ASSESSING SUPPLY CHAIN FINANCE ADOPTION BARRIERS IN INDIAN BANKING: A BEST-WORST METHOD FRAMEWORK ANALYSIS

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by

Shubham Saurabh

(Roll No. 2K22/IEM/11)

Under the Supervision of

Dr. Mohd Shuaib

Assistant Professor, Department of Mechanical Engineering

Delhi Technological University



To the

Department of Mechanical Engineering

DELHI TECHNOLOGICAL UNIVERSITY

(Formerly Delhi College of Engineering) Shahbad Daulatpur, Main Bawana Road, Delhi-110042, India

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Shukhamalaurabh

Signature

Shubham Saurabh

DELHI TECHNOLOGICAL UNIVERSITY

(Formerly Delhi College of Engineering) Shahbad Daulatpur, Main Bawana Road, Delhi-42

CANDIDATE'S DECLARATION

I Shubham Saurabh (2K22/IEM/11) hereby certify that the work which is being presented in the thesis entitled "Assessing Supply Chain Finance Adoption Barriers in Indian Banking: A Best-Worst Method Framework Analysis" in partial fulfillment of the requirements for the award of the Degree of Doctor of Philosophy, submitted in the Department of Mechanical Engineering, Delhi Technological University is an authentic record of my own work carried out during the period from January, 2024 to May 2024 under the supervision of Dr Mohd Shuaib.

The matter presented in the thesis has not been submitted by me for the award of any other degree of this or any other Institute.

Shukhamalaurabh

Candidate's Signature

iν

DELHI TECHNOLOGICAL UNIVERSITY

(Formerly Delhi College of Engineering)

Shahbad Daulatpur, Main Bawana Road, Delhi-42

CERTIFICATE BY THE SUPERVISOR

Certified that Shubham Saurabh (2K22/IEM/11) has carried out their search work

presented in this thesis entitled "Assessing Supply Chain Finance Adoption Barriers in

Indian Banking: A Best-Worst Method Framework Analysis" for the award of Master of

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University, Delhi, under my supervision. The thesis embodies results of original work,

and studies are carried out by the student himself and the contents of the thesis do not

form the basis for the award of any other degree to the candidate or to anybody else from

this or any other University/Institution.

Date:31 May, 2024

Signature

Dr. Mohd Shuaib

Assistant Professor

Department of Mechanical Engineering

Delhi Technological University, Delhi

Assessing Supply Chain Finance Adoption Barriers in Indian Banking: A Best Worst Method Framework Analysis

Shubham Saurabh

ABSTRACT

The existence of barriers in the banking industry's supply chain affects banks' productivity and efficiency and makes strategy execution difficult. The purpose of this study is to list and prioritize the barriers of SCF adoption to the banking industry. It uses a three-phase method to identify and prioritize the essential barriers to the implementation of SCF. An extensive literature review was done which identified more than 100 barriers, among them 10 were shortlisted based on their occurrence frequency. Experts' opinion was taken with the help of questionnaires in the second step to finalize the barriers. The Best-Worst Method is used in the last step to prioritize and rank the barriers. SCF barriers were found by thoroughly reviewing the literature and submissions from the industry. The BWM approach's findings indicate that "Technology and Information related barriers" are restrictive and the main thing preventing the banking industry from growing followed by "External and Organizational Barrier". Among specific barriers 'An inadequate technological system and poor technological capability' barrier acts as an important barrier, so they requires specific considerations from the upper levels of management. This paper focuses on barriers related to SCF adoption in banking industry; other barriers have not been explored. The research relies on the opinions of an expert panel to gather information specific to the Indian environment. Decision-makers and strategists might find this research helpful in understanding the ongoing efforts to achieve full implementation of SCF in the banking sector. This research offers useful data about the problems of the banking industry by evaluating SCF barriers and providing answers to important questions about which are the most important barriers to look over first. Around the globe, the banking sector is regarded as one of the important drivers of economic growth. India is working to improve the banking industry's growth and development in many areas including operational efficiency, financial viability, and creating employment opportunities, but the existence of SCF barriers makes this challenging to do. Thus, to understand the impact of the SCF barriers on the Indian banking sector, it is essential to analyze their significance. The study uses the BWM approach to model SCF barriers within the banking industry, demonstrating how understanding barriers can improve the efficiency and productivity of SCF in the banking industry.

Keywords- Supply Chain Finance, Barriers, Banking Industry, Best-Worst Method (BWM)

Table of Contents

Acknowledgements	11
Candidate's Declaration	III
Certificate by the Supervisor	IV
Abstract	V
List of Tables	VII
List of Figures	IX
List of Symbols, Abbreviations and Nomenclature	X
Chapter 1: Introduction	1
1.1 Supply Chain Finance	1
1.2 Physical and Financial Supply Chain	2
1.3 Research Gap	1 2 3 4
Chapter 2: Literature Review	4
2.1 Supply Chain Finance Framework	4
2.2 Barriers of Supply Chain Finance adoption	5
2.2.1 Technological Barriers	5
2.2.2 Organizational Barriers	6
2.2.3 Finance Related Barriers	6
2.2.4 Market and Policy Related Barriers	6
2.3 Research Methodology	11
2.4 Framework	12
2.5 Technology and Information Related Barrier(TIB)	27
2.6 Finance and Security Related Barrier(FSB)	28
2.7 External and Organizational Barrier (EOB)	29
Chapter 3: Formulation of the problem and solution approach	31
3.1 Method Selection	31
3.2 Best Worst Method	31
3.2.1 BWM algorithm	32
3.3 AHP	33
3.3.1 AHP algorithm	33
3.4 Application of BWM for ranking of barriers to SCF adoption	36
in Banking Industry	
Chapter 4: Comparison of BWM result using AHP	43
4.1 Application of the AHP for validation of results of BWM	43
Chapter 5: Results and Discussion	47
Chapter 6: Conclusions, Limitations and Future Scope	49
References	51

LIST OF TABLES

Table No.	Title	Page no.
Table 2.1	List of all the barriers of SCF adoption from past research	7
Table 2.2	Selection of barriers for study	13
Table 2.3	Selection of final barriers for study	26
Table 3.1	The Criteria and Sub-Criteria of the Barriers of SCF adoption in Banking Industry	36
Table 3.2	CI values of BWM	33
Table 3.3	RI values of AHP	35
Table 3.4	The vector of pairwise comparisons between the best and worst performers of Sub-Criteria TIB	37
Table 3.5	The vector of pairwise comparisons between the best and worst performers of Sub-Criteria FSB	38
Table 3.6	The vector of pairwise comparisons between the best and worst performers of Sub-Criteria EOB	39
Table 3.7	The vector of pairwise comparisons between the best and worst performers of Criteria	39
Table 3.8	Ksi* and CR value of criteria	41
Table 3.9	The Barriers' Final Ranking of Supply Chain Finance adoption in Banking Industry	41
Table 4.1	Pairwise comparison between TIB Sub-Criteria	43
Table 4.2	Pairwise comparison between FSB Sub-Criteria	43
Table 4.3	Pairwise comparison between EOB Sub-Criteria	44

Table 4.4	Pairwise comparison between Major Criteria	44
Table 4.5	Normalized comparison matrix between TIB Sub-criteria	44
Table 4.6	Normalized comparison matrix between FSB Sub-criteria	44
Table 4.7	Normalized comparison matrix between EOB Sub-criteria	45
Table 4.8	Normalized comparison matrix between Major-Criteria	45
Table 4.9	Consistency Ratio	45
Table 4.10	The Barriers' Final Ranking of Supply Chain Finance adoption in Banking Industry using AHP	46

LIST OF FIGURES

Figure No.	Title	Page No.
Figure 1.1	Financial supply chains are a ubiquitous feature of supply networks running parallel to physical supply chain (Rhian Silvestro et.al 2013)	3
Figure 2.1	The framework of supply chain finance (Rhian Silvestro et.al 2013)	5
Figure 3.1	(a) The weight of each primary criteria according to considered barriers. (b) The weight of each sub-criteria of the EOB according to considered barriers. (c) Each sub-criteria's weight in TIB according to considered barriers. (d) Each sub-criteria's weight in FSB according to considered barriers.	42

List of Abbreviations

Abbr	eviations
SCF	Supply Chain Finance
SME	Small and Medium Enterprises
MSME	Micro Small and Medium Enterprises
TIB	Technology and Information Related Barrier
FSB	Finance and Security Related Barrier
EOB	External and Organizational Barrier
ROI	Return on Investment
KYC	Know Your Customer
AML	Anti-Money Laundering
SC	Supply Chain
BWM	Best-Worst Method
AHP	Analytical Hierarchy Process

CHAPTER-1

INTRODUCTION

Supply chain finance, or SCF, is a method by which an external service provider and two or more supply chain partners work together to plan, direct, and regulate the movement of financial resources across organizational boundaries in order to produce value.(Hofmann et al., 2019). It is situated where supply chain management, finance, and logistics converge. SCF first appeared in supply chain management literature and subsequently attracted more attention from scholars following the financial chaos brought on by the 2008 global financial crisis. (Chakuu et al., 2019)

Supply Chain Finance (SCF) is a crucial strategy that creates a robust, value-based ecosystem through cooperation and technology. The complex nature of worldwide trade, where purchasers seek extended credit durations and providers anticipate timely payments, reverberate along the entire supply chain, resulting in ineffective procedures and financial strain. By viewing the supply chain as an interconnected network where financial movements relate to material and information flows, supply chain finance (SCF) goes beyond standard financial transactions.

