allow workers the opportunity to harness their creativity and experience [18][19]. These improvement initiatives and opportunities will lead to a better sense of pride and a sense of job security among workers [20][21]. It has been suggested that workers should be empowered to provide ideas and suggestions to improve the processes that they are working on [5]. Employees who are skilled and experienced in their tasks could effectively contribute to their organization's innovation development [22]. More organizations are also integrating the drive for efficiency through lean approaches with the need to be more innovative by adopting open innovation [23][24]. Lean practices could potentially effectively contribute to open innovation in organizations [25]. It is evident that workers could play an essential and positive role, but organizations must prepare them well for the requirements and challenges through training initiatives.

3. Lean Manufacturing Training Complexities

The training of staff is an integral part of a lean manufacturing implementation effort. Without proper training, lean and other innovative change implementations could never be successfully implemented [26]. The training and education of workers have been noted as a critical success factor for lean manufacturing and other related improvement initiatives implementation in various industrial settings [27][28][29][30][31]. Proper resources must be allocated for workers' training, and management should encourage workers to attend the training by providing the appropriate rewards and outcomes for those engaging in training activities [10][32]. Experiences during training may also alter a learner's intention to complete the training [33]. Failure to provide proper and adequate training could even lead to low morale in the workplace [34][35]. For better quality and effectiveness, the training of skilled workers should be accomplished through a formalized process [36]. The right approach to the on-the-job training will have a positive impact on the level of innovation of the organization [37]. However, determining the types of training and how much training is necessary is a complex and complicated process [38]. The participants' learning intentions are an even more critical consideration for organizations seeking to train their workers.

Past research has identified that participation in training is a rational decision on the part of the participant. These studies enabled an understanding of the relationships between different factors and the impact on participants in training sessions [39][40][41][42][43]. Studies have also highlighted that participants could be encouraged to learn better from training activities through motivational initiatives [44][45][46]. Accordingly, the TPB has considered that a person's intention is affected by the different motivational factors that influence their behavior [47]. Therefore, the TPB is a suitable framework to be considered for better understanding participants' learning intention regarding training activities.

A limited number of past studies have applied the TPB to cover training participants' motivation, engagement, and learning. Wiethoff 2004 ^[48] adapted the TPB for a study on diversity training, while Renkema and van der Kamp 2006 ^[49] conducted a quasi-experimental study examining the individual learning accounts of learning intention and perceived learning cultures of different sectors. More recently, Ho et al. 2011 ^[43] conducted an empirical study testing the TPB to predict public sector employees' training participation and examine the factors that influence the participants' intentions and behaviors regarding participating in training. Alok et al., 2018 ^[50] tested the efficacy of the TPB in the prediction of lean adoption practices among workers of cement companies. Liu et al., 2020 ^[51], on the other hand, used the TPB to investigate workers' safety behavior and discussed the important role of safety training in an off-plant manufacturing environment. Other studies have also built upon the TPB framework to better understand the factors affecting participants' learning from training initiatives. Sanders et al., 2011 ^[41] considered the different factors that could stimulate low-education workers' learning intention in workplace learning activities. Kyndt et al., 2011 ^[42] completed a detailed study on the effects of past participation on the learning intentions of low-qualified workers. Similarly, Sanders et al., 2015 ^[52] investigated the impact of low-educated workers' training participation and learning experience on their self-efficacy. These past studies indicate the TPB framework's potential suitability for considering workers' learning intentions in lean manufacturing training.

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