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Some Recent Stories of Operational Excellence in SMES

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Abstract: Operational Excellence is a term associated with excellence in all stages of business for any business organization which may be manufacturing or a trading. Operational excellence deals with the achievement of improved productivity, profitability and reduced wastage. The present paper is an analysis of the relevant papers and the practices which may be considered for adoption by the small scale and medium scale organizations for the achievement of excellence in their operations. In less advanced countries like India the SME's play a major role in uplifting the economy. The SME's are facing tough competition and survival is a very big challenge in the current scenario around the globe. So, In this study an attempt was made to review some recent stories ranging from 2011 to 2023 for Lean practices and environment friendly practices leading to Green implementation, collectively achieving operational excellence. The research gaps have been studied and the focus is on identification of the best Operational practices coupled with suitable environment friendly practices for the productivity improvement, quality management and improved financial structure. The present paper is a novel approach for the evaluation of the green and lean management principles combined with Industry 4.0 for the operational excellence of the manufacturing sector.

Keywords: Operational Excellence (OPEX); Lean and six sigma industry 4.0 integration (LS4.0); World class manufacturing (WCM); Internet of things (IOT); Green and lean six sigma(GLSS); Lean smart manufacturing (LSM); Value Stream Mapping (VSM).

I. INTRODUCTION

The SME's are a key contributors in the economy and development of skills in a country. Considering Indian context the SME's play a major role in enhancing the GDP of the country. The number of SME's is very large in comparison to the large scale enterprises. The SMEs have the benefits of flexibility, cost effectiveness and employment generation. In view of these factors the SMEs have to play a vital role in shaping the economy and employment generation for a country. The 30% of the India's GDP is contributed by SMEs and around 40% of the citizens are employed by the SMEs. Innovation and Entrepreneurship are promoted by the SMEs among the people of any country.

The SMEs have a great contribution in the export of goods from India and is nearly 40% of the total export done by the country. Indian e-commerce sector is largely dependent on the SMEs and the e-commerce is expanding continuously with the growth of SMEs.

The urban and the rural India's youth have got good employment opportunities because of the setting up of SMEs. The schemes like 'Make in India', 'Digital India' and promotion of Startups by their funding by the Indian Government has been aiding in the expansion of SMEs to both the urban and the rural areas.

Saini and Singh, (2020)evaluates the status of Lean practices in SME's of Northern India based upon percent point score methods for implementation of lean manufacturing processes in SME's [30]. The critical factor in lean implementation in SME's has the management vision as the most valued factor.

Saini and Singh, (2020) rates 5S production management and supplier management practices rated as top lean practices in SME's of India on the basis of percent points score method. The present paper is an attempt to study the application of lean principles and green principles to achieve operational excellence in SME's. Professor Pauline Found et al., (2018) establishes that many constituents such as quality, continuous improvement, lean and agile can be unified to achieve operational excellence [15]. The term operational excellence has gained importance since its inception but the publications haven't increased substantially from 1987 to 2020 as they have just doubled in a time frame of 33 years. The most common connection to Operational Excellence is Lean in Managing Principles, Sustainable Principles and Environment [44]. Green, Six Sigma and Lean is in the development stage and the sectors involved in manufacture of goods are resistant because of cultural differences and shift in the work process [42].



