Distribution of Readiness Bands for Process Innovation Deployment in Manufacturing

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Abstract

Process innovation is an important source of increased productivity and competitive advantage. Instances of product innovation projects in manufacturing abound with reported experiences of successful and not so successful implementation. It is increasingly recognised that crucial is pre-implementation phase which includes attaining an appropriate level of readiness to deploy. Retrospectively, deployment readiness is the extent to which deployment has run smoothly and relatively problem-free. Methods of accessing deployment readiness have been reported in the literature. Of interest in this paper is the distribution of process innovation deployment readiness bands adopted in manufacturing. Through a survey of practitioners in manufacturing management in UK, this paper reports on a range of process innovation deployment readiness bands adopted in manufacturing. The results show that the typical readiness band is 71 – 80% with very few quoting 41-50%. Rarely would the readiness bands go above 95% and none of the reported readiness bands quoted is found to be below 40%. The findings led to a preliminary discussion on deployment readiness thinking in the context of readiness bands. Limitations of the study are discussed, and areas of future work are highlighted.

Keywords
Manufacturing Process Innovation, Deployment, Readiness Band.

1. Introduction

Process innovation is acclaimed as an important source of increased productivity and competitive advantage (Davison & Hyland, 2006). Process innovation involves the introduction of new elements into an organization's production or service operations—input materials, task specifications, work and information flow mechanisms, and equipment used to produce a product or render a service (Utterback and Abernathy, 1975; Rosenberg, 1982; Damanpour, 1991; Utterback, 1994; Freeman and Soete, 1997). The introduction of the new element is primarily for the purpose of achieving lower costs, higher product quality and increased service levels. Along with product innovation, process innovation has received considerable attention in the literature on the sources and determinants of change.

Instances of product innovation in manufacturing abound. Examples include introduction of new technology for shop floor data collection (Chuang & Shaw, 2008), lean philosophy adoption (Lins, et al., 2019), and Cloud-based ERP adoption (AlBar and Hoque, 2019). These instances often come with reported experiences of successful and not so successful implementation. Manufacturing companies that fail to successfully deliver process innovation do so primarily due to ineffectiveness of their pre-implementation phase and their lack of appropriate readiness to deploy.

Readiness to deploy process innovation in manufacturing is increasingly a topic of interest in the literature (e.g. Javahernia and Sunmola, 2017; Teso and Walters, 2016). Retrospectively, deployment readiness is the extent to which deployment has run smoothly and relatively problem-free. It facilitates planning and quality assurance of a proposed innovation process innovation implementation. Situating the concept of deployment readiness in the pre-implementation phase allows for a more methodological approach to preparing for implementing innovation initiatives and responding to risks.

Methods of assessing deployment readiness have been reported in the literature. They include analytical network process (ANP) and fuzzy cognitive maps (FCM) (Razmi, et al., 2009) and simulation-based approach presented by Javahernia and Sunmola (2017). The assessments results in a measure of the degree to which an organisation is ready to deploy its process innovation initiative. This will help an organisation to decide whether to proceed with the process innovation implementation, review its deployment plans, or cut short the proposed implementation entirely. Manufacturing organisations may use tolerable range between two limits of readiness levels to decide the go/no-go decision. The range between two limits of readiness levels for process innovation deployment is referred to in this paper as the process innovation deployment readiness band.

Successful deployment requires that an organisation should be aware of their acceptable readiness band and know when they have achieved the appropriate readiness that falls within the band. The aim of this paper is to explore the perspective of manufactures managers on the readiness band typically adopted in their enterprise for a go/no go decision regarding process innovation deployment.

The remaining of this paper is structured into four sections. In Section 2, the related work on manufacturing process innovation deployment readiness is introduced. The research methodology is presented in Section 3, and this is followed in Section 4 by the results and its discussion which illustrates the findings of the study. The paper ends with conclusion and suggestions for future work in Section 5.

2. Related Work

The concept of innovation in the manufacturing industry has grown in leaps and bound among researchers and practitioners in recent years. Innovation is seen as a fundamental way to ensure productivity growth and is vital for the survival and competitiveness of a firm as it can improve its business resulting to an increase in the profit for the firm (Chesbrough, 2003; Cefis and Marsili, 2006; Gonçalves Silveira Fiates et al., 2010). Businesses can innovate through their products offerrigs and/or their processes. The focus in this paper is on process innovation.

