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Influencing Factors of Employee Readiness to Adopt Advanced Manufacturing Technology (AMT) on Apparel Shop Floor in Sri Lanka

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ABSTRACT

Compared with other manufacturing industries, apparel manufacturing can be classified as the most labor-intensive industry, which needs a man behind every machine. The use of advanced manufacturing technologies in the apparel shop floor is far behind compared to other industries. The researcher believes that one reason could be the lack of readiness of employees to adopt new technologies. This paper aims to provide empirical evidence on the influencing factors on employee readiness to adopt advanced manufacturing technology on the apparel shop floor, aiming for the Sri Lankan apparel industry. Following a critical review of literature, five factors, perceived usefulness, attitude, perceived ease of use, perceived management support, and techno-optimism, were tested with the data collected through a quantitative survey conducted among 118 employees using a questionnaire. The results revealed that all five factors correlate with employee readiness in various degrees. Findings suggest that apparel organisations may need to improve employee readiness before adopting advanced technologies on the shop floor to bring more success in technology adoption. The literature addressing technology adoption in apparel shop floor is scarce, and this study contributes to that gap. Further research is recommended to contribute to knowledge and find solutions to enhance technological capabilities to bring a competitive advantage to the apparel industry.

KEYWORDS: *Advanced manufacturing technology, change readiness, factors affecting employee readiness, technology readiness, apparel shop floor technology, apparel smart factory*

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INTRODUCTION

Developing countries have gained a significant market share in apparel exports during the past three decades. As per the International Labour Organisation, this amounts to almost three-quarters of the world apparel needs (Anon 2005). As per the Export Development Board of Sri Lanka (EDB 2020) sources, the apparel industry's contribution to the Sri Lankan economy is 40% of the total annual export revenue. Also, it provides a 50% share of the total industrial export revenue, which has been growing over the past three decades.

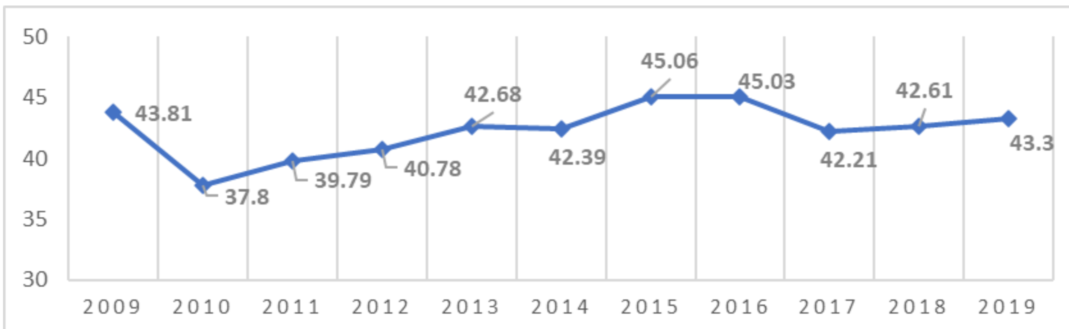

Figure 1. Contribution % of Total Export Revenue
Source: Internal Source EDB Data (EDB 2020)

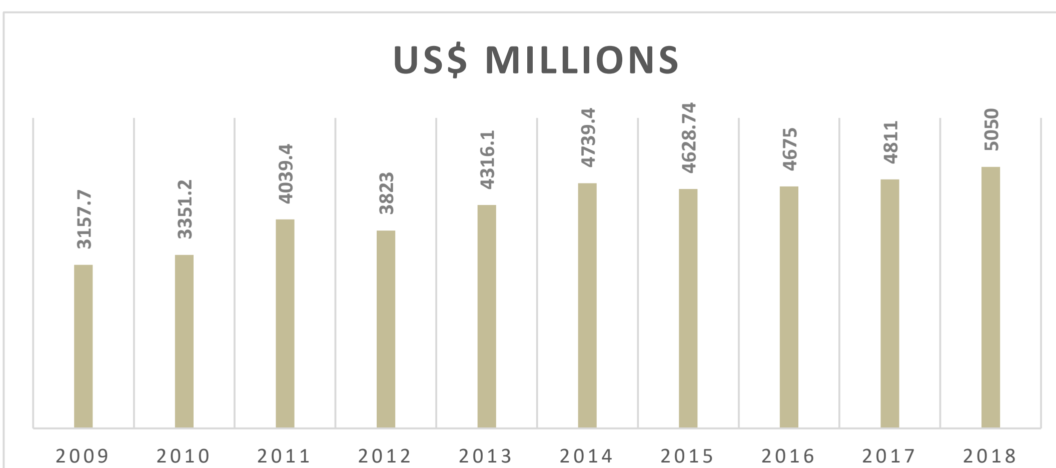

Figure 2. Annual Revenue of Apparel Industry 2009 to 2018 in US$ millions
Source: Internal Sources JAAFSL Data (JAAFSL 2020)

The apparel industry brings foreign exchange and creates 300,000 direct and 600,00 indirect employment opportunities contributing immensely to Sri Lanka's job market (Wijendra 2014; Ranjith & Widner 2011).

Challenges in Brief

After removing the MultiFibre Agreement (MFA) in 2005, the industry became highly competitive and challenging. After the quota removal, countries like China, India, and Bangladesh took advantage of skilled labour, raw material resources, and low-cost production (Haber 2004; Latha *et al*. 2015). The Sri Lankan apparel industry's biggest challenge is high manufacturing costs compared to the other neighbouring countries. High cost imposes immense pressure on business continuity, and making profits has become highly challenging.

Out of overall manufacturing cost, approximately around 15%-20% incurred from labour (Kelegama & Epaarachchi 2004; Dheerasinghe 2009). The apparel industry is still highly labour intensive and probably the largest single industry with a man behind every machine. Varukolu & Park-Poaps (2009) highlights that the apparel industry has a substantial amount of manual and production-oriented processes. Therefore, maintaining high-performance levels to bring the cost down should be a key strategy and focus on becoming competitive.

There is inevitably an intense pressure to increase productivity, high quality, speed (Ungan 2005; Premkumar *et al*. 1997), agility, compliance and ethical standards to reduce overall cost and be more competitive and profitable.