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An innovation was developed using a hybrid integrated Lean and Smart Manufacturing concepts for achieving economic sustainability [40]. The impact of industries practicing lean principles does not necessarily result in green improvement as concluded by Sri Hartini et al., (2015) [18]. The use of Lean Sigma Techniques helped in implementing operational excellence in SME's by reducing the die changes over time for the scroll line press in the pressure shop [4]. A survey of pharmaceutical companies around Bangalore city Karnataka yielded positive results which enhanced operational excellence as presented by V. Jaiganesh et al., (2015), [41]. Operational Excellence leads to enduring capacity as depicted conceptually [8]. The choice for the achievement of lean tools is dependent on the nature of the company effective and if efficient choice of operational excellence techniques in pharmaceutical industry can lead to good inventory management [17]. Leadership at the top level strongly influence the achievement of operational excellence in pharmaceutical companies as stated by Boya and Rao, (2019), [6]. The achievement of operational excellence leads to sustainability and improves the economic environmental and social performance of Companies [29, 19]. The achievement of environmental system and the government operation excellence in Sultanate of Oman are related which can improve government citizen relationship and reduce the failure possibilities [2]. The growth of Tanzanian SME's can be done by the adoption of SCM [36]. To achieve customer satisfaction the SME's must adopt innovation management which can lead to product improvement as Omar Al Azzouzi et al., (2021), [5]. The lean practices have a great effect on SCM and six sigma metrics lead to supply chain measurement and improvement. The main focus of SCM is to target right product at right cost, right time, right quality & right quantity to the right customer [24]. Popy Umbrella Mart which is an SME located in Kerala in India is a success story for innovation and Organizational Excellence. Operational excellence can be achieved by cultural shift of believing in the power of common people in attaining productivity and excellence. The 7S framework shown in figure1 can lead the SME's to operational excellence [20].



Figure 1: 7S framework of Kerala SMEs [20]

The integration of LSS 4.0 with green manufacturing, resilience and agility can be a topic of future research. The LSS4.0 can be applied to SME's which can lead to operational excellence as proposed by *Dounia Skalli et al.*, (2023), [13]. The business innovation enhances the business growth and financial performance of SME's. Ethnicity has no impact on SME innovation outcomes [12]. A study of SME's of Ghana has led to the creation of value due to the use of social media and led to a significant and positive effect on sustainability social network improves the business activities, profitability and is a promotional tool for SME's [17].

The SME's are an important part of overall economy and to improve the productivity of SME's leads to Greater participation of the people [17]. In developing countries the technology adopt in SME's is a growing area of interest which can which will improve the organization productivity [25]. The SME's performance is a cause of concern because of their low productivity, high cost and below performance [30]. In Lean manufacturing the numbers of non-value added activities were eliminated in SME's and the Six Sigma tools usage helped in achieving Operational Excellence [4]. The SME's suffer a number of challenges in the domestic and global market competition although it can adopt supply chain management [36].

The SME's face the challenge in this fast paced world of manufacturing and the determining factors are the speed to and operational efficiency. SME's in particular do not have a mindset and then neither have the kind of workforce which can implement lean practices and GWRT for improving the productivity by reducing wastage. The road to achieving operational excellence is a very complicated one for the SME's considering Indian context.



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The integration of I4.0 & WCM can benefit greater accuracy, precision and reliability of the gathered information. The I4.0 tools and the WCM tools to find the links were studied to achieve competitiveness. The I4.0 technological groups namely cloud computing, IOT, M2M Cognitive Computing, Mobile technologies, AR, Simulation, additive manufacturing and advanced robotics were studied for integration with WCM tools namely safety, cost deployment, focused improvement, autonomous maintenance, Work place organization, Professional maintenance, Quality control, Logistics, Early equipment management, People development, Energy and Environment. The I4.0 is important for the WCM as depicted in the WCM-I4.0 matrix [29].

II. METHODOLOGY

The Table 1 depicted below is an analysis of the previous research work done on the Lean, Green and I4.0 techniques for the achievement of excellence in operations of small and medium sized manufacturing firms -