SCF sees the supply chain as an integrated network where financial movements are interconnected with flow of material and information, surpassing the conventional paradigm of discrete financial transactions (Pfohl & Gomm, 2009).

1.1 Supply Chain Finance

Supply chain finance refers to the answers to optimize and balance working capital in supply chains and develop it in cooperation between buyers and suppliers in SC (

Gelsomino et al. 2016). Sustainable in the sense of sustainable development is development that meets the demand of the present without compromising the ability of future generations to meet their own demand.

Supply Chain Finance is designed to align the flow of material, finance, and information. Not only is it becoming a buzzword among academics and practitioners, but it is also viewed as a phrase describing how to manage and control financial flows within one SC as a sub-discipline(Hofmann, 2005; Pfohl and Gomm, 2009; Bryant and Camerinelli, 2014; Liebl et al. 2016).

1.2 Physical and Financial Supply Chain

The supply chain is a complex network involving various processes and activities aimed at delivering products or services from suppliers to end consumers. This network can be broadly categorized into two interlinked components: the financial and the physical supply chain.

Physical Supply Chain: The physical supply chain involves the actual transfer of goods, raw materials, and finished products from the point of start to the final destination. It encompasses processes like procurement, manufacturing, transportation, distribution, and retailing. (Chopra, S., & Meindl, P., 2016)

Financial Supply Chain: The supply chain finance focuses on the flow of funds and information associated with the physical transfer of goods. It includes financial processes such as payment, financing, and risk management to optimize cash flow and enhance financial efficiency (Van Hoek, R. I., 2019).

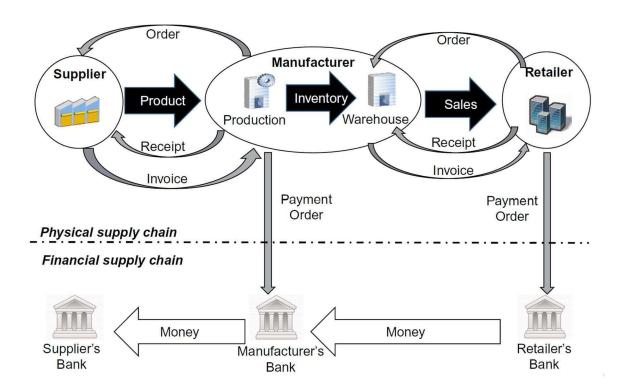


Fig.1.1 Supply networks that run concurrently with physical supply chains frequently include supply chain finance. (Rhian Silvestro et.al 2013)

1.3 Research Objective

- RO1- To identify Supply Chain Finance barriers in Banking industry in India
- RO2- To rank and assess the identified SCF barriers

CHAPTER-2

LITERATURE REVIEW

2.1 Supply Chain Finance Framework

It's the strategic use of financial tools and instruments to achieve chain efficiency and liquidity optimization. It is a mixture of factoring, reverse factoring, dynamic discounting and inventory financing among others. By merging financial processes with supply chain operations organizations can increase collaboration, reduce costs and manage risks. Key Components of the Supply Chain Finance Framework:

- 1. Working Capital Management: SCF is basically about efficient management of working capital. Businesses can optimize cash flow, shorten the cash conversion cycle, and improve liquidity through use of financial instruments. This ensures that companies are able to meet their short-term obligations while efficiently applying capital towards strategic initiatives (Ross et al. 2019).
- 2. Risk Mitigation: The SCF framework offers a structured way to recognize and mitigate risks in the supply chain. With the use of financial tools such as insurance, letters of credit as well as supply chain derivatives firms can hedge against disruptions, currency fluctuations and other uncertainties (Simchi-Levi et al. 2008)
- 3. Collaborative Relationships: Supply Chain Finance emphasizes collaboration among supply chain partners, fostering mutually beneficial relationships. The framework encourages transparency and trust through shared financial information, enabling suppliers and buyers to optimize terms, negotiate discounts, and create a more resilient supply chain ecosystem. (Monczka et. al,2015)

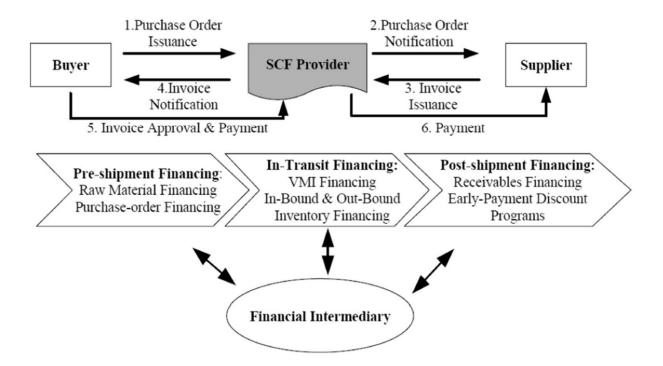


Fig. 2.1 The framework of Supply Chain Finance (Rhian Silvestro et.al 2013)

2.2 Barriers of SCF adoption

2.2.1 Technological Barriers

One selective example of a technology barrier (TB) is an integrated information system's inability to function properly, which can seriously impair SCs. (Mathiyazhagan et al. 2013) shown that a major TB limiting SMEs' cash flow is a lack of new technologies. SMEs are still lagging behind in addressing a variety of technological difficulties in global supply chains, despite the widespread use of new technologies (Childerhouse et al., 2003).

2.2.2 Organizational Barriers

Organizational barriers (OBs) have an impact on SMEs' SCF both directly and indirectly, particularly in developing nations like India. A group of OBs have been identified by (Patil et al., 2014) and (Prakash et al., 2015) as limiting the adoption of knowledge management (KM) and SCF processes.

2.2.3 Finance-Related Barrier

SCF's ultimate objective is to improve cash flows by taking into account information, goods, and financial movements along the chain. (Wuttke et al., 2013). Therefore, obstacles pertaining to finance that impede the seamless transfer of funds throughout the supply chain can be categorised as impediments to the implementation of SCF. In addition to these problems, the challenge of sourcing money coming from banks (Mangla et al., 2015).

2.2.4 Market and policy related barriers

SMEs' overall performance is hampered by a range of market and policy-related barriers (MPRBs) that hinder seamless SCF. According to Mudgal, one obstacle in SCs is a lack of understanding of market demand, which prevents SCFs from moving further. One policy obstacle that hinders the delivery of most critical SCF support is the absence of support and direction from regulatory authorities. For example, the Indian government has not provided policy assistance or guidance to the mining industry, which is the primary reason why international investors are unwilling to invest. This is also the case with SMEs.

Table 2.1- List of all the barriers of SCF adoption from past research

BARRIER	BARRIERS	REFERENCES
TYPE	DARRIERS	REFERENCES
TECHNO	 SMEs' insufficient technology infrastructure Blockchain system's limited speed and scalability Incompatibility of current technologies, old systems, and multiple blockchains SMEs' inability to streamline their payment and invoicing processes 	Kaur et al. (2022)
TECHNOLOGY AND INFORMATION RELATED BARRIERS	 An inadequate standardization and An inadequate infrastructure providers An inadequate integrated information system An inadequate new technology An inadequate technical assistance for suppliers Insufficient system for tracking item moves Slow process of payment and financial transaction 	Garg et al. (2022)
IATION RELATEI	 11. An inadequate technological system related to SCF 12. An inadequate technology in distribution, sourcing, and purchasing 13. computer breakdowns 14. Inadequate automation technology provided by outside parties 	Alora et al. (2019)
) BARRIER	15. MSMEs' low technological ability 16. A shortage of labour with the necessary skills to operate technology; and the expense of implementation	Gao et al. (2021)
S	17. An inadequate Technology trust18. Old and outdated technology still in use in the operation19. An inadequate automated payment transaction	Sahoo et al. (2021)