Use of Technology for Productivity Increase

Since the end of the 20th century, we witness the explosive growth of digital technologies revolutionising human society and the world. Like other areas, technology impact on the economies is enormous. Snow, Øystein, & Arthur (2017) describes that the global economy is being transformed by digital technology. Also, the CA Magazine explains how the industrial economy is being transformed into a digital economy (Negroponte 1995).

Advanced Manufacturing Technology (AMT)

Due to the advancement of information technology, the AMT domain covers soft and complex technologies and refers fundamentally to the technologies being used in industrial manufacturing (Kumar *et al*. 2018). AMTs are broken into three main categories by Boyer & Pagell (2000) design, administrative, and manufacturing.

In this dynamic and multi-dimensional competitive environment, AMT enables the strategic capability for the organisation to operate at high levels of performance (Zhang *et al*. 2006). It can be used as a strategic weapon (Singh *et al*. 2007) for critical long-term success (Boyle 2006; Welch & Nayak 1992; Hayes *et al*. 1989). To bring competitiveness, AMT can operate in two ways (Singh *et al*. 2007). Firstly, by creating more efficient and agile processes which can alter the cost structure. Secondly, it can bring in capabilities to enhance product design, quality, service, and lead time (Vinas *et al*. 2001).

Ample evidence can be found through many empirical studies to show that AMT has a high capability to provide a vast range of tangible and intangible benefits to an organisation. A few factors include cost, inventory, product quality, and flexibility (Kumar *et al*. 2018; Singh *et al*. 2007; Calantone *et al*. 2012).

With the increased pressure of high labour cost, apparel manufacturers are forced to adopt digital technologies as one of their main strategies to increase productivity while maintaining the quality in high volumes, in a shorter cycle time, and at low cost (Ranjith & Widner 2011; Haber 2004).

Research Problem and Questions

Abeyrathna *et al*. (2015), in their research, Technology Adaptation of Apparel Industry in Sri Lanka: An Observational Survey, discuss at length the factors and issues of technology adoption by apparel manufactures in Sri Lanka using three significant apparel manufacturing groups. Abeyrathna *et al*. (2015) explain, though the strategic initiative, Management drive and capital is there, yet the technology adoption rates are meagre. As a practitioner in the field, this researcher also testifies to Abeyrathna *et al*. (2015) findings. The findings raise a question though the organisations are ready, whether the employees are ready to adopt advanced technologies, and what factors influence their readiness to technology adoption, which is the research problem of this study.

To the best of the researcher's knowledge, no empirical study has been conducted to explore the employee readiness to embrace advanced manufacturing technology on the apparel shop floor. Therefore, the present study identifies factors that influence employee readiness for AMT adoption on the apparel shop floor. Secondly, the study attempts to understand the relationship between identified factors and employee readiness for successful adoption of AMT on the apparel shop floor. Following research, questions are formed.

1. What are the factors that influence employee readiness to adopt AMT on the apparel shop floor?
2. What is the relationship between identified factors and employee readiness for successful adoption of AMT on the apparel shop floor?

LITERATURE REVIEW

Defining Employee Readiness

Lewin (1947) explains readiness as the first stage of the change cycle, but Backer (1995) argues readiness is not just resistance to change, and it is not equal to resistance reduction. Various definitions can be found in the literature for readiness to change. Many researchers define readiness to change as positive viewpoints of the employees towards organisational change, which is change acceptance, and beliefs in the impact of the change on them and the organisation (Armenakis *et al*. 1993; Miller *et al*. 1994; Holt 2002; Jones *et al*. 2005; Riddell & Røisland 2017). According to Rafferty & Simons (2001), in a change initiative of an organisation, readiness is a predecessor to a person's behaviour.

Some other authors defined readiness for change as the degree of preparation (Huy 1999), state of an individual (Madsen *et al*. 2006), and degree of involvement, motivation and technical capability (Holt & Vardaman 2013) of executing an organisational change. Parasuraman (2000) defines technology readiness as the inclined nature to use and adopt new technology to achieve personal and work-life goals.

As we observe in much of the literature, it is evident that readiness is not the availability of resources but a cognitive concept (Backer 1995), which involves beliefs and perceptions of the proposed change. Therefore, as Riddell & Røisland (2017) describes, readiness consists of several factors, including individual intent, beliefs, attitudes, processes, context, outcomes, and stakeholders of the intended change.

However, individual cognitions are not the only factors for readiness to change (Backer 1995). There are technological, social, and other organisational factors that influence readiness to change (Riddell & Røisland 2017).

Change Management Theoretical Aspect of Readiness for Adoption

AMT involves technology adoption by employees, for which they must go through specific changes in their behaviour. Technology adoption has been widely studied as an essential subcategory of change management. Riddell & Røisland (2017), in their Master's theses, mention that Readiness is novel in the change management domain and literature.

Change awareness within the organisation and 'unfreeze' to make the employees ready for the intended change is often mentioned as change readiness (Riddell & Røisland 2017; Armenakis & Bedeian 1999).

Researchers have developed other models using Lewin's three-step model despite many criticisms, but the core is Lewin's model (Riddell & Røisland 2017; Bakari 2017). The table below compares Schein (2010) and Armenakis & Bedeian (1999) models with Lewin's three-step model.

Table 1. Comparison of Three-Step Models
Source: Developed by the Researcher

Lewin (1947)	Armenakis & Bedeian (1999)	Schein (2010)
Unfreeze	Readiness	Disconfirmation cognitive
Change	Adoption	Restructuring
Refreeze	Institutionalisation	Internalising new concepts

In all the above models, change readiness directly links to the first step of Lewin's (1947) model, which is 'unfreeze' (Madsen *et al*. 2006). To enhance employee readiness to embrace change, or in other words, to unfreeze the current state to make change initiative successful, is one of the critical challenges the change agents have to go through (Drzensky *et al*. 2012). Readiness, in other words unfreezing, requires employees to break their beliefs in the current status quo and create a vision and enhance the self-efficacy that the future state will be beneficial and have long term effects (Armenakis *et al*. 1993). Bakari (2017) discusses three constructs related to readiness in his study, behavioural belief, normative beliefs and control belief which are considered in the current study.