S.No	Topic and Author	Year	Conclusions	Research Gaps
1.	'Teaching of	2011	The teaching of operational	Detailed direct surveys which are
	operational		excellence (Lean Management) a	required to be conducted for
	excellence in		proposal has been derived to	teaching of operational excellence so
	Moroccan		complete such a project in	that a reasonable conclusion can be
	universities and high		Morocco.	arrived [14].
	schools A major			
	lever for a			
	competitive			
	Moroccan company'			
	Laila Elouarat,			
	JanahSaadi and			
	Khalid Kouiss.			
2.	'Challenges and	2011	Supply chain management if	A critical mass analysis must be
	opportunities of		adopted by the SMEs can	studied so that SCM can be adopted
	Tanzanian SMEs in		strengthen economy and improve	by the SMEs [36].
	adapting supply		operational performance.	
	chain management'			
	Sama ,Hamisi.			
3.	'Implementing	2012	Reduction in Die setup time was	Study limited to just Six Sigma
	operations		achieved by the tools such as	techniques of Lean and needs to be
	excellence in small		Lean Six Sigma manufacturing.	extended to the use of other LMPs
	and medium size		This resulted in improvement in	[4]
	manufacturing		the Business Performance.	
	companies - using			
	lean-sigma			
	techniques' Ashok			
	Kumar Puri.			
4.	'Technology	2013	Technology adoption by the	The areas of innovations in SMEs
	Innovation for SME		SMEs in Indonesia has	are largely to be explored so that an
	Growth: A		significantly improved	Empirical research on the innovation
	Perception for the		performance in terms of profit	techniques can be suitably found [3].
	Emerging		and market share. The innovation	
	Economies' Hanadi		in SMEs has contributed largely	
	AL-Mubaraki & M.		to the economic growth.	
	Aruna.			

Table 1: Some recent stories of the Operational Excellence in SMEs



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5.	'POPY UMBRELLA MART-A CASE OF ORGANISATIONA L EXCELLENCE IN SMEs' BEST: JOB P. A.	2014	The case study on Poppy Umbrella Mart reveals that the family unit concept of China brought excellence to the SMEs as "Self Ownership" requirement of employees was achieved.	Case Study is limited to Human Resource and can be extended to Smart systems for achievement of operational performance [20].
6.	'Value Stream Mapping : A Lean Tool' Manjunath M., Dr. Shiv Prasad H.C., Keerthesh Kumar K.S and Deepa Purthran,	2014	VSM is an important lean tool which can bridge tools, process and people for continuous improvement.	5S, Kaizen and TPM combined with VSM can be a scope of future study for excellence achievement [27].
7.	'The relationship between government operation excellence and e-government system in sultanate of Oman' Muatasim Anwar Ahmed Al Salmi & Norlena Bt Hasnan.	2015	The e- government system is transforming the lives of citizens and improving the government citizen relationship to improve the government operational excellence.	The government needs to conduct more surveys to verify the achievement of government operational excellence [2].
8.	'The relationship between lean and sustainable manufacturing on performance: literature review, Sri Hartini and Udisubakti Ciptomulyono.	2015	This study has confirmed that lean implementation yields higher green results. Lean and Green further yield better operational performance and sustainability.	Quantitative Techniques are required to reach conclusive results of lean and green implementation on Operational Excellence [18]
9.	'Study the Influence of Lean Principles which Enhances the Operational Excellence in the Pharmaceutical Industry' V. Jaiganesh and Clement Sudhahar	2015	Knowledge of Lean Principles is missing in the different levels of people working in Pharmaceutical Industry. Operational Excellence can be achieved through a continuous effort in LEAN awareness and lean implementation	Study limited to Pharma Industry only and the survey is limited to Pharmaceutical Industry of Bangalore [41]
10.	'Review the Operational Excellence Factors of Service Firms: A Literature Review' Rana Mohammad Shehadeh,	2016	Leadership, Operations Strategy, management practices and involvement culture can lead to operational excellence in Service Industry.	Limited factors have been considered and the research can be extended to find new factors for the promotion of OE in manufacturing sector also [38].



