Emperor International Journal of Finance and Management Research

ISSN: 2395-5929 **Mayas Publication ©** **www.mayas.info**

Volume- X **Issue- 9** **September-2024**

SLIIM: A Theoretical Innovation Growth Stage Model for Digital Transformation of SMEs

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Abstract

The primary objective of this paper is to propose a theoretical growth stage Model (GSM) that can mitigate the challenges faced by small and medium-sized enterprises (SMEs) and enhance their sustainability and scalability. Through the implementation of proposed SME Lifecycle Integrated Innovation Model (SLIIM), SME growth can be accelerated by integrating Industry 4.0 tools into the product development cycle. SLIIM aims to support and enhance innovation processes within SMEs in India by continuously innovating the product based on market requirements. However, it is important to note that SLIIM alone does not guarantee success in the innovation development process (IDP). Instead, it serves

as an enabling factor and supports product improvisation towards achieving product maturity and SME growth. This research study will serve as a fundamental pillar for the innovation development process in SMEs. The alignment of innovative tools such as Industry 4.0 with the product life cycle will provide SMEs with dynamic capabilities within their organizations. By leveraging these capabilities, SMEs can adapt to changing market demands, drive innovation, and achieve sustainable growth.

Keywords: Small and mediumsized enterprises, Industry 4.0 challenges, Innovation model, Growth stage Model.

I.INTRODUCTION

The SMEs in India plays a pivotal role in building economy and provide a large share of employment. MSMEs are majorly contributing to the Indian economy, accounting for around 33% of GDP and providing employment to over 110 million people[15] SME sector is becoming backbone of socio-economic development of India in terms of employment generation, product exports, innovation, and inclusive growth of the economy. It is highly important to transform the way SMEs are doing business in the era of digitalization, where there is technology and innovation embedded in every product development towards maximizing businessopportunity;especiallyIndustry4.0 technologies (Internet of Things (IOT), Artificial Intelligence, Cloud Computing, Augmented Reality)are present in every layer of the business.

MSMEs are presently defined based on investment in plant and machinery/ equipment. To facilitate ease of doing business, the Government has introduced the new criteria from 1st July 2020 for classification of micro, small and medium enterprises turnover based, which will be useful for MSMEs.

Table 1:Revised Classification applicable w.e.f 1st July 2020 [16]

Classification of Micro, Small and Medium Enterprise (MSME) sector (Composite Criteria: Investment in Plant & Machinery/equipment and Annual Turnover)			
Classification	**Micro**	**Small**	**Medium**
Manufacturing and Service Sector Enterprises	Investment in Plant and Machinery or Equipment upto Rs.1 croreand Annual Turnover does not exceed Rs. 5 crore	Investment in Plant and Machinery or Equipment upto Rs.10 croreand Annual Turnover does not exceed Rs. 50 crore	Investment in Plant and Machinery or Equipment upto Rs.50 crore and Annual Turnover does not exceed Rs. 250 crore

The Fourth Industrial Revolution (4IR) technologies has tremendous potential to enhance small businesses, This will serve customers with better quality product and help SMES to create effective online present in today's digital ecosystem .

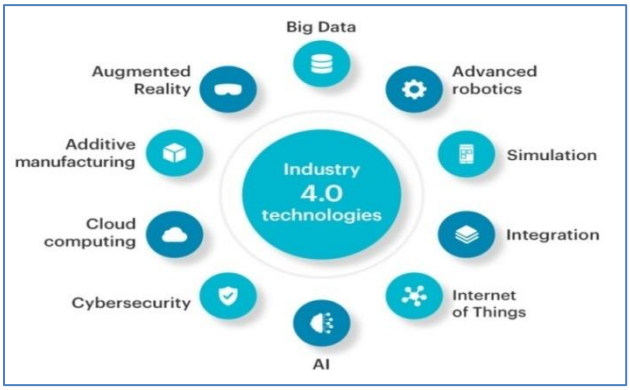


Fig 1: Technologies/tools of Industry 4.0 [17]

India's SME segment has the potential to undergo significant transformation through the establishment of a robust digital ecosystem supported by Industry 4.0 tools. Companies in this sector require digital transformation to drive innovation in their business models by adopting new technologies such as Industry 4.0 tools.The adoption of Industry 4.0 tools is challenging task for SMEs due to various implementation challenges. These problems are more severe for developing countries like India[1].