	Resistance to switching to new systems	Vous et al. (2022)
	2. An inadequate workforce specialized in	Kaur et al. (2022)
	Blockchain technologies	
	3. Problems in collaboration, communication, and	
	coordination in the supply chain	
	4. Inadequate information disclosure policy	
	between supply chain participants	
	5. Insufficient understanding of blockchain	
	C T CC :	
	6. Insufficient cooperation to establish a consortium blockchain	Alora et al. (2019)
		Alora et al. (2019)
	7. adoption are the scarcity of skilled labor	
	8. poor common vision of partners	
	9. employee chaos	Comp et al. (2022)
	10. perception of the management	Garg et al. (2022)
) R	11. quality of external relationships	
GA	12. OBs as SCF barriers in separate sites' incentive	
ORGANIZATIONAL BARRIER (OB)	programs and independent performance	
\mathbb{Z}_{ℓ}	measures	
	13. By delaying SCF procedures and the adoption	
	of knowledge management (KM)	
A	14. An inadequate proper organizational structure	
LH	15. Lack of knowledge of the best SCF practices	
	16. An inadequate co-ordination among SC	
RR	partners	
	17. An inadequate management focus on SCF	
R (initiatives	Sahoo et al.
l Of	18. An inadequate commitment from top	(2021)
<u> </u>	management	1 (2010)
	19. Lack of interest of top management in adopting	Alora et al. (2019)
	new processes	
	20. Lack of SCF training facility available for	C1 (2021)
	individuals	Chen et al. (2021)
	21. Shortage of SCF expertise for managing SCF	
	properly	
	22. An inadequate shared objectives	
	23. poor interaction between partners	Gao et al. (2021)
	24. An inadequate infrastructure considerations	
	25. An inadequate regulatory framework for	
	service sector	
	26. Complications of implementing CSR	
	(corporate social responsibility)	
	27. Internal conflict of interest	

	1. An inadequate funds and inflated costs at	Garg et al. (2022)
	various nodes of supply chains	
	2. Uncertain financial flows	
	3. Extended duration of sourcing	
	4. Purchasing and distributing among vendors	
	5. An inadequate third party financing	
	6. Extended trade credit durations	
	7. Suppliers' inadequate financial capacity	
	8. Lack of understanding of SCF results in lower	
	working capital and funding availability	
	9. fewer returns on investments	
	10. Lack of steady financial flow in the supply chain	Alora et al. (2019)
	11. difficulty in sourcing funds from financial	
日	institutions	
\geq	12. Variable exchange rates and inflation	
	13. The parties' unequal working capital situations.	Sahoo et al.
FINANCE RELATED BARRIER	14. The supply chain's inadequate management of	(2021)
2E	cash flow	(===1)
LA	15. Longer cash conversion cycle	
I	16. Supplier's poor financial condition	Kaur et al. (2022)
Ď	17. Significant initial financial investments for	120002 00 0010 (2022)
BA	energy and infrastructure	
R	18. An inadequate understanding of Costs, ROI and	
	financial losses	
R	19. Blockchain configuration decision	Pandharkar et al.
	20. An inadequate financial Resources, Complex	(2020)
	tax implications around the digital assets	(====)
	21. Audit concerns	
	22. High KYC costs	Gao et al. (2021)
	23. Accounting treatment: negative effect on loan	(=0=1)
	covenants and the company's leverage ratio	
	24. High Transaction costs	
	25. Grey transaction participants	Zheng et al.
	26. Flexibility in financing terms	(2022)
	27. Credit data barriers	Ioannou et al.
	28. The expense and difficulty of carrying out KYC	(2022)
	compliance and anti-money laundering (AML)	()
	processes processes	
	processes	

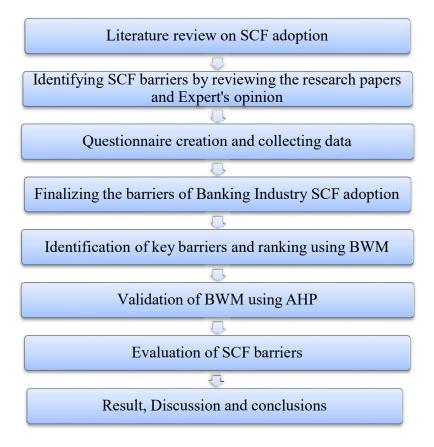
	 Data protection and privacy concerns Data security concerns 	Kaur et al. (2022)
SECURITY BARRIER	 Data integrity concerns Low security of credit data An inadequate integrity of credit history The need to stop providing false credit reports Risk of fraud 	Zheng et al. (2022) Ioannou et al.
	7. Risk of fluid	(2022)
EX	 Market rivalry and uncertainty of using Blockchain Technology Legal and regulatory challenges An inadequate qualified blockchain developers An inadequate Ecosystem collaboration with 	Kaur et al. (2022)
EXTERNAL BARRIER	blockchain5. Conflict of interest between nations6. Banking competition7. External quality evaluation	Gao et al. (2021)
ARRIER	8. Trade secrets9. Attracting investment10. Conflicts between supply chain partners11. Challenges arise due to the trans-boundary	Sahoo et al. (2021)
	trading system 12. Antisocial considerations 13. An inadequate collaborations for SCF	Chen et al. (2021) Garg et al. (2022)
MARKET AND	 Inadequate government regulations and SCF-friendly policies Suppliers' inadequate traditional SCF methods Issues with diverse cultures An inadequate market focus on SCF issues Vast geographic regions and difficulties 	Garg et al. 2022
ND POLICY RELATED BARRIER	 6. Rules and regulation by the government 7. An inadequate government regulations 8. An inadequate political coherence 9. Unstable political climate 10. Poor laws combined with insufficient government backing may make it difficult for 	Sahoo et al. (2021) Chen et al. (2021) Alora et al. (2019)
LATED	SCF adoption. 11. The cultural context 12. Modifications to regulations 13. The partners' geographical location.	

	1. A lack of communication between commercial	Garg et al. (2022)
Su	partners inside and outside the company	
Supply F	2. An inadequate quality material	
ly :	3. Lead time fluctuations and on-time delivery	
and Barri	4. An inadequate resources for SC management	
	5. An inadequate preparedness, An inadequate	
Supplier	eco-literacy among supply chain stakeholders	Ioannou et al.
lier	6. Lack of supply chain visibility	(
•		(2022)

2.3 Research Methodology

This research presents a three-phased strategic framework for SCF barrier assessment in banking industry. First phase demonstrates the identification and acknowledgment of the SCF Barriers. This is done by analyzing the research databases of SCF and available Literature and conducting surveys with a group of industry experts in the field of Banking Industry. In second phase all of the barriers that have been found are evaluated by assigning specific preference weights which is carried out by using the best worst method (BWM). In the third phase, the study is validated using AHP to justify its use and suitability of the technique. This assessment could have also been conducted with the help of other techniques like Fuzzy Analytical Hierarchy Process (AHP), and Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) etc., these methods involve several pairwise comparisons with large amounts of data usually required for frequent evaluations (Garg and Sharma, 2020). BWM generates better, more reliable results with less data to get around this.

2.4 Flowchart



This framework shows how the study was carried out, first this paper has did a thorough literature review on supply chain adoption. This paper has identified the SCF barriers by reviewing the research papers. After that this paper has created questionnaires and sent it to experts for their opinion and then the collected data from the responses and get from the experts. Then this study has finalized the barriers of SCF adoption in banking industry. This study has identified the key barriers and ranked them using BWM Technique. To validate the results from BWM this paper has used AHP.

Table 2.2- Selection of final barriers for study

1											
BARRIER TYPE	BARRIERS	Kaur et al. (2022)	Garg et al. (2022)	Alora et al. (2019)	Gao et al. (2021)	Sahoo et al. (2021)	Chen et al. (2021)	Ioannou et al. (2022)	Zheng et al. (2022)	Pandharkar et al. (2020)	Barrier Frequency
1	SMEs' insufficient technology infrastructure	✓	~	~	V	V					5
ECHNOLO	Blockchain system's limited speed and scalability	✓									1
TECHNOLOGY AND INFORMATION RELATED B	Incompatibility of current technologies, old systems, and multiple blockchains	✓									1
RMATION RE	SMEs' inability to streamline their payment and invoicing processes	√				√					2
ELATED BARRIERS	An inadequate standardization An inadequate infrastructure providers	√	√	√			√				4
	An inadequate integrated information system		~								2
	An inadequate new technology	√	√	√							3

BARRIER TYPE	BARRIERS	Kaur et al. (2022)	Garg et al. (2022)	Alora et al. (2019)	Gao et al. (2021)	Sahoo et al. (2021)	Chen et al. (2021)	Ioannou et al. (2022)	Zheng et al. (2022)	Pandharkar et al. (2020)	Barrier Frequency
	An inadequate technical assistance for suppliers	V	V	V	V	V					5
	Insufficient system for tracking item moves		V								1
	Lengthy financial transactions and payment processes		√								1
	An inadequate a SCF-related technological system	√	✓	✓	√	√					5
	An inadequate technology in distribution, sourcing, and purchasing	√	✓	✓	✓	✓					5
	computer breakdowns			√							1
	Inadequate automation technology provided by outside parties	√	✓	✓	✓	✓					5
	MSMEs' low technological ability,	V	V	V	V	✓					5
	A shortage of labour with the	✓	√	√							3