According to Cusick (2018), Kotter's first four steps create urgency, form a powerful coalition, create a vision for change, and communicate the vision covering Lewin's first phase, change readiness.

The sense of urgency and the need must be communicated to the employees clearly to understand that the threat of failure and change is inevitable. This urgency will create positive attitudes and beliefs and increase the employee's readiness for the desired state of change.

Forming a powerful group to lead the change is a key task (Kotter 1996; Pollack & Pollack 2014). Pollack & Pollack (2014) describe three groups: change leaders, the executive management coalition, the General Management Advisory Group coalition, and the technical level coalition. Though it is often difficult to identify isolated factors for successful change initiatives (Van der Meer 1999), it is proven the importance of the program sponsors role (Helm 2005) in complex change initiatives which is crucial (Remington 2001). This substantial coalition increases perceived collective efficacy and organisation membership readiness towards the change initiative.

The readiness level to accept the change will increase based on the intensity and clarity of employees' long-term personal benefits due to the successful change and the perceived outcome. Porras & Robertson (1992) explains that perceived outcome has a link with the change vision.

Many researchers highlight the importance of communicating the vision for employee readiness for change (Schweiger & Denisi 1991; Miller *et al*. 1994; Wanberg & Banas 2000). However, managers do not understand the importance and seriousness of consistent and continuous communication required for a successful change initiative (Pollack & Pollack 2014). It is vital to repeatedly communicate the message in different channels to attract the employees' hearts and minds (Backer, 1995). The effectiveness of this communication results in the employee wanting to change and the desire to make it happen soon (Jung 1966), which enhances the positive attitudes towards the anticipated change (Armenakis *et al*. 1993; Lines 2016).

Lewin's and Kotter's models mainly focus on the change initiative's process and execution, giving less emphasis on the individual experience (Galli 2018). Hiatt’s ADKAR Model (Hiatt 2013) emphasises the employees and how they experience the change but have limitations in the process and execution of significant change initiatives (Galli 2018). ADKAR model discusses five goals.

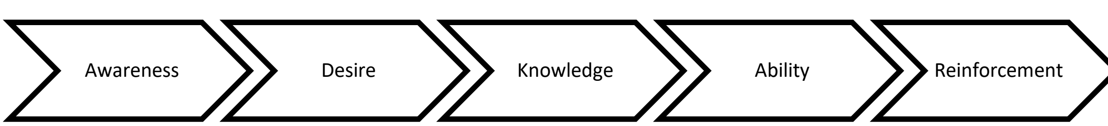

Figure 3. ADKAR Change Goals
Source: Developed by the Researcher

Like Lewin's first phase, 'unfreeze', and Kotter's first four phases of readiness, Awareness and Desire goals in the ADKAR model discuss employee readiness for the desired change. Awareness is announcing the change initiative to employees and project teams. The challenge is understanding the depth and level of change required (Galli 2018). Galli (2018) explains that the desire is essential for the employees to have positive attitudes and support change actions.

Theories and Models of Technology Adoption and Readiness

Rogers did not precisely examine human choice behaviour when introducing the Innovation Diffusion theory half a century ago (Sun 2016). Rogers (2003) explained, when an individual or group of individuals perceived an idea or practice as new even though it was invented a long time ago, it is an innovation (Dearing 2009). Communicating the innovation between the social group's members through clear channels is called Diffusion (Dearing 2009). Innovation adoption and attributes are critical concepts in this theory that are important for this research study.

There are five stages in the innovation-decision process. The employee needs to increase motivation to reduce the uncertainty of benefits and disadvantages of the desired change (Dearing 2009).

The process starts with the knowledge phase, where employees start to gain an understanding of the innovation, asking questions 'What?', 'How?', and 'Why?'. Rogers (2003) categorised this knowledge into three: awareness, how, and principle knowledge. Understanding the existence of the innovation, which is awareness, will help motivate the employee and gain knowledge on other two aspects, which eventually leads to the adoption of the change (Dearing 2009). 'How' and 'principle' knowledge explains how to use the technology and why the innovation works. These two types of knowledge enhance the employee's readiness to adopt new technology (Spotts 1999), as it increased ease of use, which eventually increased perceived self-efficacy (Bandura 2001). Rogers (2003) says that influencing technology adoption will be more effective if the employee gains more understanding in the knowledge stage.

Rogers (2003) explains the innovation-diffusion process as reducing uncertainty and proposing five attributes to support this. He further explains that these attributes are crucial to predict an individual's favourable adoption rate (Dearing 2009). The individual perceived value given to each of these behaviours will decide the readiness of the employee to adopt specific technology (Dearing 2009).

The first attribute, 'relative advantage,' explains the employee's perception that the specific innovation is superior to any other (Rogers 2003), which refers to perceived usefulness. Second attribute compatibility, although conceptually different from the first one, is similar to it. These attributes refer to how much the innovation is perceived as valuable and compatible with the experience, current values, and needs of the innovation adaptors (Dearing 2009). Adaptors needs will negatively result in innovation usage if the innovation is not compatible. Complexity is the third attribute, which refers to the degree of the perceived difficulty of understanding and using the innovation. Complexity can be referred to as user-friendliness or perceived ease of use of the technology. Rogers (2003) says, this can negatively impact the readiness and adoption of innovation. The degree of the experiment can be done if innovation is referred to as 'triability' by Rogers (2003), which is the fourth attribute and has a positive correlation to adoption, where the adoption is faster if the innovation is experienced more times which leads to the self-efficacy of employees (Rogers 2003). The final and the fifth attribute is observability and refers to the extent of the outcome seen by others. Peer observation is a key for the adoption, which positively correlates to the rate of adoption. Successful implementation of technology will continuously motivate others and increase collective efficacy.

Task Technology Fit (TTF) theory is extensively used (Goodhue & Thompson 1995) to measure the performance and impacts of system usage. To increase performance and make a positive impact on a given task, the technology must be fit for the task (Lu 2014). The theory explains a positive correlation between technology utilization and technology fit, influenced by task and technology characteristics (Lu 2014).