	Mahmoud			
	Maqableh,			
	Mohammad Orsan			
	Al-Zoubi, Abdel			
	hakim O.			
	Akhorshaideh,			
	Majed Khalil Al-			
	Shami.			
11.	'Guidelines to	2017	Managing Inventory is critical	Present study is limited to Pharma
	choose Operational		factor for pharmaceuticals and	Industry inventory management only
	Excellence		suitable OE techniques evaluation	and it can be eve opener for OE tools
	techniques/tools for		for improvement of the supply	not only for inventory management
	inventory		chain in the Pharma Sector	but for other factors also [25]
	management: the		chain in the Fharma Sector.	
	case of			
	pharmacouticals			
	pharmaceuticals			
	Monolar Applearie			
	Mouaky Addelaziz			
	Berrado and Loubna			
12	Jenaddou.	2017	The imposed in states are in the	The complexity of wat 40
12.	Innovation	2017	The innovation strategy requires	The sample size of just40
	Strategies and		huge investment which is a very	organizations is very low to reach to
	Challenges in		big challenge.	concrete conclusions [10].
	Emerging			
	Economies: The			
	Case of Research			
	and Technology			
	Organizations in			
12	furkey F. Demir	2017	Encellence Medal ansauted deals	Case Studies must be done to
15.	Operational	2017	Excellence Model presented deals	Case Studies must be done to
	excellence as a		with the relationship between	acmeve quantative results of
	means to achieve an		organizational culture, aginty and	operational excenence model being
	enduring capacity to		operational excellence.	suggested in this paper[8].
	change – revision			
	and evolution of			
	Am Convolto D			
	Ann. Carvanno, P.			
	Sampaio, E.			
	Servie			
14	Jaravia.	2019	The comparison table is useful in	Empirical test are required for most
14.	Lean practices for	2018	selection of the heat I are	suitable loop practices on 4 there is a
	consummating		selection of the best Lean	suitable lean practices and there is a
	competitive		practices for SIVIE's and the	footone which are held in a stranger
	priorities in SME's:		problem with the people or	for implementing the Lass Dust!
	a critical review		process can be found using the /P	for implementing the Lean Practices.
	Doordershi Sirah		mouel.	[31].
15	Doordarsni Singn	2010	I con this line con a set to	Empirical testing with induction i
15.	of operational	2018	Lean thinking can need to	Empirical testing with industries is
	of operational		operational excellence through	required so that the industries can



	excellence' Total		leadership management. Quality,	progress towards operational
	Quality		Continous improvement and	excellence. This paper is limited to
	Management and		agility are also important to	only one conceptual model and lacks
	Business Excellence		achieve operational excellence.	in detailed analysis on the factors
	Professor-Pauline		I	which can lead to operational
	Found. Mr Andrew			excellence [15].
	Mason.			
16.	'Influence of	2019	A survey of three pharmaceutical	The present work is limited to
	Leadership at Top		companies strongly concluded	pharmaceutical companies only and
	Level Management		that the top level management has	Empirical analysis is the scope of
	in Achieving		an important role in achieving	future work [6].
	Operational		operational excellence in	
	Excellence in		pharmaceuticals.	
	Pharmaceuticals'		r · · · · · · · · · · · · · · · · · · ·	
	Venkateswara			
	Reddy Boya & K. S.			
	Sekhara Rao.			
17.	'Insights on Supply	2019	In the Indian context very less	An intensive study on SMEs in India
	Chain Needs and		literature is available on a supply	is required so that SMEs improve on
	Issues in Indian		chain strategy that is effective for	product development time, quality,
	SMEs' G.		improvement in the pursuance of	cost, productivity and process flow
	Narkhede1 and		SMEs which leads to low	[28].
	N.R.Rajhans2		performance of SMEs.	
18.	'An evaluation of	2020	The percent point score method	This study is confined to the
	the status of lean		finds 5S, productivity	Northern India SMEs and some
	manufacturing		management and supplier	other qualitative and quantitative
	practices in SME's		management lean practices score	techniques can be exploding to
	in Northern India'		higher for implementation in	select the most suitable lean
	Sachin Saini and		SMEs of Northern India. In a	practices [30]
	Doordarshi Singh		collective view every lean	
			practices is found to contribute	
			but some score better.	
19.	'A Systematic	2020	Six-sigma is a systematic method	SMEs have financial issues so an
	literature review of		which minimizes defects by using	extended Empirical basis of study is
	implementation six		statistics and problem solving	required to check the financial
	sigma in		tools. The quality, productivity,	feasibility for implementing six-
	manufacturing		lower costs and product change	sigma in SMEs [37].
	industries' Indri		can be achieved by six-sigma.	
	Setiawan1#) &			
-	Fransisca Debora2			
20.	'Ethnicity,	2020	Ethnicity and religiosity had no	This research must be exhaustible
	religiosity and SME		effect on the SMEs innovation	carried out in large group so that the
	innovation		outcomes.	effect of ethnicity and religiosity on
	outcomes: some			innovation in SMEs can be
	insights from a			reasonably concluded [16].
	Muslim ethnic			
	group' Donard			
	Games,			
21.	'Industry 4.0 and	2020	WCM promotes accuracy,	SMEs have investment issues and