BARRIER TYPE	BARRIERS	Kaur et al. (2022)	Garg et al. (2022)	Alora et al. (2019)	Gao et al. (2021)	Sahoo et al. (2021)	Chen et al. (2021)	Ioannou et al. (2022)	Zheng et al. (2022)	Pandharkar et al. (2020)	Barrier Frequency
	necessary skills to operate technology; and the expense of implementation An inadequate Technology trust	√	✓	✓	~	✓					5
	Old and outdated technology still in use in the operation	√	✓	√	✓	√					5
	An inadequate automated payment transaction	✓	•	•	•	~					5
ORG	Resistance to switching to new systems	√				√					2
ANIZATIONAL BARRIER	An inadequate workforce specialized in Blockchain technologies	√	√	√							3
AL BARRIER	Problems in collaboration, communication, and coordination in the supply chain	√					√				2

BARRIER TYPE	BARRIERS	Kaur et al. (2022)	Garg et al. (2022)	Alora et al. (2019)	Gao et al. (2021)	Sahoo et al. (2021)	Chen et al. (2021)	Ioannou et al. (2022)	Zheng et al. (2022)	Pandharkar et al. (2020)	Barrier Frequency
	Inadequate information disclosure policy between supply chain participants	√	✓	✓			✓				4
	Insufficient understanding of blockchain	✓	√								2
	Insufficient cooperation to establish a consortium blockchain	√					√				2
	adoption are the scarcity of skilled labor	✓		✓							2
	poor common vision of partners	✓	√	✓			√				4
	employee chaos perception of the management		√	√ ✓	✓		✓				3 2
	quality of external relationships			√							1
	OBs as SCF barriers in separate sites' incentive programs and independent performance measures		√								1

BARRIER TYPE	BARRIERS	Kaur et al. (2022)	Garg et al. (2022)	Alora et al. (2019)	Gao et al. (2021)	Sahoo et al. (2021)	Chen et al. (2021)	Ioannou et al. (2022)	Zheng et al. (2022)	Pandharkar et al. (2020)	Barrier Frequency
	By delaying SCF procedures and the adoption of knowledge management (KM)	✓	✓								2
	An inadequate proper organizational structure		√	√	√		√				4
	Lack of knowledge of the best SCF practices		✓								1
	An inadequate co-ordination among SC partners	✓	✓	✓	✓	✓	✓				6
	An inadequate management focus on SCF initiatives		√	√							2
	An inadequate commitment from top management		√	√							2
	Lack of interest of top management in adopting new processes	✓				✓					2
	An inadequate SCF training facility			√			√				2

	T							1	1		
BARRIER TYPE	BARRIERS	Kaur et al. (2022)	Garg et al. (2022)	Alora et al. (2019)	Gao et al. (2021)	Sahoo et al. (2021)	Chen et al. (2021)	Ioannou et al. (2022)	Zheng et al. (2022)	Pandharkar et al. (2020)	Barrier Frequency
	available for individuals										
	Shortage of SCF expertise for managing SCF properly	✓	*	*			~				4
	An inadequate shared objectives	✓	√	√			√				4
	poor interaction between partners	√	√	√			√				4
	An inadequate infrastructure considerations	√	√	√			✓				4
	An inadequate regulatory framework for service sector		✓	V			V				3
	Complications of implementing CSR (corporate social responsibility)		√	√	√		√				4
	Internal conflict of interest			√	√						2
FINANCE RELATED BARRIER	An inadequate funds and inflated costs at various nodes of supply chains	√	√	√		√					4
~ U m	Uncertain financial flows		√	✓		√					3

BARRIER TYPE	BARRIERS	Kaur et al. (2022)	Garg et al. (2022)	Alora et al. (2019)	Gao et al. (2021)	Sahoo et al. (2021)	Chen et al. (2021)	Ioannou et al. (2022)	Zheng et al. (2022)	Pandharkar et al. (2020)	Barrier Frequency
	Extended duration of sourcing		√								1
	Purchasing and distributing among vendors	√	√	√		√					4
	An inadequate third party financing		√								1
	Extended trade credit durations		✓								1
	Suppliers' inadequate financial capacity	√	✓	✓		✓					4
	Lack of understanding of SCF results in lower working capital and funding availability		✓								1
	fewer returns on investments		✓								1
	Lack of steady financial flow in the supply chain		√	√		√					3
	difficulty in sourcing funds from financial institutions		√	√		√					3
	Variable exchange rates and inflation			√							1

BARRIER TYPE	BARRIERS	Kaur et al. (2022)	Garg et al. (2022)	Alora et al. (2019)	Gao et al. (2021)	Sahoo et al. (2021)	Chen et al. (2021)	Ioannou et al. (2022)	Zheng et al. (2022)	Pandharkar et al. (2020)	Barrier Frequency
	The parties' unequal working capital situations.	√	√	√		√					4
	The supply chain's inadequate management of cash flow		√	√		√					3
	Longer cash conversion cycle					√					1
	Supplier's poor financial condition	✓	√	√		√					4
	Significant initial financial investments for energy and infrastructure	✓									1
	An inadequate understanding of Costs, ROI and financial losses	✓	√	√		√					4
	Blockchain configuration decision	✓					√				2
	An inadequate financial Resources, Complex tax implications	✓	✓	√		√		✓		√	6

BARRIER TYPE	BARRIERS	Kaur et al. (2022)	Garg et al. (2022)	Alora et al. (2019)	Gao et al. (2021)	Sahoo et al. (2021)	Chen et al. (2021)	Ioannou et al. (2022)	Zheng et al. (2022)	Pandharkar et al. (2020)	Barrier Frequency
	around the digital assets										
	Audit concerns									√	1
	High KYC costs	✓						✓		√	3
	Accounting treatment:				✓						1
	negative effect on loan covenants and the company's										
	leverage ratio										
	High Transaction costs				√						1
	Grey transaction participants				√						1
	Flexibility in financing terms				√						1
	Credit data barriers								✓		1
	The expense and difficulty of carrying out KYC compliance and anti-money laundering (AML) processes	√						√		√	3
SEC URIT Y	Data protection and privacy concerns	√						√			2

		1	1		1				I	1	
BARRIER TYPE	BARRIERS	Kaur et al. (2022)	Garg et al. (2022)	Alora et al. (2019)	Gao et al. (2021)	Sahoo et al. (2021)	Chen et al. (2021)	Ioannou et al. (2022)	Zheng et al. (2022)	Pandharkar et al. (2020)	Barrier Frequency
	Data security concerns	✓									1
	Data integrity concerns	✓							✓		2
	Low security of credit data								√		1
	An inadequate integrity of credit history	✓							√		2
	The need to stop providing false credit reports							√			1
	Risk of fraud	✓						✓			2
	Market rivalry and uncertainty of using Blockchain Technology	✓	✓								2
EXTERN	Legal and regulatory challenges	√									1
NAL BARRIER	An inadequate qualified blockchain developers	√	√								2
UER	An inadequate Ecosystem collaboration with blockchain	✓	√								2
	Conflict of interest between nations				√						1

BARRIER TYPE	BARRIERS	Kaur et al. (2022)	Garg et al. (2022)	Alora et al. (2019)	Gao et al. (2021)	Sahoo et al. (2021)	Chen et al. (2021)	Ioannou et al. (2022)	Zheng et al. (2022)	Pandharkar et al. (2020)	Barrier Frequency
	Banking competition				~						1
	External quality evaluation				√						1
	Trade secrets				√						1
	Attracting investment					√					1
	Conflicts between supply chain partners	√	√	√	√	√	√				6
	Challenges arise due to the trans-boundary					✓					1
	Antisocial considerations			✓	✓		✓				3
	An inadequate collaborations for SCF	√	√								2
MARK REL.	Inadequate government regulations and SCF-friendly policies		✓	✓		✓	✓				4
ARKET AND POLICY ELATED BARRIER	Suppliers' inadequate traditional SCF methods		√								1
OLIC RIER	Issues with diverse cultures		√								1
X	An inadequate market focus on SCF issues		✓								1

		K	G	>	G	Š	Ω	Io	Z	Pa	В
BARRIER TYPE	BARRIERS	Kaur et al. (2022)	Garg et al. (2022)	Alora et al. (2019)	Gao et al. (2021)	Sahoo et al. (2021)	Chen et al. (2021)	Ioannou et al. (2022)	Zheng et al. (2022)	Pandharkar et al. (2020)	Barrier Frequency
	Vast geographic regions and difficulties		√	√							2
	Rules and regulation by the government		√			√	√				3
	An inadequate government regulations		√			√	√				3
	An inadequate political coherence						√				1
	Unstable political climate						✓				1
	Poor laws combined with insufficient government backing may make it difficult for SCF adoption.		√	✓		√	√				4
	The cultural context			✓							1
	Modifications to regulations			✓							1
	geographical location of partners		✓	✓							2
SUPPLY AND SUPPLIER BARRIER	A lack of communication between commercial partners inside	✓	✓								2