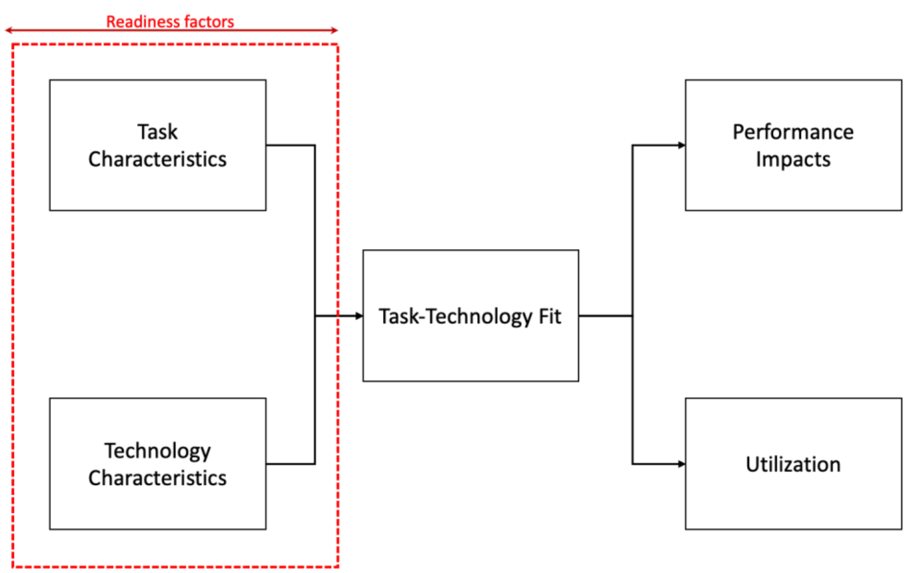

Figure 4. Readiness factors in TTF Model
Source: Adopted from Goodhue & Thompson (1995)

For this study, the crucial fragments of this model are task and technology characteristics. Task characteristics refer to the degree of technology fit to a specific task attributed to perceived usefulness. Technology characteristics can be attributed to perceived ease of use, and past research has confirmed the same (Mathieson & Keil 1998).

Venkatesh and Davis, after further research, found that both perceived usefulness and ease of use have a direct influence on the behavioural commitment of the actual use of the new technology (Lai 2017). They came up with their final model of TAM in 1996, eliminating attitude towards use concept (Venkatesh & Davis 1996).

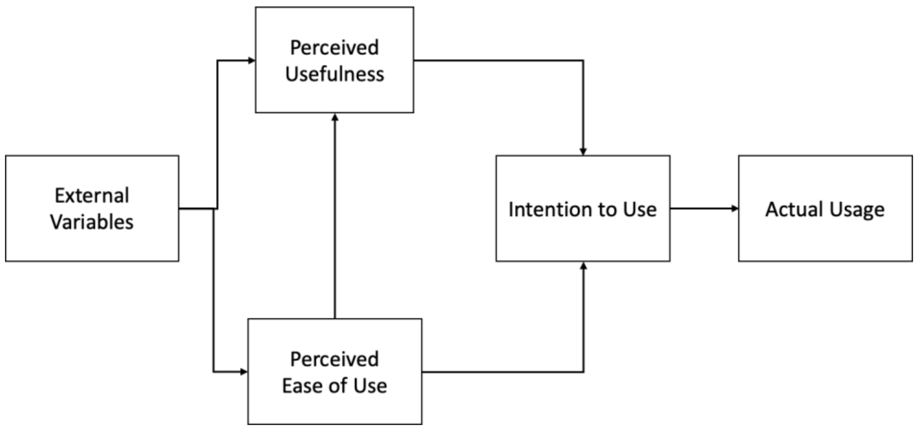

Figure 5. Final TAM (Lai, 2017)
Source: Adopted from Lai (2017)

Perceived usefulness is defined as the belief that the new technology can improve performance, and the belief that using specific technology involves less effort (Lai 2017).

By integrating various elements of eight prominent theories and models, Venkatesh, Morris, Davis and Davis (2003) developed UTAUT (Anderson & Schwager 2004; Im *et al*. 2011; Williams *et al*. 2015; Lai 2017). UTAUT model proposes four key concepts, performance expectancy, effort expectancy, social influence, and facilitating conditions which have been considered in this study (Im *et al*. 2011; Williams *et al*. 2015; Lai 2017).

Jamaludin & Mahmud (2011) describe performance expectancy as the level of trust one individual has in the new technologies ability to enhance their performance. They further explain that the constructs of performance expectancy are motivation, perceived usefulness, relative advantage and expectancy of the outcome (Jamaludin & Mahmud 2011).

Effort expectancy is the degree of convenience to use the system, which means perceived ease of use. It positively correlates with adopting and using new technology (Jamaludin & Mahmud 2011). Social influence influences how others believe that the specific technology is useful (Bozan *et al*. 2016; Kijsanayotin *et al*. 2009). An individual perceives the availability of infrastructure and technical support to adopt new technology, defined as facilitating conditions (Yang & Forney 2013).

Behavioural Science Theoretical Aspect for Readiness

The essence of the TRA theory is that an individual's behaviour is determined by behavioural intention. Attitude towards the behaviour (e.g., Smartphone is easy to use) and subjective norm (e.g., Other colleagues are using a smartphone and it is a status) influence an individual's behavioural intention.