According to various researches conducted major challenges faced by Indian SMEs are : Lack of financial support, Lack of business funding , Failing to adapt new technology, Lack of skilled employee, Poor marketing strategy, Lack of upgraded technology, Unstable Government policies , change in tax rates. raw material unavailability.[14]

One of the major challenges in SME failure is failing to adapt new technology / innovation, which is preventing SMEsfrom delivering based on customer expectation. This is one of the key reasons why the growth of Indian SMEs are slow ,This could be one of the factor which is affecting Indian Economy. In order to overcome this key challenge (Adoption of new technology / innovation) , SMEs are requires to integrate digital transformation in their business models by adopting new technologies such as Industry 4.0 tools.

SMEs vary widely in size, capacity and nature of business.It becomes outward that SMEsare facing similar challenges at similar stages of their product development life cycle, In spite of many differences in nature of business. These points of similarities in product development cycle can be organized into a framework and It can be called as Growth stage Model (GSM).Due to the rapid change in business development in the industrial revolution 4.0 era, where technology and innovation is refining the industries and creating innovative trend in to attract customer. [7]

In this era where business becomes more agile,complex and customized as per customer expectation, It is highly required for every SME to follow a systematic growth cycle (starting from Idea generation to maturity stage). During this growth cycle, SMEs face challenges to sustain with rapid change in business development and technology. Hence this articlewill focus, how SME growth can be accelerated by integrating Industry 4.0 tools into the product development cycle during early stages of SME growth stages.Also this article will propose a theoretical innovation growth stage model SLIIM (SME Lifecycle Integrated Innovation Model), in order to mitigate the business risk and sustain in market

Review of Literature

Literature review has been split into two areas, first to find out the relevant literatures which focus on the key challenges faced by SMEs during implementation of Industry 4.0 tools for sustainability and secondly up-to-date growth stage models proposed by researchers to overcome the I4.0 tools implementation challenges in SMEs towards mature product cycle.

Challenges of implementing I4.0 tools

About 62 research articles were studied from various Scopus, Research Gate, Science Direct, Willy Journals using keywords (Industry 4.0 challenges, Small and medium sized enterprises, Innovation, SME). Out of them, about 12 articles retrieved for more detail evaluation and finally7 research articles studies are included in this research paper considering the potential contribution towards the research area.

Based on the Literature survey it was observed that the adaptation of Industry4.0 tools are challenging for SMEs due to several reasons. Some of the critical challenges are High cost of industry 4.0 technology, awareness about government policy, management support, Lack of IT-based infrastructure (Software &Hardware) [1]. Businesses need to implement complete digital solutions for the end to end processes, starting from financial/payment access, operations ,product delivery, Up skilling and managing knowledge source is highly import for the business. Considering the implementation obstacles for a particular SME segment which is more dominated by different micro stages of product development, digital tool readiness of SME should be capable to mitigate the complex problems. [2]. The flexibility of Industry 4.0 technologies, organization and blending with other available resources are one of the key challenges [3]. Adopting new technology, acquiring new skill and complete understanding of various features is must require for technology implementation[4]. The limitation AI/ML are lack of quality Data (Data quality, Quantity, and availability), Lack of knowledge and skill, Lack of Budget, solution complexity, lack of management involvement and strategy. As there are various type of SME and its different product development stages, it is very difficult to provide appropriate AI/ML based solutions. The lack of interest among employees for adoption of new technology can affect 4.0 technologies implementation significantly[5]. Due to the extensive usage of IOT and AI/ML based solutions in the e-commerce industry, the ecosystem became victim of cyber threats/ cyber security, data thefts, data manipulation and frauds. [6].

Growth Stage Models to overcome the challenges in implementing I4.0 tools.

About 47 research articles were studied from various Scopus, Research Gate, Science Direct, Willy Journals using keywords (Growth Stage Model, Small and medium sized enterprises, Innovation model).Out of it about 20 articles retrieved for more detail evaluation and finally 7 research article's studies are included in this research paper considering the potential contribution towards the research area.