BARRIER TYPE	BARRIERS	Kaur et al. (2022)	Garg et al. (2022)	Alora et al. (2019)	Gao et al. (2021)	Sahoo et al. (2021)	Chen et al. (2021)	Ioannou et al. (2022)	Zheng et al. (2022)	Pandharkar et al. (2020)	Barrier Frequency
	and outside the company										
	An inadequate quality material		✓								1
	Lead time fluctuations and on-time delivery		√								1
	An inadequate resources for SC management		✓								1
	An inadequate preparedness		✓								1
	Lack of supply chain visibility							√			1
	An inadequate eco-literacy among supply chain stakeholders		✓								1

Table 2.3- Selection of final barriers for study

BARRIER TYPE	BARRIER	DESCRIPTION	References
Technology and Information	An inadequate technological system and poor technological capability of MSMEs and SMEs A shortage of labor with the necessary skills to operate	The lack of technological capability of MSMEs and SMEs is one of the key barriers to innovation that they come across. MSMEs and SMEs often lack the skilled individuals needed to run	Kaur et al. (2022) Garg et al. (2022) Alora et al. (2019) Gao et al. (2021) Sahoo et al. (2021) Chen et al. (2021) Kaur et al. (2022) Garg et al. (2022) Alora et al. (2019)
Related Barrier(TIB)	technology and the expense of implementation	technology.	Gao et al. (2021) Sahoo et al. (2021)
	An inadequate Infrastructure and regulatory framework for service sector	Inadequate relationships between organizations can be an important barrier to adoption.	Kaur et al. (2022) Garg et al. (2022) Alora et al. (2019) Gao et al. (2021) Sahoo et al. (2021)
	Lack of financial resources, suppliers and poor financial condition	Insufficient financial resources represent the main barrier to adopting SCF methods across all industries.	Kaur et al. (2022) Garg et al. (2022) Alora et al. (2019)
Finance and Security Related	Parties' unbalanced working capital positions	An excess or overworking capital position is indicative of mishandled inventory, inadequate terms of payment, and delays.	Kaur et al. (2022) Garg et al. (2022) Alora et al. (2019) Sahoo et al. (2021) Ioannou et al. (2022) Pandharkar et al. (2020)
Barrier(FSB)	Data protection and Data Security concerns	Its design presents certain basic issues regarding privacy. The transparency of the network and the user's anonymity. It results in participants in the supply chain will only be willing to	Kaur et al. (2022) Ioannou et al. (2022) Zheng et al. (2022)

		provide information that	
		provide information that is sensitive to business.	
	A		
	An inadequate	Partners should agree on	
	proper	the SCF implementation's	
	organizational structure and shared	*	
		objectives, such as quick	
	objectives	and easy settlements and	
		transparency, otherwise	
		they might be unwilling to execute it.	
	Conflicts between		
		Supply chain finance can	
	supply chain	be hampered by friction	
	partners	between suppliers and retailers. Banks are	
		reluctant to offer loans	Kaur et al. (2022)
		that depend on the	Garg et al. (2022)
		seamless cooperation of	Alora et al. (2019)
		partners not only due to	Gao et al. (2021)
		unsettled disputes over	Sahoo et al. (2021)
		pricing, quality and	Chen et al. (2021)
		delivery delays but also	
External and		because of this mistrust	
Organizational		which arises from them.	
barrier(EOB)	An inadequate	The bank avoiding the	
	government	implementation of SCF	
	regulations and	is the uncertainty of	
	unstable political	government laws and	
	climate	political volatility. If no	Garg et al. (2022)
		rules are set, and the	Alora et al. (2019)
		market can change any	Sahoo et al. (2021)
		second due to some other	Chen et al. (2021)
		factors or players, the	(')
		bank cannot risk	
		investing money in that	
		scenario.	
	A lack of	Ineffective partner	V (4 -1 (2022)
	communication	communication can	Kaur et al. (2022)
	between	result in complicated	Garg et al. (2022)
	commercial	adoption	Alora et al. (2019)
	partners inside and	misunderstandings.	Gao et al. (2021)
	outside the		Sahoo et al. (2021)
	company		Chen et al. (2021)

The summary in Table 2.2 shows many of the barriers are shared by the findings of various researchers. The barriers that seriously restrict the adoption of SCF in the banking sector are identified based on the results of this literature analysis and discussions with the experts. The specifics of several criteria and their sub-criteria are covered in detail in the following sub-criteria.

2.5 Technology and Information Related Barrier (TIB)

2.5.1 An inadequate technological system and poor technological capability of MSMEs and SMEs

The lack of technological capability of MSMEs and SMEs is one of the key barriers to innovation that they come across. SCF implementation requires IT ability, which raises the installation expenses significantly. India's general technological infrastructure is still in its early stages. As a result, the infrastructure needed to support blockchain in Indian SMEs and MSMEs can be both expensive and limited. For blockchain technology to be implemented successfully, a strong internet connection is essential, yet in many areas of the nation, data infrastructure is not well-developed.

2.5.2 A shortage of labor with the necessary skills to operate technology and the expense of implementation

MSMEs and SMEs often lack the skilled individuals needed to run technology. Skilled personnel are needed to run and oversee IT-based programmes and solutions. The main element of SCM needs to be understood as the human components, which include labour, skill, experience, and their relationship. Members of the organisation should be knowledgeable and experienced in sustainability, however they are not.(Jalali et al., 2022)

2.5.3 An inadequate Infrastructure and regulatory framework for service sector

Inadequate relationships between organizations can be an important barrier to adoption. To achieve desired financial performance, supply chain finance strategies should be strategically connected with entire business strategy.

2.6 Finance and Security Related Barrier (FSB)

2.6.1 Lack of financial resources and suppliers poor financial condition

Insufficient financial resources represent the main barrier to adopting SCF methods across all industries. The effective application of SCF depends on finance. One of the biggest challenges is to implementing SCF practices in any sector is the lack of funding.

2.6.2 Parties' unbalanced working capital positions

An excess or overworking capital position is indicative of mishandled inventory, inadequate terms of payment, and delays. Companies operating in a competitive market must set their prices at or below the going rate. Due to the higher cost of green and sustainable products, companies are reluctant to adopt sustainable supply chain management techniques in an effort to maintain their market position.

2.6.3 Data protection and Data Security concerns

Its design presents certain basic issues regarding privacy. The transparency of the network and the user's anonymity. It results in participants in the supply chain will only be willing to provide information that is sensitive to business.

2.7 External and Organizational Barrier (EOB)

2.7.1 An inadequate proper organizational structure and shared objectives

Partners should agree on the SCF implementation's objectives, such as quick and easy settlements and transparency, otherwise they might be unwilling to execute it.

2.7.2 Conflicts between supply chain partners

Supply chain finance can be hampered by friction between suppliers and retailers. Banks are reluctant to offer loans that depend on the seamless cooperation of partners not only due to unsettled disputes over pricing, quality and delivery delays but also because of this mistrust which arises from them.

2.7.3 An inadequate government regulations and unstable political climate

The bank avoiding the implementation of SCF is the uncertainty of government laws and political volatility. If no rules are set, and the market can change any second due to some other factors or players, the bank cannot risk investing money in that scenario.

2.7.4 A lack of communication between commercial partners inside and outside the company

Ineffective partner communication can result in complicated adoption misunderstandings. SC partners' lack of shared interest in implementing SCF. The move to sustainable techniques is influenced by suppliers' unwillingness to give up on traditional methods. The adoption of environmentally friendly methods by the supply chain network is dependent upon the willingness of its suppliers to provide environmentally friendly raw materials.

CHAPTER-3

METHOD SELECTION AND MODEL FORMATION

3.1 Method Selection

As mentioned before, BWM is used to evaluate the ranking of preference for Supply Chain Finance barriers. BWM is relatively a new technique proposed by Jafar Rezaei (2016). Best-Worst Method is a quantitative method

3.2 Best-Worst Method

According to BWM, the decision-maker first determines which criteria are the best (e.g., most significant, and most desirable) and which are the worst (e.g., least significant and least desirable), Next, pairwise comparisons are performed between the other criteria and each of these two criteria (best and worst). Finally, A maximin problem is to be formulated and solved to establish the weights of many criteria. (Rezaei et al. 2014).

The key advantages of BWM over other current MCDM techniques are that (1) It needs fewer comparison data; and (2) It produces more constant comparisons, leading to more reliable conclusions.