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	World Class Manufacturing Integration: Lorenzo D'Orazio, Roberto Messina and Massimiliano M. Schiraldi,		precision, liability when coupled with I4.0. The integration leads to continuous growth of competitiveness the paper lists nearly 100 I4.0 technologies which can empower world class manufacturing.	manpower issues for I4.0 and WCM integration. The study can be extended by surveys of SMEs [9].
22.	'Investigating the perceptions of lean manufacturing practices in Northern India in SMEs: An Empirical study'Sachin Saini and Doordarshi Singh	2020	The paper aims on the perceptions in adopting the lean and focuses on continuously improving and reducing the waste. The different lean perceptions are rated in a graphical manner with a percent score.	The different perceptions can be statistically evaluated with better techniques and more data collection is required [33].
23.	^c Integration the 6th category Business Excellence Framework, the 8th clause ISO 9001:2015 and the 6th category KPKU Indonesia Framework Sri Widaningrum, Musli Mohammad and Rasidi .	2020	Indonesian OE consists of 5 criteria and 14 sub-criteria.	Verification and validation frameworks are missing in OE model of Indonesia [43].
24.	'Lean Industry 4.0' – Current trends and future perspectives, Cogent Business & Management, Krzysztof Ejsmont, Bartlomiej Gadysz, Donatella Corti, Fernado Castano, Wael M. Mohammed & Jose L. Martinez Lastra	2020	LM is linked to I4.0 and it can be correctly said that both promote each other.	LI4.0 is not well defined and availability of literature is limited so there is a great scope of research work on LI4.0. Quantitative data which certifies the advantages of combination of lean practices and I4.0 is not available[12].
25.	'Operational Excellence within Sustainable Development Concept-Systematic Literature Review' Daniel Wojtkowiak	2020	This work successfully establishes that sustainable development and operational excellence are related. Lean concepts strengthens sustainability and green policy also significant in waste reduction	Nearly 10% of the articles collected that operational excellence is connected with sustainable development and this is not a considerable percentage to reach a respectable conclusion. The concept of sustainability can be extended to