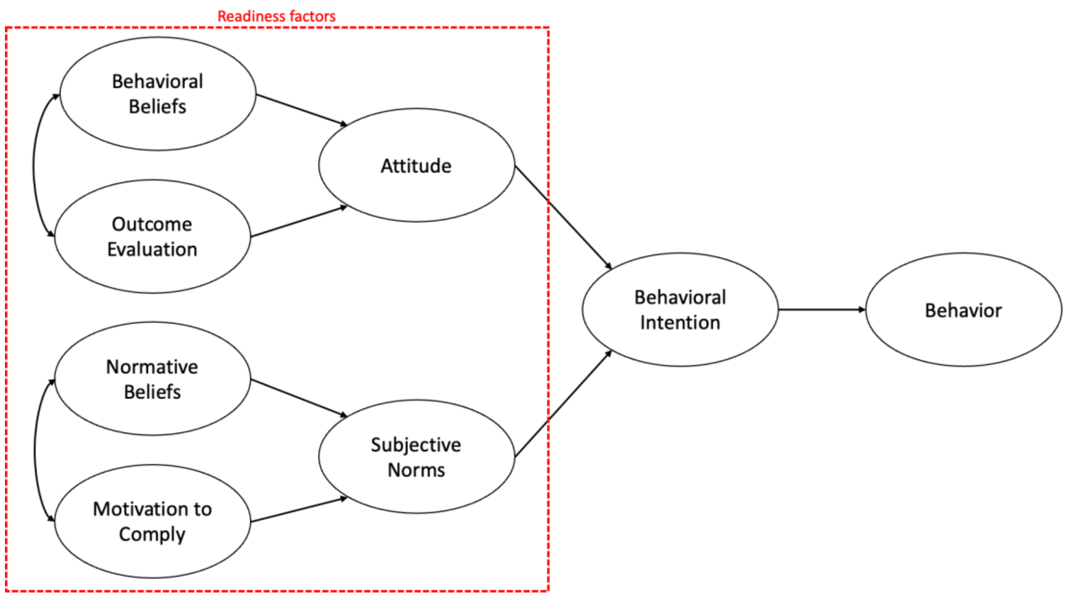

Figure 6. TRA and Readiness Factors
Source: Adopted from Lai (2017)

Positive and negative feelings that are linked with behavioural performance are defined as behavioural beliefs influencing attitude. These are internal factors of an individual. Normative beliefs mean the support or displeasure of the behaviour by other people. Nature to perform what other people expect is referred to as motivation to comply (Montaño & Kasprzyk 2008). These factors are related to the social and cultural aspects of an individual.

Theory of Planned Behaviour (TPB) is an extension of TRA (Ajzen 1991), shown in Figure 07 below.

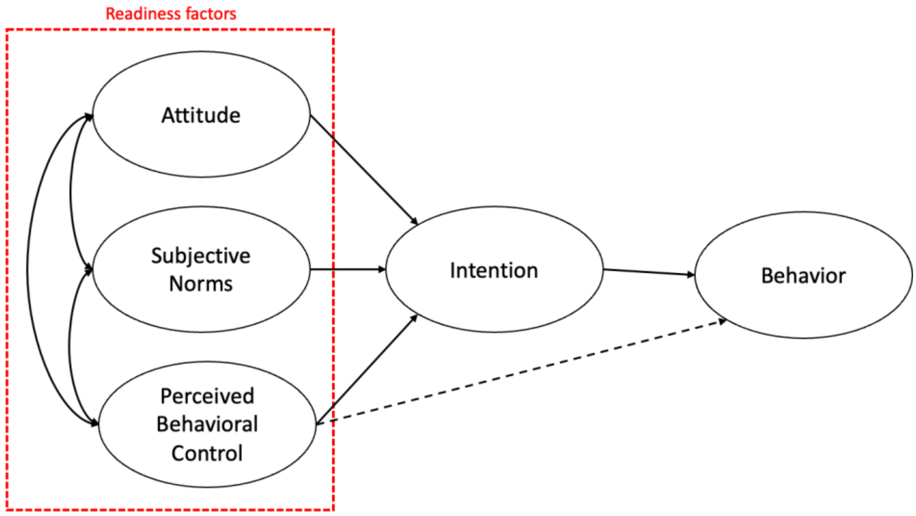

Figure 7. TPB and Readiness Factors
Source: Adopted from Lai (2017)

TPB is created by adding perceived behavioural control to TRA, which is defined as the individual perception of limiting their behaviour. Other factors are like TRA first two factors.

The theory of Self-Efficacy is another popular theory to explore. Self-efficacy is defined as the degree of an individual's finding based on his/her belief of his/her ability to reach specific goals in a given situation (Bandura 1982). It can influence the technology usage of a person (Hsia 2014). Affective state, verbal persuasion, are mastery experience, various experiences are the four primary foundations of self-efficacy. The state of an individual's psychology and effective state directly affects self-efficacy. An enjoyable state will have a positive impact, but an unhappy state will affect it negatively.

The core context of Social Cognitive Theory (SCT) explains that learning happens through mutual interaction between individual, environment, and behaviour (Bandura 1986). To understand the technology adoption process, SCT is vital. Two concepts displaying related to production and support to the motivational process is extremely helpful in understanding technology adoption. (Bandura 2001; Straub 2009).

Straub (2009) explains that an individual observing others using specific technology successfully will influence himself/herself to successful adoption of it (Straub 2009). The probability of an individual's interest in sustaining an action can be defined as a concept of reinforcement (Straub 2009), and it focuses on the importance of Management and organisational support in technology adoption.

Technology Readiness Empirical Research

In two studies done by Walczuch *et al.* (2007) and Son & Han (2011), four constructs impacting technology readiness optimism, innovativeness, discomfort, and insecurity were discussed.

Optimism is a belief that specific technology can help to improve the efficiency, control, and flexibility of an individual (Parasuraman 2000). Optimistic individuals tend to see positive aspects and openly deal with new technology (Walczuch *et al*. 2007).

The individual's tendency to use technology is defined as innovativeness (Parasuraman 2000), and such individuals demonstrate high comfort levels and need little convincing related to the outcome of technology adoption. Prior research has reported a positive correlation of innovativeness towards readiness of technology adoption.

Insecurity is defined as the lack of trust related to privacy and security reasons (Parasuraman 2000). Such individuals tend to have negative feedback on the technology (Son & Han 2011). The general tendency of fear (Mukherjee & Hoyer 2001) and the perception of lack of control (Parasuraman 2000) can bring discomfort in adopting specific technology.

Walczuch *et al*. (2007) concludes that optimism has a solid relationship to perceived usefulness (PU) and perceived ease of use (PEOU) which in turn has an impact on readiness for technology adoption as per TAM. He further explains that innovativeness and discomfort negatively impact PU and PEOU. In addition to PEOU, PU, subjective norms, and perceived behavioural control, Sun *et al*. (2009) tested the relationship of perceived work compatibility to readiness for technology adoption. Work compatibility is not related to this study as it defines the organisational fit of selected technology but not the personal fit.