3.2.1 BWM Algorithm

- 1. Define the set of criteria : Define all the criteria concerned with your choice. That is suppose C be the set of them, then $C = \{c1, c2, ..., cn\}$.
- 2. Identify the best and the worst critera: According to your opinion, determine the most and least important critera and state it is denoted by the best and worst, as a notation.
- 3. Make pairwise comparison:
- Best-to-Others (BO): Make a comparison between the best criterion, b, and the othres, ci which in order to express the preference of i through a scale such as 1 ~
 9. The comparison can be a vector, BO = (b over c1, b over c2, ..., b over cn).
 - Worst-to-Others (WO): Compare all criteria (c_i) with the worst criterion
 (w) using the scale, indicating your preference for c_i over w. This creates a
 vector WO = (c₁ over w, c₂ over w, ..., c_n over w).

4. Calculate the weights:

- 1. Define a weighting vector (w) where each element (w_i) represents the weight of a criterion (c_i).
- 2. Formulate an optimization problem where the objective function is minimization of the maximal absolute difference between the values from calculated vector and the values obtained from BO and WO.

Mathematically:

minimise ξ

subjected to:

$$|A * w - BO| \le \xi |w - WO| \le \xi$$

w sum = 1 (weights sum to 1)

 $w_i \ge 0$ (all weights are non-negative)

where:

- 1. ξ is a slack variable representing the maximum deviation.
- 2. A is a comparison matrix where each element (a_{ij}) represents the comparison value between criterion (i and j). A is diagonally filled with 1s and populated based on BO and WO vectors.
- 5. Solve the optimization problem: Use linear programming techniques to solve the optimization problem and obtain the weight vector (w). These weights represent the relative importance of each criterion in your decision-making process.

Evaluate alternatives (optional): If you have alternative options to choose from, score each alternative against each criterion based on a defined scale. Multiply these scores with the corresponding criteria weights (from step 5) and sum them up for each alternative. The alternative with the highest score is considered the best option based on the weighted criteria.

Table 3.1- CI values of BWM

n	1	2	3	4	5	6	7	8	9
CI	0	0.44	1.00	1.63	2.30	3.00	3.73	4.47	5.23

3.3 AHP

Decision-makers can quickly assign importance to coefficients and compare alternatives by using pair-wise comparisons [Attribute vs Attribute], which are used to compare alternatives with respect to multiple parameters and evaluate their relative weights. Its hierarchical structure allows it to be used to any volume of data to address decision-making problems (Bhattacharjee et al. 2023). According to Sharma et al. It is more beneficial to rank the factors that affect new technology adoption by experts' preferences to enable organizations to better comprehend the adoption scenario and decide which barriers are more crucial when making an adoption choice. The weights are determined by applying Saaty's Analytic Hierarchy Process (AHP) approach (satty et al. 1990). AHP is a model that was developed for subjective decision-making in a hierarchical structure. It is useful for addressing complex issues involving judgments and perceptions from people (James et al. 2020). Thus the paper has used AHP methodology to validate the results from BWM

3.3.1 AHP Algorithm:

- 1. Define the problem: Identify the goal, criteria ($C = \{c_1, c_2, ..., c_n\}$), and a set of alternatives ($A = \{a_1, a_2, ..., a_m\}$).
- 2. Construct pairwise comparison matrices:
 - Criteria comparisons: Create a square matrix (n x n) where each element
 (a_{ij}) represents the relative importance of criterion i compared to criterion
 j. Use a scale (e.g., 1-9) where 1 indicates equal importance and higher
 values indicate stronger preference for the row criterion over the column
 criterion. The matrix should be reciprocal (a_{ij} = 1/a_{ii} for all i ≠ j).
 - 2. Alternative comparisons: For each criterion, create a comparison matrix where each element (a^{ik_j1}) represents the relative performance of

alternative k against alternative l for criterion i. Use the same scale as for criteria comparisons.

3. Calculate weights:

1. Criteria weights: For the criteria comparison matrix, calculate the eigenvector corresponding to the largest eigenvalue (λ_{max}). Normalize the eigenvector elements to obtain the weights (w) for each criterion. Consistency check: Calculate the Consistency Index (CI) using λ_{max} and the matrix size (n). Then Consistency ratio (CR) is calculated. A CR less than 0.1 indicates acceptable consistency in judgments. If not, revise your comparisons.

b.

Mathematical Expressions:

- 1. A = Criteria comparison matrix
- 2. λ_{max} = Largest eigenvalue of A
- 3. w = Normalized eigenvector corresponding to λ_{max}
- 4. $CI = (\lambda_{max} n) / (n 1)$
- 5. CR = CI/RI

Table 3.2- RI values of AHP

n	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

3.4 Application of BWM for ranking of barriers to SCF Adoption in Banking Industry

The weights in BWM were given after talking an expert opinion from 20 banking expert using a survey. Those values the used in BWM solver in excel and weights were calculated.

The meaning of the numbers 1-9 when comparing best to others and others to worst is:

- 1: Equally-important
- 2: Somewhere between Equal & Moderate
- 3: Moderately more importance than
- 4: Somewhere between Moderately and Strong
- 5: Strongly more importance than
- 6: Somewhere between Strong and Very strong
- 7: Very strong important than
- 8: Somewhere between Very strong and absolutely strong
- 9: Absolute more important than

Table 3.3- The Criteria and Sub-Criteria of the Barriers of SCF adoption in Banking Industry

Criteria	Code	Sub-Criteria			
	TIB1	An inadequate technological system and poor technological capability			
Technology and Information Related	TIB2	An inadequate Infrastructure and regulatory framework for service sector			
Barrier(TIB)	TIB3	A shortage of labour with the necessary skills to operate technology; and the expense of implementation			
Finance and Security Related Barrier(FSB)	FSB1	An inadequate financial resources and suppliers poor financial condition			

	FSB2	Parties' unbalanced working capital positions		
	FSB3	Data protection and Data Security concerns		
	EOB1	An inadequate proper organizational structure and shared objectives		
External and	EOB2	Conflicts between supply chain partners		
Organizational barrier(EOB)	EOB3	An inadequate government regulations and unstable political climate		
	EOB4	A lack of communication between commercial partners inside and outside the company		

Table 3.1 shows the Criteria i.e TIB, FSB and EOB and their Sub-Criteria of the Barriers of SCF adoption in Banking Industry.

Table 3.4- The vector of pairwise comparisons between the best and worst performers of Sub-Criteria TIB

No. of Criteria- 3	Criteria-1	Criteria-2	Criteria-3
Names of Criteria	TIB1	TIB2	TIB3
Select the Best	TIB1		
Select the Worst	TIB3		
Best to Others	TIB1	TIB2	TIB3
TIB1	1	3	5
Others to the Worst	TIB3		

TIB1	5		
TIB2	3		
TIB3	1		
Weights	TIB1	TIB2	TIB3
	0.6444444	0.2444444	0.11111111

Table 3.4 shows the vector of pairwise comparisons between the best and worst performers of Sub-Criteria TIB. The table shows that the weight obtained from BWM of TIB1,TIB2 and TIB3 are 0.644, 0.244 and 0.111 respectively.

Table 3.5- The vector of pairwise comparisons between the best and worst performers of sub-criteria FSB

No. of Criteria- 3	Criteria-1	Criteria-2	Criteria-3
Names of Criteria	FSB1	FSB2	FSB3
Select the Best	FSB3		
Select the Worst	FSB2		
Best to Others	FSB1	FSB2	FSB3
FSB3	2	4	1
Others to the Worst	FSB2		
FSB1	2		
FSB2	1		
FSB3	4		
Weights	FSB1	FSB2	FSB3
	0.28571429	0.14285714	0.57142857

Table 3.5 shows the vector of pairwise comparisons between the best and worst performers of Sub-Criteria FSB. The table shows that the weight obtained from BWM of FSB1,FSB2 and FSB3 are 0.285, 0.143 and 0.571 respectively.

Table 3.6- The vector of pairwise comparisons between the best and worst performers of sub-criteria EOB

No. of Criteria- 4	Criteria-1	Criteria-2	Criteria-3	Criterion 4
Names of Criteria	EOB1	EOB2	EOB3	EOB4
Select the Best	EOB2			
Select the Worst	EOB4			
Best to Others	EOB1	EOB2	EOB3	EOB4
EOB3	3	1	2	7
Others to the Worst	EOB4			
EOB1	4			
EOB2	8			
EOB3	6			
EOB4	1			
Weights	EOB1	EOB2	EOB3	EOB4
	0.18446602	0.48058252	0.27669903	0.05825243

Table 3.6 shows the vector of pairwise comparisons between the best and worst performers of Sub-Criteria TIB. The table shows that the weight obtained from BWM of EOB1, EOB2, EOB3 and EOB4 are 0.127, 0.318, 0.501 and 0.052 respectively.