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	and Piotr Cyplik		and process efficiency	SMEs [44]
	and riou cyplik,		improvement	
26	Reckoning with the	2020	The barriers in implementing the	The evaluation of barriers must be
20.	harriers to Lean	2020	lean in SMEs of uncoming	extended to different sectors of the
	implementation in		economies like India have been	SMEs. The present work limits to
	Northern India		identified to a reasonable level	the manufacturing sector only and
	SMEs using the		identified to a reasonable level.	methomatical analysis can be further
				used to assign weights to different
	annroach' Sachin			barriers in implementing the Lean
	approach Sachin			tachniques [24]
	Sallil allu Doordorshi Singh			techniques [54].
27	Unnovation	2021	A model which includes	Only managerial view per company
27.	Monogement in	2021	A model which includes	bas been survivated wheneves the
			ineoretical relationships between	has been surveyed whereas the
	SME and		innovations in organizational	responses from different stake
	Organization		learning and consumer	holders of the company must be
	Development Based		satisfaction is developed in the	surveyed [5].
	on Customers		SMES.	
	Satisfaction Omar			
	El Azzouzi&Prof.			
• •	Dr. GozdeUlutagay			
28.	'Integral measures	2021	The integration between green,	GLSS implementation needs to be
	and framework for		six sigma and lean can enhance	tested practically and also it must be
	green lean six sigma		profitability, quality, customer	tested mathematically to achieve
	implementation in		satisfaction, responsiveness and	concrete results. GLSS must be
	manufacturing		process efficiency. This	studied for linking with
	environment'		integration can be achieved	sustainability and 14.0 environment
	Vishwas Yadav,		through management	[42].
	Pardeep Gahlot,		commitment and team efforts.	
	RajeevRathi,			
	Gunjan Yadav, Anil			
	Kumar & Mahender			
-	Singh Kaswan,	2021		
29.	From Lean	2021	Lean 4.0 is a combination of lean	Lean4.0 is the future for smart
	Production to Lean		manufacturing and Industry 4.0	implementation which can bring
	4.0: A Systematic		technologies.	about green improvement and
	Literature Review			sustainability [17].
	with a Historical			
	Perspective'			
	Francisco Gil-			
	Vildal, José A.			
	Yagüe-Fabra2,* and			
	Albert Sunyer3			
30.	"The Effects of	2021	GSCM implementation in	The study is limited to Korean
	Green SCM		electronics industry achieved	electronics industry only and the
	Implementation on		sustainable competitiveness, cost	business performance changes over
	Business		reduction, flexibility and quality	time so sustainability is a matter of
	Performance in		across supply chain.	study. The study is limited to SMEs
	SMEs : Sung Tae			sector only [21].
	Kim, Hong-Hee			



	Lee* and Seongbae			
	Lim,			
31.	'Sustainability through Operational Excellence: An Emerging Country Perspective' Rafael Henríquez- Machado,Andrés Muñoz- Villamizarand Javier Santos	2021	Operational excellence improves the economic, environment and social performance of companies. In developed countries operational excellence is implemented successfully.	The identification of most critical determinants and barriers to implement operational excellence in emerging companies is a scope for further work. In emerging countries the companies are mostly small, micro and medium sized so a method to achieve a sustainable excellence model needs to be devised [19]
32.	['] A Sustainable Productive Method forEnhancing Operational Excellence in Shop Floor Management for Industry 4.0 Using Hybrid Integration of Lean and Smart Manufacturing: Varun Tripathi, Somnath Chattopadhyaya, Alok Kumar Mukhopadhyay, Shubham Sharma, Changhe Li, Sunpreet Singh, Waqas UI Hussan, Bashir Salah, Waqas Saleem and Abdullah Mohamed	2022	This paper concludes that smart techniques like IOT and AI etc are linked to operational excellence. Shop floor management can be effectively improved by the implementation of the lean and I4.0.	The paper is unable to evaluate different factors where faults occur and the study can be extended to digital integration between lean sustainability smart manufacturing and application in I4.0 [40].
33.	'Development of a model to assess the impact to lean practices on firm performance in SMEs' Sachin Saini and Doordarshi Singh.	2022	Analytical results from approaches based on analysis have been developed in this paper. This work mainly assesses that Mixed Approach is preferred in successfully implementing LMPs	Quantitative techniques may be used in the future and the study can be extended to other manufacturing industries rather than limiting it to the SMEs sector only [32].
34.	'Lean manufacturing practices for enhancing firm performance in medium enterprises:	2022	Lean practices such as 5S, Kaizen, OEE, Kanban and JIT brought about reduced rejections. The objectives like customer satisfaction, timely deliveries and business sales improved largely	Study was limited to manufacturing organization dealing in air- conditioning and combines parts. The study results can be extended to other sectors of industry and further its impacts on green improvements