The influencing factors in adopting new technology vary as experience (Venkatesh & Davis 2000). In their research on 3D technology readiness, Chatzoglou & Michailidou (2009) highlights some of the key constructs to adopt AMT. They further explained that high experience levels improve the degree of ease of use than lower experience levels. Therefore, it is often assumed that experience level positively affects an individual's readiness for technology use (Thompson *et al*. 1991).

The job relevance of the adopted technology is essential for an individual's perceived usefulness (Thompson *et al*. 1991), which has a moderate effect (Chatzoglou & Michailidou 2009). The degree to which an individual perceived that the technology helps him/her to carry out the job well and efficiently is called output quality (Venkatesh & Bala 2008), which has a strong positive relationship to perceived usefulness (Compeau *et al*. 1999).

In addition to the above, Chatzoglou & Michailidou (2009) have considered behavioural constructs like other literature attitudes, PEOU, and PU. Chen *et al*. (2009) and Chen *et al*. (2013), in their research, has also considered these constructs.

Employee readiness falls into the organisational context. Many authors have discussed HR preparation, cultural adjustments, and change management in the subject of the organisation (Khazanchi *et al*. 2007; Waldeck & Leffakis 2007).

Darbanhosseiniamirkhiz & Wan Ismail (2012), in their journal Advanced Manufacturing Technology Adoption in SMEs: an Integrative Model, highlights three critical areas of AMT adoption, environmental context, organisational context, and technological context.

He further explains that employee support is very much essential for the successful adoption of AMT. To reach desired goals, preparing employees before starting the implementation process is essential (Darbanhosseiniamirkhiz & Wan Ismail 2012) to enhance their readiness. Moreover, skills that come with experience, knowledge which comes through IT literacy, and attitudes are the key factors to make them ready for the adoption of advanced technology (Darbanhosseiniamirkhiz & Wan Ismail 2012).

Darbanhosseiniamirkhiz & Wan Ismail (2012) stressed that management support is a significant factor for AMT adoption. Towards the adoption of AMT, management motivation, enthusiasm, and employee encouragement are crucial (Ramdani *et al*. 2009; Al-Qirim 2007). According to (Jayaraj *et al*. 2006), one of the best predictors of the success of AMT adoption is management commitment and support.

Al-Ajam & Ali (2015), in their study, focuses on the constructs of the theory of reasoned action and its implications towards adoption of internet banking services in Yeman and validates the influence of attitudes and subjective norms towards technology adoption.

RESEARCH METHODOLOGY

Through literature review mapping, five independent variables were identified. Perceived usefulness (PU), attitude towards technology (ATT), perceived ease of use (PEOU), perceived management support (PMS), and Techno-Optimism (TOP) were derived as independent variables, where advance manufacturing technology readiness has been identified as the dependent variable.

Table 2. Literature Review Mapping of Readiness Determinants

Source: Developed by the Researcher

Author(s)	**TRI Variables**													
	Perceived usefulness (PU)	Attitude towards technology (ATT)	Perceived ease of use (PEOU)	Perceived management support (PMS)	Techno-Optimism (TOP)	Perceived collective efficacy (PCE)	Self efficacy (SE)	Innovativeness (INO)	IT Literacy (ITL)	Social interaction (SI)	Experience (EXP)	Infrastucture and support (IAS)	Personal qualities (PQ)	Job relevenece (JR)
Change Management theories														
Lewin's Three Step (Bakari, 2017)	X	X		X										
Kotter's Eight Steps (Baloh, et al., 2018)	X	X		X		X								
ADKAR (Hiatt, 2013)	X	X												
Technology Adoption Theories														
DIT (Sun, 2016)	X	X	X	X		X			X	X				
TTF (Goodhue & Thompson, 1995)	X		X											
TAM (Lai, 2017)	X		X											
UTAUT (Venkatesh, et al., 2003)	X	X	X							X		X		
Social Science Theories														
TRA (Lai, 2017)	X	X		X										
TPB (Lai, 2017)	X	X				X	X			X				
Self-Efficacy Theory (Hsia,2014)				X			X		X				X	
Social Cognitive Theory (Bandura,1986)		X		X			X		X					
Emperical Researches														
Walczuch, et al. (2007)	X		X		X			X						
Sun, et al. (2009)	X	X	X											
Chatzoglou & Michailidou (2009)	X	X	X								X			X
Chen, et al. (2009)	X	X	X		X	X		X						
Son & Han (2011)	X		X		X			X						
Darbanhosseiniamirkhiz & Wan Ismail (2012)		X		X					X		X			
Chen, et al. (2013)	X		X											
Hsia (2014)	X		X				X							
Al-Ajam & Ali (2015)	X	X												
Csuka, et al. (2019)		X	X		X									
Blut & Wang (2020)	X	X	X		X			X						
Total	**18**	**15**	**13**	**7**	**5**	**4**	**4**	**4**	**4**	**3**	**2**	**1**	**1**	**1**

Conceptual Model and Hypothesis Development

Following conceptual model was used to develop hypotheses, to be tested through data collection and statistical analysis.

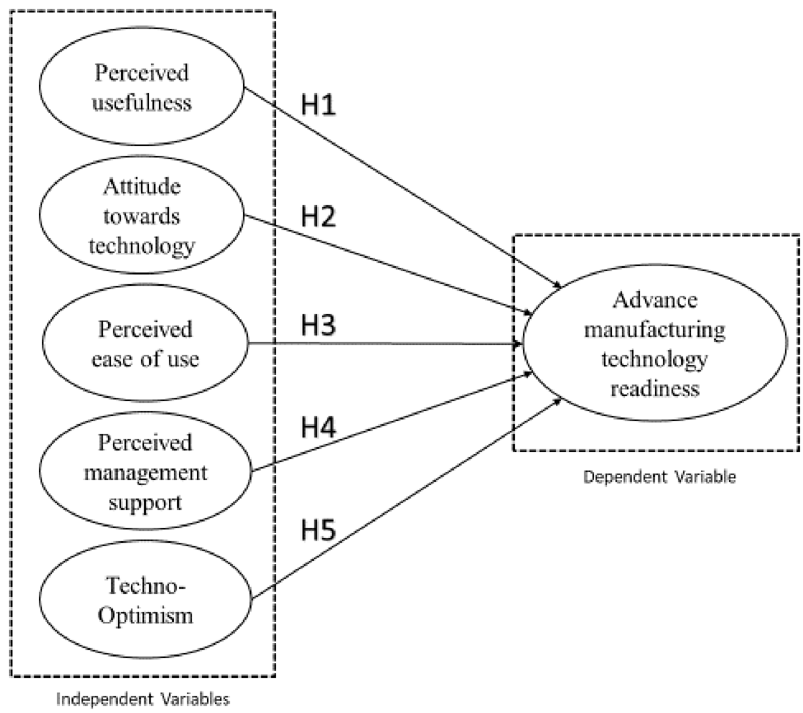

Figure 8. Conceptual Framework of the Research
Source: Developed by the researcher

Five hypotheses are constructed in line with the conceptual model.