Table 3.7- The vector of pairwise comparisons between the best and worst performers of Criteria

No. of Criteria- 3	Criteria-1	Criteria-2	Criteria-3
Names of Criteria	TIB	FSB	EOB
Select the Best	EOB		
Select the Worst	FSB		
Best to Others	TIB	FSB	EOB
EOB	8	9	1
Others to the Worst	FSB		
TIB	2		
FSB	1		
EOB	9		
Weights	TIB	FSB	EOB
	0.10833333	0.08333333	0.80833333

Table 3.7 shows the vector of pairwise comparisons between the best and worst performers of the criteria. The table shows that the weight obtained from BWM of TIB, FSB and EOB are 0.108, 0.083 and 0.808 respectively. From the above data from the table, BWM is applied and ranking of the selected barriers were calculated as shown in Table 3.9.

Table 3.8- Ksi* and CR value of criteria

Criteria	Ksi*	CR=Ksi*/CI
Main-Criteria	0.058	0.058
Sub Criteria of TIB	0.088	0.088
Sub Criteria of FSB	0	0
Sub Criteria of EOB	0.0728	0.044

Table 3.9- The Barriers' Final Ranking of Supply Chain Finance adoption in Banking Industry

Major	Weight	of	Sub-	Local	Global Weight	Final
Criteria	Major		Criteria	weight		Rank
	Criteria					
TIB	0.108		TIB1	0.644	0.6955	1
			TIB2	0.244	0.0263	7
			TIB3	0.111	0.0119	9
FSB	0.083		FSB1	0.2857	0.0237	8
			FSB2	0.1428	0.0118	10
			FSB3	0.5714	0.0474	5
EOB	0.808		EOB1	0.184	0.1486	4
			EOB2	0.4805	0.388	2
			EOB3	0.2767	0.223	3
			EOB4	0.0582	0.047	6

The table 3.9 shows the final rank of the barriers based on the global weight of the criteria. The table shows the weights of major criteria and global weight. Based on the global weights the ranking is given. The TIB1that is 'An inadequate technological system and poor technological capability of MSMEs and SMEs' is given the first rank because the weight of the TIB1 is maximum among others.

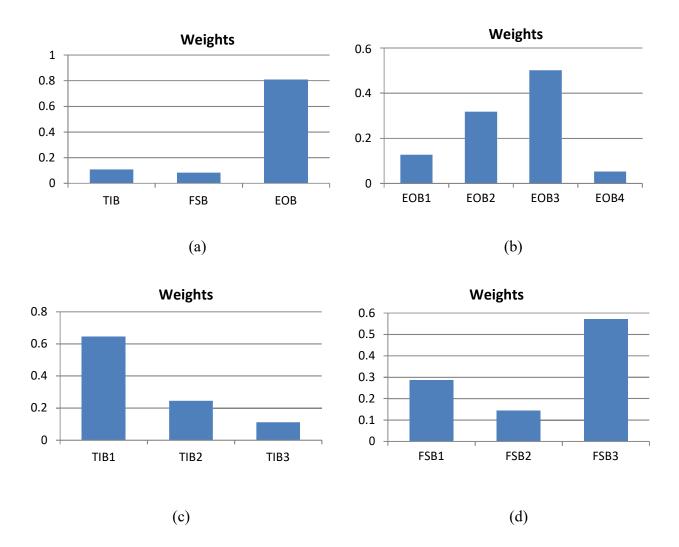


Fig.3.1 (a) The weight of each primary criteria according to considered barriers. (b) The weight of each sub-criteria of the EOB according to considered barriers. (c) Each sub-criteria's weight in TIB according to considered barriers. (d) Each sub-criteria's weight in FSB according to considered barriers.

The above graph represents the weights of each of the primary criteria and sub-criteria according to considered barriers

CHAPTER-4

COMPARISON OF BWM RESULT USING AHP

4.1 Application of the AHP for validation of results of BWM

Initially a pairwise comparison matrix is formed between the sub-criteria and main criteria. After that the Normalized comparison matrix is formed which gave the weights of each of the sub-criteria and Major-criteria. After Normalized comparison matrix, Consistency ratio is calculated. The consistency ratio below 0.1 is considered optimal. The consistency ratio of all the criteria is below 0.1 which shows that the result of this paper is consistent.

Table 4.1 Pairwise comparison between TIB Sub-Criteria

	TIB1	TIB2	TIB3
TIB1	1.00	3.00	5.00
TIB2	0.33	1.00	2.00
TIB3	0.20	0.50	1.00
	1.53	4.50	8.00

Table 4.1 shows the pairwise comparison between the Sub-criteria of Technology and Information related barrier (TIB)

Table 4.2 Pairwise comparison between FSB Sub-Criteria

	FSB1	FSB2	FSB3
FSB1	1.00	2.00	0.50
FSB2	0.50	1.00	0.25
FSB3	2.00	4.00	1.00
	3.50	7.00	1.75

The above table shows the pairwise comparison between the Sub-criteria of Finance and Security related barrier (FSB)

Table 4.3 Pairwise comparison between EOB Sub-Criteria

	EOB-1	EOB-2	EOB-3	EOB-4
EOB-1	1.00	0.25	0.20	5.00
EOB-2	4.00	1.00	0.50	9.00
EOB-3	5.00	2.00	1.00	9.00
EOB-4	0.20	0.11	0.11	1.00
	10.20	3.36	1.81	24.00

The above table shows the pairwise comparison between the Sub-criteria of External and Organizational Barrier (EOB)

Table 4.4 Pairwise comparison matrix between Major Criteria

	TIB	FSB	EOB
TIB	1.00	2.00	9.00
FSB	0.50	1.00	9.00
EOB	0.11	0.11	1.00
	1.61	3.11	19.00

The above table shows the pairwise comparison between the Major Criteria

Table 4.5 Normalized comparison matrix between TIB Sub-criteria

	TIB1	TIB2	TIB3	weight
TIB1	0.652174	0.666667	0.625	0.648
TIB2	0.217391	0.222222	0.25	0.23
TIB3	0.130435	0.111111	0.125	0.122
				1

Table 4.6 Normalized comparison matrix between FSB Sub-criteria

	FSB-1	FSB-2	FSB-3	weight
FSB-1	0.285714	0.285714	0.285714	0.286
FSB-2	0.142857	0.142857	0.142857	0.143
FSB-3	0.571429	0.571429	0.571429	0.571
				1

Table 4.7 Normalized comparison matrix between EOB Sub-criteria

	EOB-1	EOB-2	EOB-3	EOB-4	weight
EOB-1	0.098039	0.07438	0.110429	0.208333	0.122796
EOB-2	0.392157	0.297521	0.276074	0.375	0.335188
EOB-3	0.490196	0.595041	0.552147	0.375	0.503096
EOB-4	0.019608	0.033058	0.06135	0.041667	0.038921
					1

Table 4.8 Normalized comparison matrix between Major-Criteria

	TIB	FSB	EOB	weight
TIB	0.62069	0.642857	0.473684	0.579077
FSB	0.310345	0.321429	0.473684	0.368486
EOB	0.068966	0.035714	0.052632	0.052437
				1

Table 4.9 Consistency Ratio

0.00318
0
0.05748
0.0465

The consistency ratio shows whether the data is consistent or not. The value of consistency ratio close to 0 is considered consistent.

Table 4.10 The Barriers' Final Ranking of Supply Chain Finance adoption in Banking Industry using AHP

Major Criteria	Weight of Major Criteria	Sub- Criteria	Local weight	Global Weight	Final rank
TIB	0.579	TIB1	0.648	0.37519	1
		TIB2	0.23	0.13317	3
		TIB3	0.122	0.07064	5
FSB	0.368	FSB1	0.286	0.10525	4
		FSB2	0.143	0.05262	6
		FSB3	0.571	0.21013	2
EOB	0.052	EOB1	0.123	0.0064	9
		EOB2	0.335	0.01742	8
		EOB3	0.503	0.02616	7
		EOB4	0.039	0.00203	10

The table 4.10 shows the final rank of the barriers based on the global weight of the criteria. The table shows the weights of major criteria and global weight. Based on the global weights the ranking is given. The TIB1that is 'An inadequate technological system and poor technological capability' is given the first rank because the weight of the TIB1 is maximum among others.

CHAPTER-5

RESULTS AND DISCUSSION

Table 3.9 provides the weight of major criteria and local and global weights of Sub-Criteria. Global weight was obtained by multiplying the respective local weights of sub-criteria to their Major Criteria's weights. These global weights served as the basis for ranking these sub-criteria.

As shown in the table above, among the main barriers of SCF adoption in Banking Industry the EOB (External and Organizational barrier) was first place with a 0.808 importance weight. The TIB (Technology and Information Related Barrier) criteria with an significance weight of 0.108, was ranked second, the FSB (Finance and Security Related Barrier) criterion with an significance weight of 0.083 was ranked third.