	Sachin Saini and Doordarshi Singh		on the implementation of LMPs	need to be evaluated [39]
35.	'Logistics: Impact of Industry 4.0'Appl. Sci. Sarah El Hamdi1,2,* and Abdellah Abouabdellah2	2022	Logistics 4.0 has positive environmental impacts and combined with I4.0 can lead to sustainability.	Elimination of jobs as the I4.0 and Logistics4.0 mainly concentrate on process efficiency [13].
36.	'Root Cause Analysis in the Industrial Domain using Knowledge Graphs: A Case Study on Power Transformers' Jorge Martinez-Gil, George Buchgeher, David Gabauer, Bernhard Freudenthaler, Dominik Filipiak and Anna Fensel.	2022	Use of Knowledge graphs for the detection of faults and finally using a query program leads to a possible solution to find out the faults in the system. The human operator can reach to suitable conclusion in fault detection using this novel approach of Knowledge graphs.	Artificial Intelligence techniques must be further used to process the numeric information for a more user friendly solution [24]
37.	'Social Media Usage and SME Firms' Sustainability: An Introspective Analysis from Ghana' Emmanuel Bruce, Zhao Shurong, SulemanaBankuoru Egala, John Amoah, Du Ying, Huang Rui and Tai Lyu	2022	In a developing country prospective the social media can improve business and profitability thereby promoting small and medium size businesses. The Empirical data collected from various SMEs of Ghana is the basis of this study.	The study is limited to only the manufacturing industry and must be extended to service industry [7]
38.	'The Development of an Excellence Model Integrating the Shingo Model and Sustainability' José Carlos Sá, Manuel Reis, José Dinis-Carvalho, Francisco J. G. Silva, Gilberto Santos, Luis P. Ferreira, and Vanda Lima.	2022	A new model is designed to select the best lean tools to improve the operational excellence of a company. A conceptual model based on has been proposed sustainability by applying lean six sigma and Shingo's model.	The Empirical validation of the conceptual model needs to be justified by a real case study [29].



39.	'An empirical	2023	"Consistency", "Product-	Future scope is to explore
	investigation on the		excellence", "Process -	Consistency procedures by usinf I4.0
	deployment of		efficiency", Supplier-efficacy",	enablers and quantitative and
	operational		Contractual-conformance" and	qualitative management [23].
	excellence in SMEs'		"Competitive-potential(CP) are	
	Satvajit Mahato.		the key factors for	
	Amit Rai Dixit.		implementation of OE in SMEs	
	Rajeev Agrawal.		T	
	Jiiu Antony, Jose			
	Arturo Garza-Reves			
	and Anbesh Jamwal			
40	'Barriers to adoption	2023	The paper concluded 12 critical	The results are confined to Indian
40.	of industry 4.0 and	2025	barriers for the adoption of	SMFs and further the barriers may
	sustainability: a case		sustainability and 14.0 in SMEs	vary for SMEs of different countries
	study with SMEs'		The interrelationship between the	The study can be further extended to
	Shachent Kumer		homione was studied using the	find out if structural equation
	Delevel D. Deset		barriers was studied using the	
	Kakesn D. Kaut,		interpretive structural modeling.	Indening can be implemented in
	EmelAktas,			Indian context as done for Malaysian
	Baikrishna E.			firms [22]
	Narkhede& Vidyadh			
	ar V. Gedam.			
4.1	(D)::	2022		
41.	Driving	2023	Reduction of lean in	A detailed study of the problems of
	Operational		pharmaceutical industry is slow	pharmaceutical industry is required
	Excellence:		because of human involvement in	to identify root cause before the
	Application of Lean		different stages of production.	lean practices are adopted. [26].
	Practices to		The defect finding was simple	
	Minimize		using PDCA approach.	
	Turnaround Time in			
	a Pharmaceutical			
	ManufacturingCom			
	pany' Muhammad			
	Iqbal Suleman.			
42.	'Evaluating the	2023	Management Vision and	The scope of this research is not
	critical success		participation of everyone, training	applicable to large scale industries of
	tactors for lean		and model of business are some	North India and a more analytical
	implementation in		of the critical success factors for	analysis is required to ascertain the
	SME's in Northern		implementing the lean practices	success factors which are critical for
	India using VIKOR		in SMEs.	Lean implementation [35].
	approach'Sachin			
	Saini and			
	Doordarshi Singh			
43.	'Industry 4.0 and	2023	LSS and I4.0 are mutually	Empirical studies such as case study
	Lean Six Sigma		synergistic and compatible. The	and surveys is future scope of work
	integration in		identification of 139 articles	for relationships between LSS and
	manufacturing: A		published between 2011 to May	I4.0 [11].
	literature		2022 has very less papers dealing	
	review,DouniaSkalli		with the relation between LSS	
	,		and I4.0.	