H1: Perceived usefulness influences AMT readiness.
H2: Attitude towards technology influences AMT readiness.
H3: Perceived ease of use influences AMT readiness.
H4: Perceived management support influences AMT readiness.

H5: Techno-Optimism influences AMT readiness.

2.2 Operationalisation

Constructs are broken into measurable parts where they could be measured. These specific parts are used to operationalise and test defined hypotheses. The Likert scale is used as the measurement method, as it is well recommended for a respondent to indicate their feelings, opinions, and attitude about a particular problem better (Nemoto & Beglar 2014).

Table 3. Table of Research Operationalization
Source: Developed by the researcher

Variable	Construct	Measurement Indicator	Scale	Question Number
Independent Variable	Perceived usefulness (PU)	Individual efficiency and performance	Likert 1-5	Q5
		Effective time management	Likert 1-5	Q6
		Get attention and help	Likert 1-5	Q7
		Improve corporation	Likert 1-5	Q8
Independent Variable	Attitude towards technology (ATT)	Individual liking	Likert 1-5	Q9
		Overall factory efficiency	Likert 1-5	Q10
		Improve quality of the machine operator	Likert 1-5	Q11
		Effectiveness for the future	Likert 1-5	Q12
Independent Variable	Perceived ease of use (PEOU)	Easy to learn and understand	Likert 1-5	Q13
		Very less effort to adopt	Likert 1-5	Q14
		Minimum technical errors	Likert 1-5	Q15
		Easy to use and operate	Likert 1-5	Q16
Independent Variable	Perceived management support (PMS)	Senior management support	Likert 1-5	Q17
		Resource availability	Likert 1-5	Q18
		Adequate training	Likert 1-5	Q19
		Recognition and rewards	Likert 1-5	Q20
Independent Variable	Techno-Optimism (TOP)	Technology is essential in day to day life	Likert 1-5	Q21
		Technology makes work easy and efficient	Likert 1-5	Q22
		Technology provides more control	Likert 1-5	Q23
		Technology is easy to learn and adopt	Likert 1-5	Q24
Dependent Variable	Employee readiness for AMT adoption (AMTR)	Willingness to support new technology	Likert 1-5	Q25
		Desire to learn and adopt AMT	Likert 1-5	Q26
		Willingness to change current manual methods	Likert 1-5	Q27
		Openness to get trained	Likert 1-5	Q28

Sampling and Data Collection

This research is adopted the deductive method, and data was collected through a quantitative survey. An apparel company that has implemented advance manufacturing technology was selected for the survey. There were 258 machine operators actively involved in using the technology. Hence the population for this survey is taken as 258, i.e., *N = 258.*

Maximum likelihood requires a sufficient number of samples, and a smaller number could lead to failure or improper results (Hair, *et al*. 2010). In line with this condition proposed by Hair, Black, Babin, & Anderson (2010) and by using an online sample calculation tool (System 2012), the sample size was determined as 112, i.e., *n = 112* with a 95% confidence level and confidence interval at 7.

Since the population is small and in one geographic location, a simple random sampling method was used to reduce any bias involved. All 258 employees were given a serial number and generated a random number.

A questionnaire was prepared with two sections to collect primary data. The first section was to collect demographic data such as gender, age, education qualifications, and experience. The second section consists of 28 questions to measure independent and dependent variables as highlighted below.

Table 4. Questionnaire Structure
Source: Developed by the researcher

Section 1: Demographic Data	
Gender	Q1
Age	Q2
Education Qualifications	Q3
Experience	Q4
Section 2: Variable Data	
Perceived usefulness	Q5, Q6, Q7, Q8
Attitide towards technology	Q9, Q10, Q11, Q12
Perceived ease of use	Q13, Q14, Q15, Q16
Perceived management support	Q17, Q18, Q19, Q20
Techno-Optimism	Q21, Q22, Q23, Q24
Readiness for AMT adoption	Q25, Q26, Q27, Q28

The questionnaire was designed to complete within 10 to 15 minutes, consisted of close-ended questions with a Likert scale of 1 – 5. As the shopfloor employee's English proficiency was not up to the desired level, the questionnaire was translated into the Sinhala language. Hard copies of the questionnaire were distributed among 125 randomly selected employees and received 118 completed responses.

RESULTS & DISCUSSION

Data Reliability

A pilot data test was done with 20 samples to check the reliability of the questionnaire, and Cronbach's Alpha is 0.884, which represents 88% reliability.

Table 5. Pilot Data Cronbach’s Alpha

Cronbach's Alpha	Cronbach's Alpha Based on Standardised Items	N of Items
0.884	0.887	24

Cronbach's Alpha test was conducted on the 118 total samples collected. Given below are the test results of each independent and dependent variable.

Table 6. Total Sample Test Data Cronbach's Alpha

Variables	Questions	Cronbach's Alpha
Perceived usefulness (PU)	Q5, Q6, Q7, Q8	0.726
Attitude towards technology (ATT)	Q9, Q10, Q11, Q12	0.616
Perceived ease of use (PEOU)	Q13, Q14, Q15, Q16	0.854
Perceived management support (PMS)	Q17, Q18, Q19, Q20	0.771
Techno optimism (TO	Q21, Q22, Q23, Q24	0.843
Readiness for AMT adoption	Q25, Q26, Q27, Q28	0.899

The alpha value was 0.909 for all 24 questions, which means the data is 90% reliable for further analysis and investigation.