The notion of process innovation represents an effort to reduce the cost (Bernstein and Kök, 2009), enhance quality (Terziovski and Guerrero-Cusumano, 2009) and flexibility (Reichstein and Salter, 2006), which leads to a change in the production and/or service function, allowing firms to gain a sustainable competitive advantage and economic successes. Process innovation differs from product innovation in terms of its evaluation and its potential impact on competitive advantage (Utterback & Abernathy,1975; Bonanno and Haworth, 1998; Cleff and Rennings, 1999; Fritsch and Meschede, 2001).

In manufacturing, process innovation is inevitable for enterprises wishing to gain competitive advantage. Manufacturing process innovation has been defined in various ways, including the definition put forward by Hammer and Champy (1993) which states that process innovation is an organization-wide effort that involves fundamental rethinking and radical redesign of manufacturing related processes and systems to achieve dramatic improvements in manufacturing performance measures such as cost, quality, service, and speed.

Several examples of successful and not so successful innovation exist. A common thread is that a not so successful process innovation in manufacturing fail because of inadequate readiness for the implementation of their innovation initiatives. According to Reichstein and Salter (2006), the process innovation implementation stage is the most significant phase of the integration of technology and its application in the firm. The phase is categorized into three sub-phases namely pre-implementation, implementation, and post-implementation. Pre-implementation is one of the essential phases for enabling successful implementation of process innovation and it involves planning and organising activities in readiness for deployment. Pre-implementation is the first stage after the testing phase is completed. Central to the pre-implementation phase is the notion of deployment readiness.

Retrospectively, deployment readiness can be viewed as the extent to which deployment has run smoothly and relatively problem-free. It is at the pre-implementation phase that the organisation prepares itself and develops the plans for deploying its innovation initiative. The importance of deployment readiness and its benefits cuts across manufacturing and services industry, including, for example, in quality control scenarios (Lim and Jiju, 2013).

Manufacturing companies need to appraise their readiness to deploy innovation initiatives, assess the risks involved, and select appropriate risk response strategies (Javahernia and Sunmola, 2019). Situating the concept of deployment readiness in the pre-implementation phase allows for a more methodological approach to preparing for implementing innovation initiatives and responding to risks. Methodology for deploying process innovation have been forward in the literature. For example, in manufacturing Javahernia and Sunmola (2016), described a five step approach consisting of: a) setting out the objective of the deployment, b) development of a deployment plan, c) assessment of deployment readiness and conducting acceptance tests, d) exploring opportunities for improving the level of readiness, and e) improving readiness levels if possible, otherwise deploy.

Central to the methodology is the need to assess how ready an organisation is to deploy its innovation initiative. Several methods of assessing deployment readiness now exists and they include analytical network process (ANP) and fuzzy cognitive maps (FCM) (Razmi, et al., 2009) and simulation-based approach presented by Javahernia and Sunmola (2017). Through the assessments and the resulting deployment readiness level index, an organisation will be able to decide whether to proceed with the process innovation implementation, review its deployment plans, or cut short the proposed implementation entirely. This can be done, for example, via a deployment readiness review meeting (Javahernia and Sunmola, 2019). A tolerable range between two limits of readiness levels can be pre-set and used in the review meeting to decide the go/no-go decision for the deployment plan that underlies the process innovation implementation initiative under review. The range between the two limits of readiness levels is referred to as the process innovation deployment readiness band.

3. Research Methodology

The study employed a descriptive research design to determine the empirical evidence about deployment readiness band in manufacturing. A questionnaire survey approach was used. The questionnaire was designed to gather data from professional manufacturing managers working in UK that have at least one-year experience implementing process innovation in manufacturing organization(s).

A list of companies was obtained from various sources such as via internet research and LinkedIn, but primarily from FAME database. The list comprised of seven hundred managers in the manufacturing sector of UK. The seven hundred manufacturing companies were selected randomly to construct the sample. The selection covers manufacturing companies from different manufacturing sectors. From the 700-survey distributed, 101 manufacturing managers useful responses were obtained, one participant only from one company. Due to the system used for collecting data (Online Bristol Survey) the system automatically did not accept any incomplete responses. Consequently, the 101 usable responses from a population of 700 companies represents an overall response rate of 14.4%.