	AbdelkabirCharkao			
	ui, AnassCherrafi,			
	Jose Arturo			
	GarzaReyes, Jiju			
	Antony & Alireza			
	Shokri			
44.	'STRATEGIC HRM	2023	Pandemic has taught the IT	Study is limited to IT companies
	BEST PRACTICES		companies to focus on employee	operational excellence only and can
	AND		protection and seek new methods	be extended for OE achievement of
	OPERATIONAL		to safeguard the workforce	other sectors during and after
	EXCELLENCE IN		alongwith company performance.	pandemic situation [1].
	IT INDUSTRY			
	DURING AND			
	AFTER THE			
	COVID-19			
	INCIDENT'			
	Akhilesh Kumar			
	Das and Raj Tomad.			

The contributions of the different countries for the achievement of excellence in the operations of SMEs is depicted in the bar graph below -



Fig 2 : Country wise papers published on Operational Excellence

III. RESULTS AND DISCUSSIONS

The papers [1, 4, 15, 23, 25, 26, 31, 38, 40, 41, 44] relate mainly to the achievement of operational excellence in SMEs. The papers chosen for study had SMEs as the main focus of study. The other papers studied in this research concentrate on the Lean, Green and Industry 4.0 principles for achievement of sustainability, agility and greater productivity. Value Stream Mapping and Six Sigma are some of the important tools of Lean for SMEs and couple with Industry 4.0 can lead to Lean 4.0 [17, 27, 37]. The latest published papers promote the Industry 4.0 concept and its integration with lean practices [11, 22, 23, 26, 35]. The environment awareness and its preservation promotes waste reduction in SMEs and elimination of harmful waste. The present study unfold that 'Self Ownership' concept is a requirement of the employee which in turn brings excellence for the organization [20]. Employee awareness and involvement is a key factor for the industry as is seen in Pharmaceutical Industry survey. The different levels of people must be aware about the lean management principles [41]. The strategy for operation, leadership and implementation cultures are the desired factors for excellence in operations [38]. The top level management has to play an important role for Operations Excellence in SMEs.



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IV. CONCLUSIONS

The research papers from the recent years ranging from 2011 to 2023 show that only 25 percent papers are published by taking the central theme as operational excellence. In the published work India dominates mainly coupling operational excellence with lean concepts but Europe has the maximum published work on operational excellence. Industry 4.0 is an emerging concept and latest papers are concluding it of great importance for SMEs. The SMEs have to go a long way in implementing Industry 4.0 in Indian context as revealed by the study. The African published work dominates in implementation and integration of Lean and Industry 4.0. The conclusions are very important and the novel research in this paper has a promising future for the SMEs of India which are facing global challenges.

V. SUGGESTIONS FOR FURTHER RESEARCH

- 1) Quantification of the lean and green practices can be a scope of future study in the context of SMEs
- 2) Empirical studies on the digitalization of the SMEs and the essential IT tools which can rapidly transform the conventional practices.
- *3)* A detailed study to evaluate the benefits of the GLI4.0 a new terminology for the modern SMEs and extending this to the higher phases for rapid productivity improvement.
- 4) Digitally linking different departments so that the management can reduce wastage at different stages and expedite innovation in SMEs

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