Storey and Greene (2010) [7]proposed a GSM after deeply analysed previous models and included growth stage at stage 5 followed by declining phase at stage-6. In this stage 6 growth declination is due to the ignorance of continuous innovation to survive in competition. In this model top management's contribution in every stage of growth model is significant. Top management skill, understanding of market, monitoring the current business growth, future business forecast, investment strategy plays a major role in growth cycle of SMEs. In this model Revenue and earning time are defined separately to explain the early-stage Businesses won't be able to make any income in this stage due to various obstacles and challenges faced by company

Muhoset.al (2011)[8] proposed a four stagemodel excluding the stage zero (0) which is considered as prior to establishment and basically the Ideation stage.In this modelStage 1 is the Conception and development where company focuses on business idea, identification of a market and create potential customer base. The cash flow at this stage under the line as the product is not ready for sale. Stage 2 is the Commercialization stage wherecompany focus will be on product development, commercialization and marketing of the product. Stage 3 is the Expansion stage where company focus will be towards Manufacturing and marketing product in large volume to increase positive cash flow. Stage 4 is the stability and renewal phase, during this stage company has to go through lower growth rate and completion in the market.So in this stage SME should launch second product, identification of new markets, cost control to maintain the stability and maintain positive cash flow.

Nia KurniatiBachtiar et al, (2019) [7] proposed a modern Growth stage model that respond to the challenges faced due to adaptation of Industry 4.0 tools towards innovation and technology. In this GSM business will have start up phase, stage 2 will be the Survival stage, where business struggles to sustain their position and increase their scalability by generating more income, increasing sales and expanding the market. Stage 3 is the highest point in this GSM In this stage business reaches the peak point, However, the peak point will not sustain for longer due to the rapid change in technology and customer aspiration the products. The products will be replaced with more innovative and desirable products in very short time span. SMES are forced to diversify their business by creating new product

Junic Kim *et al* (2019)[9]represented a conceptual framework to analyze step by step business strategy based on the various literature review. There are four major growth stages like, entry stage, growth stage, expansion stage and maturity stage. Strategies applied in each of these stages supports to create a successful platform business ecosystem.

This study also highlights how online digital platforms using IT tools can be presented as a growth stage model which helps the SMEs to continuously sustain in the volatile business situations and expand their product market.

Mochammad Ridwan Ristyawan (2020) [10] The result of this study proposed aintegration model of RBV and AI. The results of this study aims at identifying strategic resources owned by MSMEs and apply Artificial Intelligence design (AI) in the MSMEs RBV strategy. The results of the study indicated that the company should give highest priority to human resources for the company, other resources are marketing & distribution, finance & funding, operation & production, the internet usage & technology should be prioritize.

Peter M. Bican *et al* (2020) [11]proposeda theoretical growth stage model includingDigital Readiness, Digital Technology, and Digital Business Models related to Innovation and digital transformation. Here by implementing digital innovation tools SMEs can address the challenges and sustain longer.

Luigi Mosca*et al* (2021) [12]Proposed five primary elements of good theory (i.e Who, What , When, Why and How) to analyze characteristic of five seminal Organization Life Cycle Model called OLC. These model propose organizational development trajectory that can confront with the challenge in today's business world.

Research Methods

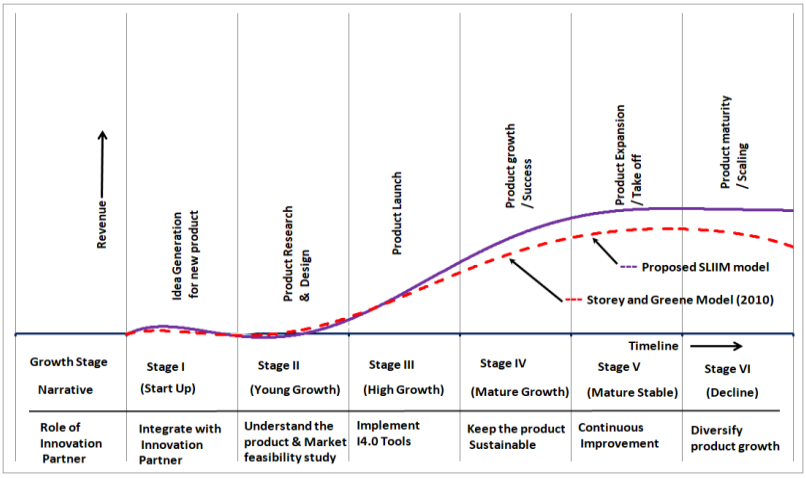
The Research Methodology will comprise of comprehensive review of the existing global literature on the challenges in Industry 4.0 tools implementation in SME, either directly or indirectly and various Growth stage models proposed over the period to streamline the product development cycle. In order to understand the implementation challenged of Industry4.0 tools in SME life cycle, the literature review has been carried out in two folds. At the first fold the literatures related to the challenges in implementing Innovative tools for SMEs are reviewed and at the second fold various SME growth stage models are reviewed.