The research team developed the questionnaire based on constructs supported by the literature This paper is part of a larger survey on manufacturing process innovation deployment. In this paper, the question of specific interest from the questionnaire asked a) whether the respondent's organisation regularly innovate their manufacturing processes b) whether the respondent's organisation needs to innovate in order to survive, and c) what level of confidence regarding implementation success will the respondent's organisation normally require in order to proceed with implementing process innovation. A 7-point Likert scale, with the responses ranging from 1 (Strongly disagree) to 7 (Strongly agree) was adopted for the first two questions and 1 (Low - <40%) to 7 (High – >95%) is used for the last question, i.e. Item (c) above, in gathering data from respondents. The survey was granted ethics approval by University of Hertfordshire Science and Technology Ethics Committee.

4. Result and Discussion

The respondent's companies are distributed across small to very large. The distribution is shown in Figure 1. As seen in Figure 1, the dominant profile of respondents belongs to the small and medium size enterprises (SME'S) which accounted for about 60% of the total distribution.

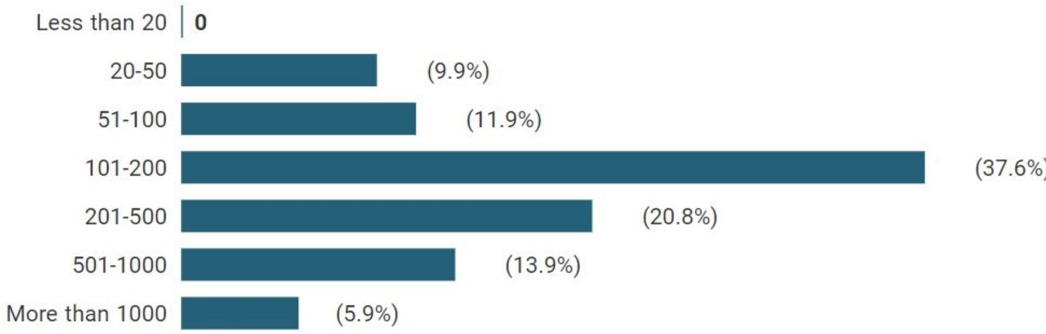

Figure 1: Distribution of the Respondent's Company Size (No of Employees)

A descriptive statistic of the participants years of experience is shown in Figure 2. It is observed that over 39.6% of the respondents have been engaged in the industry for a period of 5 years and above. 28.7% of the respondent have been engaged in the industry for a period of 4 to 5 years, while 31.7% respondent confirmed to have been engaged in the industry for a period of 1 to 3years.This result shows that a large percentage of the respondents have the necessary experience needed for the study.

Figure 2: Years of Experience.

Two questions were asked as follows: a) do your company need to innovate to survive? and b) Do your company regularly innovate its manufacturing process? The result is shown in Figures 3 and 4.
It is acknowledged that innovation is essential of the survival of an organization. As Figure 3 shows, the distribution of the respondents, regarding the question of whether the respondent's company needs to innovate in order to survive is not surprising. This result shows that most of the respondents were familiar with, and understand, the importance of innovation as key criterion of any company to survive; a cumulative of (23.8%, 26.7%, 26.7%) 77.2% agreed. Overall, the results show most of the companies agreed they need to innovate. This suggests that the respondent's companies recognise the need to engage in process innovation.
Although most of the participants in the study have acknowledged the need to innovate as shown in Figure 3, the result in Figure 4 shows that about 60% of the participant's companies regularly innovate their manufacturing process. Whilst the respondents understood the need to encourage and provide resources needed for innovation, this does not appear to always translate to actions regarding regular implementation of innovation initiatives. It also gives credence to the fact that innovation is an evolving process in most organisations and that it can be a catalyst for improved performance and a source for sustainable competitive advantage. For example, innovation has been suggested as one of the most effective strategic options available to the firm in dealing with environmental issues that affect business performance (see Ordanini et al., 2014; Eisingerich et al., 2009; Darroch and McNaughton, 2002; Li and Atuahene-Gima, 2001).