Table 3.9 "Local Weight" column indicates, the sub-criteria TIB1 (An inadequate technological system and poor technological capability), the sub criterion FSB3 (Data protection and Data Security concerns), the sub criterion EOB2 (Conflicts between supply chain partners) were the most important sub-criteria of each of the main criteria respectively. Based on local weight, Figure 3.1 displays the weights assigned to each of the primary criteria's sub-criteria.

The final weights of the sub-criteria are shown in Table 3.9; these weights were established using the BWM technique to acquire the local weights of the sub-criteria and the weights of the major criterion. Among 10 sub-criteria, 3 sub-criteria TIB1 (An

inadequate technological system and poor technological capability), EOB2 (Conflicts between supply chain partners) and EOB3 (An inadequate government regulations and unstable political climate) are ranked from first to third with an importance weights of 0.6955, 0.388 and 0.223, respectively.

The impact and relative significance of SCF barriers on the banking industry are difficult to understand, but using the BWM technique to rank these barriers makes more sense because it helps decision-makers make well-informed choices about how to evaluate these barriers.

The result of the work indicate that the TIB1 (An inadequate technological system and poor technological capability of MSMEs and SMEs) are the significant in nature and have attained highest preference weight of 0.6955. It suggests that Technology and Information related barrier are the main factors of the inefficiencies and challenges faced in the banking industry.

It results to the fact that TIBs needs quick management considerations in order to their impact can be counter-balanced.

To validate the results obtained from BWM we have used AHP. We can see from the table that the results from both the MCDM techniques have given first rank to TIB1 (An inadequate technological system and poor technological capability of MSMEs and SMEs) . Hence we can say that the result obtained from the BWM is accurate

CHAPTER-6

CONCLUSIONS, LIMITATIONS AND FUTURE SCOPE

6.1 Conclusions, Limitations, and Future scope

To get past the unexpected occurrence disrupting SCF in banking industry, in this research, we have selected and ranked the barriers in order of criticality because it is important to examine the many types of barriers. Technology and Information are necessary for supply chains at every stage, so it is impossible to deny that TIBs are the most important. In conclusion, bank executives and governments must pay special attention to TIBs since they are the most active and significant barriers to the growth of the Indian banking sector.

The BWM method is used in this article to rank the SCF barriers in the Indian banking sector. The current study aims to assess major SCF barriers with regard to banks. Because the experts on the panel are from the same region, the study relies on their opinions to gather information that is specific to the Indian context. Because the study's findings are the product of experts' understanding and judgement, they could not be free from bias. The study's expert panel consisted of a small number of participants; larger numbers may be included in future studies to yield more comprehensive results.

Future empirical research must be done to identify the barriers more thoroughly or to provide solutions or strategies for overcoming them. The present paper examines the barriers related to SCF adoption in the. As a result, the current study allows additional

SCF barriers to be considered in future studies, thus improving the framework. For similar problems, many MCDM approaches can be used, like VIKOR, ANP, DEMATEL, and TOPSIS. In subsequent research, the outcomes and findings can be compared. Furthermore, research in the future can concentrate on how these obstacles affect the banking sector.

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Α	A+	A+	A+		17	9.00	
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IEM5404: INDUSTRY 4.0 & SMART MANUFACTURING

IEM5304: International Logistics and Warehouse Managment

IEM502	IEM504	IEM5404	IEM5304	IEM5210	TC	SGPA	Papers Failed
4	4	4	3	2			
F	F	F	F	F	0	0.00	IEM502IEM504, IEM5404, IEM5304, IEM5210,
0	B+	A+	Α	0	17	8.71	
0	B+	Α	Α	A	17	8.24	
B+	В	В	В	В	17	6.24	
Α	С	Α	B+	A+	17	7.24	
A+	B+	0	A+	A+	17	8.76	
0	0	0	0	0	17	10.00	
A+	Α	Α	A+	A+	17	8.53	
A+	Α	0	0	A+	17	9.18	
Α	Α	0	A+	A	17	8.65	
A+	B+	Α	Α	A	17	8.00	
0	B+	A+	A+	A	17	8.65	
A+	A+	A+	A+	A+	17	9.00	

s/course code/title should be brought to the notice of Controller of Examination/OIC B.tech(Eve.) within 15 days of declaration of result , in the prescribed proforma.

y Madhukar Cherukuri , OIC (Results) loaded from http://exam.dtu.ac.in

Controller Of Examination

<u>k</u>

THE RESULT OF THE CANDIDATE WHO APPEARED IN THE FOLLOWING EXAMINATION HELD IN NOV 2023 IS DECLARED AS UNDER:-

Master of Technology(Industrial Engineering and Management), III-SEMESTER

Result Declaration Date : ... Notification No: 1660

OIC (Results)

Controller of Examination

THE RESULT OF THE CANDIDATE WHO APPEARED IN THE FOLLOWING EXAMINATION HELD IN NOV 2023 IS DECLARED AS UNDER:-

Master of Technology(Industrial Engineering and Management), III-SEMESTER

Result Declaration Date : 04-03-2024

IEM601 : MAJOR PROJECT I IEM6201 : E- Commerce IEM6303 : Knowledge Management IEM6405 : Advanced Operation Research

Sr.No	Roll No.	Name of Student	IEM601	IEM6201	IEM6303	IEM6405	SGPA	тс	Failed Courses
31.110	KOII NO.	Name of Student	3.00	2.00	3.00	4.00	SGFA	10	
1	2K22/IEM/02	AMAN MAAN	B+	0	Α	A+	8.42	12	
2	2K22/IEM/03	ANIKET MODI	B+	Α	B+	Α	7.5	12	
3	2K22/IEM/04	ASHISH MALHOTRA	B+	Α	С	В	6.33	12	
4	2K22/IEM/05	HAMISH ALI	B+	A+	В	B+	7.08	12	
5	2K22/IEM/06	KAMALDEEP SAHU	B+	A+	В	A+	7.75	12	
6	2K22/IEM/07	KUMAR AMIT	A+	0	0	0	9.75	12	
7	2K22/IEM/08	LAKSHYA SAINI	A+	A+	B+	A+	8.5	12	
8	2K22/IEM/09	SAMIR KUMAR	B+	A+	Α	Α	7.92	12	
9	2K22/IEM/10	SHEETAL SHARMA	B+	A+	В	Α	7.42	12	
10	2K22/IEM/11	SHUBHAM SAURABH	B+				7.25	12	
11	2K22/IEM/12	SUBADEEP DAS	Α	A+	В	A	7.67	12	
12	2K22/IEM/13	VATAN SINGH	Α	0	Α	A+	8.67	12	

OIC (Results)

Controller of Examination

Notification No: 1660

BRIEF PROFILE / CV

Shubham Saurabh +91 9852668595

Shubham2330@gmail.com

EDUCATION

M.TECH(Industrial Engineering andManagement)	2022-2024	Delhi Technological University, New Delhi	78.8 % (Pursuing
B.TECH(Mechanical Engineering)	2015-2019	DIT University, Dehradun	69.4%
CBSE (Class XII)	2015	DAV Public School	84.4 %
CBSE (Class X)	2013	DAV Public School	91.2 %

INDUSTRIAL EXPOSURES

BHEL, Haridwar

May 2018-June 2018

Plant overview-Learnt about the various functions of the manufacturing of steam turbine parts

Mother Dairy Plant, New Delhi

Plant Overview-Purification and Homogenization of token milk

ACADEMIC PROJECT

Experimental investigation on Heat Transfer enhancement using inserts

- · An experimental investigation on the perforated conical inserts for friction factor and heat transfer enhancement. Exploratory Data Analysis of IPL Players
- Using Predictive analysis, predicting the price of IPL players using Ms. Excel and Python

Case study: DELL Inc. improving flexibility of a Desktop PC supply chain

ACADEMIC ACHIEVEMENTS AND AWARDS

- GATE Oualified 2020
- Secured Second position in water rocket competition in DTU
- Recipient of MHRD scholarship being a GATE qualified candidate

TECHNICAL SKILLS

Technical Skills- Power BI, Excel, QM, Technical Analysis in Stock Market

Position of Responsibility

- Technical Analysis stock training.
 Attended workshop on Vehicle Overhauling.

(UDEMY) (PRIGMA)

Global Online Course on Competing in Business through AI-Powered Supply Chains 2022.(NITIE Mumbai & BITS Pilani)

CERTIFICATIONS

Teaching Assistant-During my M.Tech., I performed the necessary tasks to help the concerned faculty member. Helped the teacher administer and grade quizzes and exams for about 200+ students. Aided the department's newlyaccepted students in both academic and extracurricular areas.

Coursework Information

Subjects- Data Analytics | Supply Chain Management and Analytics | Production and Operation Management | Total

Management | Industry 4.0 and Smart Manufacturing | Operations Research | International Logistics and Warehousing