For the detailed literature review, research topics published in various management journals database (time span: 2010–2023) usingthe following keywords: 'SME life cycle' ,'Industry 4.0 tools in SME', 'challenges in implementation of I4.0 tools in SMEs', stages of SME growth and growth stage models in SMEs' have been considered. This search produced six review articles on first area: Ravinder Kumar *et al* (2020), Sharon Buteau (2021), Dan Zhang *et al* (2021),Vranda Jain *et al* (2021), Ramanjeet Singh (2021), Valentina De Simonea, *et al* (2023),

By using the snowball approach, we analyzed the various growth stage models presented in literatures meeting the following three criteria: (1) the model should be unique (2) the model should be able to justify the changes of SME growth life cycles and (3)the model should be an original intellectual source and not only an empirical test. Through this analysis, we selected threeprimary growth models: Storey and Greene (2010), Muhos et.al (2011), NiaKurniati Bachtiar et al (2019), and literatures from Junic Kim *et al* (2019),Mochammad Ridwan Ristyawan (2020),Peter M. Bican *et al* (2020) ,Luigi Mosca *et al* (2021).

The results found by comprehensive literature review will help to do assessment of I4.0 tools implementation challenges in SMEs and their relationship with proposed growth stage models by researchers.Therefore continued our analysis and propose a theoretical innovation model SLIIM as a solution to the challenges faced by SMEs.

Proposed Theoretical SLIIM Model (2023)



[Fig. 2: Proposed SLIIM Growth stage model (2023)]

SLIIM model is a SME lifecycle integrated innovation model, It is aggregation of innovation model along with existing growth life cycle that leads to an improvement in transforming various phases of SME life cycles. The SLIIM Model has six stages and its role in SME growth cycle is explained as below.

Stage I: Start up/Idea Generation:

This is the phase where the idea entrepreneur has been nurturing since long is finally taking a shape. Also called the pre-seed stage, the amount of funds used in this stage is usually small; One of the biggest challenges to overcome in the ideation stage is to have one focused problem, which you're trying to solve with a clear visualization of your future product landscape.

Stage II: Young Growth / Product Research and Development:

The Product Research and development stage is all about ensuring that their product or service has potential to solve the identified problem in the market. At this stage the SME has a readymade product and it needs to meet the potential demand of the startup's product/service. This is called 'Proof of Concept (POC)'and after which the Product is launched to the consumer market. Based on **SLIIM** Model approach at this stage SME should start collaboration with Innovation Partner and share the Product details. The Innovation partner will understand the product and do the market research to understand the similar product. Market research for new/Existing product is all about identifying opportunities for innovation and implementation of Innovation tools (i.e. Industry 4.0 tools) into existing product line.

Stage III: High Growth / Product Launch:

In this stage, entrepreneurs and SMEs are actively developing the product and refining their product as per the customer requirement. As soon as the product is ready for sale, the Product launch stage begins. The product launch is a very crucial stage in SME lifecycle .The main aim of Product launch stage is to build enough awareness of the product move to Growth stage. It is expected the product may have low sales, High Spending, Little profitability and likely low competition. Based on SLIIM Model approach at this stage, Innovation partner will work on implementing Industry 4.0 tools (industrial IoT networks, AI, Big Data, robotics, and automation) into the existing / New products developed by SME. The product will either be a new launch or re – launch of existing product post enhancement.

Stage IV: Maturity Growth/ Product Growth & Success:

Entrepreneurs and SMEs in this stage have a business strategy to grow revenue and new client/customer. Growth and Success are strategy for this stage. The SMEs need to identify ways to consistently grow business. The SME should identify ways to improve business model, by implementing innovative methodologies, product enhancement, marketing, sales, In order to move to the next phase of business growth. The SME must be making profit and generating enough cash flow to stay in business and fund growth.