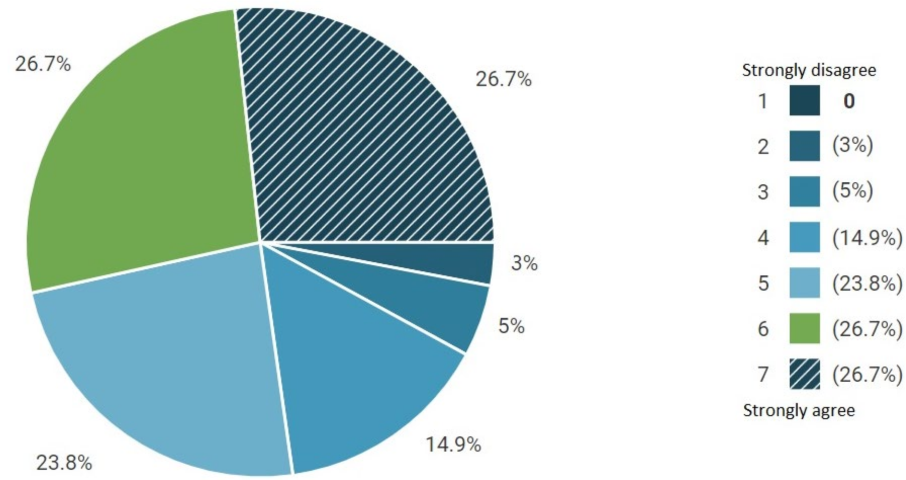

Figure 3: Our organisation needs to innovate in order to survive

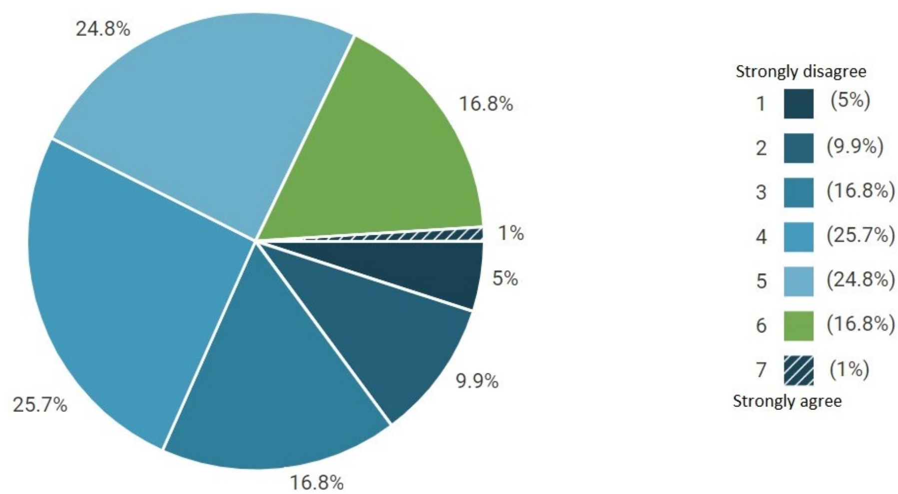

Figure 4: We regularly innovate our manufacturing processes

Figure 5 shows the respondents answers to the questions relating to readiness band. The question was meant to ascertain to what degree of readiness would they require before deploying their process innovation initiatives. The result shows that majority of the manufacturing managers agree that they need readiness to deploy innovation; over 60% of the managers stated that they need more than 70% readiness to deploy their innovation initiatives. Also, 1% believed that they need to be over 95% ready. Whilst the 95% appears to be an exceptionally high standard to attain, most appear satisfied with a readiness band of 70%-80%. None of the respondents reported a readiness band of 40% and below. The implication of this result is that although most managers do recognise the importance of readiness, some factors may affect their acceptable level of readiness to proceed with deployment. For instance, deployment readiness plan may be revised to include a substantial risk plan particularly in states where deployment readiness is relatively low (Javahernia & Sunmola, 2017). There is also an option of pilot deployment and using the pilot to enhance their readiness, sometimes beyond the original threshold readiness band.