Demographic Profile of the Sample

Analysis shows that 80% of the respondents are female, representing the general understanding that most Sri Lankan apparel shop floor machine operators are female workers.

Only 4% of the employees are over 45+ years of age. One-fourth of the population is in the age group of 36-45 years. The majority of the employees fall into groups 18-25 years (36%) and 26-35 years (35%), which means around 71% of the employees of the population are young.

Almost half, 48% of the respondents, is between 1-5 years of experience, while one fourth (25%) is between 6-10 years, which indicates that 80% of the respondents are well experienced. There are only 20% of respondents below one year.

Correlation and Coefficient Analysis

Following scale from Saunders, Lewis, & Thornhill (2016) is used to find the relationship and strength of the relationship of the independent variable to dependent variable.

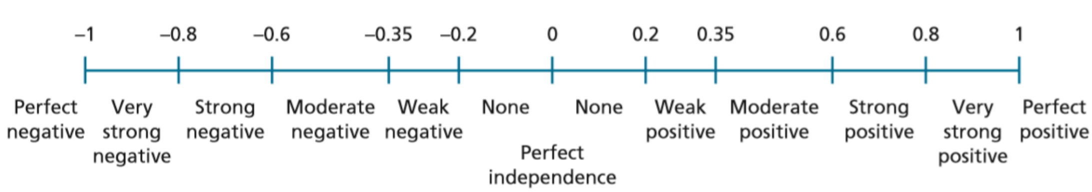

Figure 9. Correlation Coefficient Scale of Value
Source: Adopted from Saunders, Lewis, & Thornhill (2016)

Pearson Correlation and coefficient analysis resulted are shown in below tables 07 and 08.

Table 7. Correlation (r)

	AMT Readiness	PU	ATT	PEOU	PMS	TO
AMT Readiness	1					
PU	0.429	1				
ATT	0.495	0.551	1			
PEOU	0.607	0.378	0.500	1		
PMS	0.285	0.251	0.222	0.549	1	
TO	0.472	0.468	0.395	0.455	0.411	1

Table 8. Significance

Variable	p-value
PU	0.000
ATT	0.000
PEOU	0.000
PMS	0.002
TO	0.000

The result shows that perceived ease of use has a strong positive relationship and perceived management support has a week positive relationship. All other three factors show a moderate positive relationship.

Multiple Regression Analysis

Table 9. Multiple Regression Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.680	0.463	0.439	0.46429

R2 = 0.463; the independent variables perceived usefulness, attitudes, perceived ease of use, perceived management support, and techno-optimism account for 46% of the employee readiness for AMT adoption, which means there could be other factors impacting employee readiness that are not captured in the current study.

Table 10. Multiple Regression ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	20.806	5	4.161	19.304	0.000
Residual	24.143	112	0.216		
Total	44.950	117			

The overall regression model was statistically significant F(5,112) = 19.304, p < 0.001, R2 = 0.463. Test results of five independent variables together predict employee readiness for AMT adoption significant. Hence the conceptual framework of this study is fit.

Data Analysis Summary

Table 11. Data Analysis Summary

Variable	Hypothesis	Pearson Correlation	Sig. (2-tailed)	R2	Implication	Strength of Relationship
PU	H1	0.429	0.000	0.184	Accepted	Moderate Positive
ATT	H2	0.495	0.000	0.245	Accepted	Moderate Positive
PEOU	H3	0.607	0.000	0.369	Accepted	Strong Positive
PMS	H4	0.285	0.002	0.081	Accepted	Weak Positive
TO	H5	0.472	0.000	0.223	Accepted	Moderate Positive

DISCUSSION

Many recent researchers emphasised the importance of preserved usefulness and its impact for readiness (Chen *et al*. 2013; Hsia 2014; Al-Ajam & Ali 2015). This study sanctions the findings of previous research that PU has a moderate positive relationship with a contribution of 18%.

This study also confirms that attitudes have a moderate positive relationship towards employee readiness for advanced manufacturing technology. Al-Ajam & Ali (2015), Csuka, *et al*. (2019), and Blut & Wang (2020) express that employees attitudes play a vital role in readiness towards technology adoption and account for 25% of readiness.

In all technology adoption theories reviewed in this study, perceived ease of use is crucial for employee readiness for technology adoption (Goodhue & Thompson 1995; Venkatesh & Davis 1996; Venkatesh, *et al*. 2003; Sun 2016; Lai 2017). Also, many studies done by Chen, *et al*. (2009), Chen, *et al*. (2013), Hsia (2014), Csuka *et al*. (2019), and Blut & Wang (2020) confirm the same. This research confirms that perceived ease of use is a pivotal and significant factor for employee readiness and accounts for 37% towards readiness which is the highest.

Lai (2017), Hsia (2014), and Social Cognitive Theory by Bandura (1986) stressed the perceived management support as a critical influencing reason. Further, perceived management support was considered a predictor of successful manufacturing technology adoption (Jayaraj *et al*. 2006). The findings of this research are moderately compatible with previous studies and contribute 8% towards readiness.

This study sanctions the findings of previous research that techno-optimism of the employees has a significant influence on employee readiness. Though it was not discussed and highlighted in theories, much research, Walczuch *et al*. (2007), Chen *et al*. (2009), Son & Han (2011), Csuka *et al*. (2019), and Blut & Wang (2020) have stressed the importance of techno-optimism towards readiness. This study confirms that techno-optimism has a moderate positive relationship and 22% contribution towards employee readiness for AMT adoption.

Like any other research, this study has gaps. The sample selection is from one single company, which limits the generalisability of the findings. A study needs to be taken place to cover an adequate number of companies using AMT. Also, this study focused only on five factors that contribute 46% towards employee readiness for AMT adoption. Future research can investigate other factors that influence employee readiness for AMT adoption on the apparel shop floor. Also, the study could be expanded to test this framework on other industries.

Formulate an employee readiness measuring scale would be useful, and it must be based on commonly accepted criteria. Such a tool would be useful for apparel companies to measure the level of employee readiness before implementing AMT projects.

Further study on smart factories and industry 4.0 on the apparel shop floor is also recommended as the apparel shop floor is very much behind technology compared to other industries.

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