Based on SLIIM Model approach at this stage, SME need to work on improving the core product based on the consumer response, whereas Innovation partner should provide the platform to make the product more sustainable and reachable to the consumers. Implementation of Innovation will make the product more reachable to different state of customers.

Stage V: **Mature stable / Product Expansion &Take off**:

Entrepreneurs have identified the key challenges in previous stages. They might have already fixed these issues and now effectively managing the growth stage. They are in a stage to expand the current business competencies. Since the business has become profitable and making money, the main strategy will be to maintain stability in the company and manage the cash flow effectively to expand/take off business to next stage. The objective of the entrepreneur should be to retain the SME in this place indefinitely and avoid any kind of disruptions in the industry. Based on SLIIM Model approach at this stage both SME and Innovation partner should focus on keeping the product sustainable and competitive as per the market trend and focus on product expansion. This is required to ensure the SME can continue to be in this stage as long as the product is one of the innovative products in market.

Stage VI: Decline/ Product Maturity Scaling:

After reaching the product maturity stage, SMEs find that the product competition goes high, product sales goes down and the overall business growth become stagnant, This is normal and expected in the traditional SME growth life cycle .However, in this stage SME will take certain actions like (diversifying the product, entering new market, attracting new customer base, launching new products), At the same time due to the collaboration with Innovation partner in the young stage of SME life cycle, the sustainability of the SME will be preserved even during the declining stage. That's why SLIIM model argues that the SME will continue to sustain in the market and would not be impacted due to the traditional declining stage of SME growth cycle.

Results and Discussion:

By conducting a comprehensive review of the existing literature on the implementation challenges of Industry 4.0 tools in SMEs and various Growth stage models proposed over the period to streamline the product development cycle. However, this article mainly focuses to discuss GSM for SMEs to assist them in pursuing their growth by integration with Innovation model..As mentioned above, this article proposed a theoretical SME Lifecycle Integrated Innovation Model (SLIIM) that can enhance their sustainability and scalability.

This model uses Industry 4.0 tools to develop innovative products during manufacturing along with systems and things that create self-organizing and dynamic control. In this model SME will work in collaboration with Innovation partner. It has six stages starting from stage 1(Startup /Idea generation), Stage 2 (Young Growth/Product Research & development), Stage 3 (High Growth/Product Launch), Stage 4(Maturity Growth/ Product Growth &Success), Stage 5 (Mature stable / Product Expansion &Take off), Stage 6 (Decline/ Product Maturity Scaling). Involvement of Innovation partner will start from Product Research and Development stage. The Innovation partner will understand the product and do the market research to understand the similar product. Market research for new/Existing product is all about identifying opportunities for innovation and implementation of Innovation tools (i.e. I4.0 tools) into existing product line. In next phase Innovation partner will work on implementing I4.0 tools (industrial IoT networks, AI, Big Data, robotics, and automation) into the existing / New products developed by SME. The product will either be a new launch or re–launch of existing product post enhancement. Once the product is launched with enhanced feature survival /sustainability is one of the major priorities for both SME and Innovation partner.

SME need to work on improving the core product based on the consumer response, whereas Innovation partner should provide the platform to make the product more sustainable and viable to the consumers. The above process continues as the SME moves further to growth and Expansion / Take off stage. In SLIIM Model we are assuming the product will continue to sustain during the maturity stage, since the product has been continuously enhanced to make it viable for the consumer preference. Based on Muhos (2011)'s model SME should focus on diversifying the product for effectiveness and efficiency issues.. For Company renewal exploring new product market will be beneficial for the company.

II. Conclusion and Scope for future work

The purpose of this research is to propose the strategies or mitigation plans to overcome the Industry 4.0 tools implementation challenges towards achieving an ethical and sustainable integrated innovation model. Based on the comprehensive literature review, a theoretical model integrating various tools of industry 4.0 with SME life cycle has been proposed. This will be further substantiated through a quantitative research by conducting an in-depth data analysis to SMEs which intend to adapt innovation in early stage in the growth stage model. These research questions could be addressed by exploring novel research methodologies such as a qualitative comparative analysis (QCA), experimentation and simulation. Hence, the contribution of this article to literature is by providing a new perspective especially for SMEs life cycle.

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