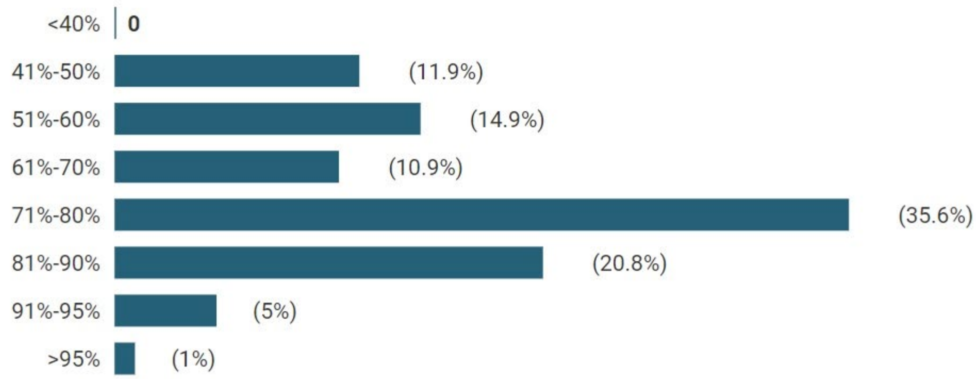

Figure 5: Distribution of Process Innovation Deployment Readiness Bands

The risk of exposure and the climate for innovation that a company might be experiencing when deploying readiness could play a role in the managers thinking about their readiness band. Figure 6 shows a hypothesised grid of deployment performance vs acceptable readiness bands. It can be inferred from the grid the resulting quadrants of optimistic, pessimistic, and realistic viewpoints. The grid can help map out the various directions a company may follow depending on how they view and balance their deployment performance exposure risk in relation to their acceptable deployment band. This reinforces the importance for a company to establish their process innovation deployment readiness band and to explore the deployment performance explore risk associated with their choice of deployment readiness band.

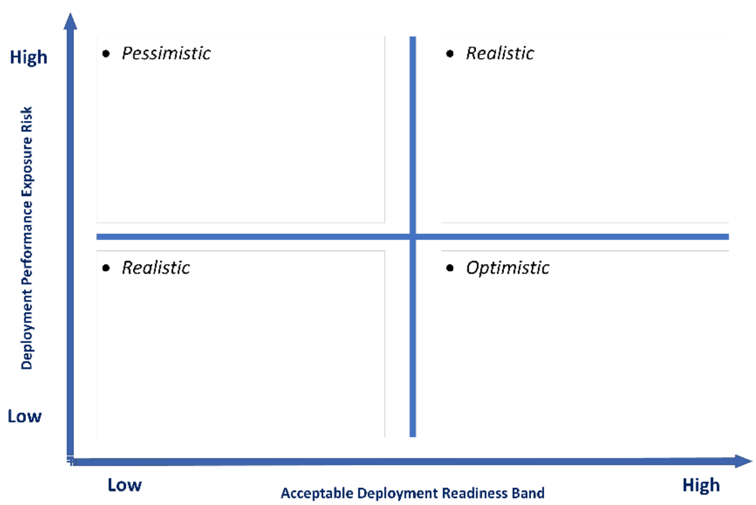

Figure 6:An Hypothesised Deployment Performance Exposure Risk vs Readiness Band Grid

5. Conclusions and Future Work

Process innovation is an important to enterprises as it could help in enhancing productivity and gaining competitive advantage. To benefit from a process innovation initiative, it is necessary for that the implementation of the initiative is successful. This generally requires an appropriate level of deployment readiness level is attained prior to the start of the implementation. It is reported in this paper that for manufacturing process innovation the typical readiness band is 71 – 80%. This finding is from a survey of a sample of manufacturing managers in UK. It is noted in this paper that manufacturing companies should find an appropriate balance their deployment performance exposure risk in relation to their acceptable deployment band. This is an exploratory study and the findings are not generalisable due to the limitations of the study. A limitation of the sample size, more participants will be required to obtain a generalisable distribution. In addition, the focus in this paper is on UK manufacturing, an international study may be a direction for future work.

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Alireza Javahernia is currently a Lecturer in Operations and Business Management at University of Chichester. Prior to joining University of Chichester, he was a visiting lecturer at the University of Hertfordshire, and he is in the final stages of completing his PhD in the School of Engineering and Computer Science, University of Hertfordshire UK. He specialises in Manufacturing Management and Industrial Engineering. He has over 10 years' experience in manufacturing and service industry.

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