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INDUSTRIAL SECTOR'S CRITICAL RISK FACTORS: AN ANALYSIS

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Abstract

The industrial sector is one of the vital sectors that contributes to the country's economic growth. There is increasing attention towards project management to serve the diverse demands of the customers and for sustainable industrial growth. One of the fundamental knowledge areas in project management is "Risk Management (RM)." For leveraging performance and ensuring sustainable growth, identification of critical risks and effective RM implementation is of utmost importance. However, in today's survival of the fittest industrial techno-economic scenario, despite the known field, RM has not got full attention, especially in the context of Small and Medium Enterprises (SME's) across sectors. Traditionally risk is analyzed in the context of finance and safety only. For sustainable growth, equal focus on risk assessment and RM in other aspects is of paramount importance. This paper seeks to explore the Critical Risk Factors (CRFs) along with barriers for RM implementation in construction, manufacturing, and software industries by an in-depth review of 44 published articles. The paper presents various tools/techniques applied by researchers, enlists risk factors within the sector, and reveals challenges or barriers for RM implementation in a specific context. This article provides valuable insights into the RM domain by unfolding critical areas of concern for developing proactive risk mitigation strategies and way forward to future research conduct.

Keywords: Critical Risk Factors (CRFs), Risk Management (RM).

1. INTRODUCTION

Today's world is marked by increasing competitiveness in all sectors. To survive the competition and to get an edge over other industries for achieving sustainability, companies are adopting various methodologies. With increasing complexities, the sources of risk have also increased. One important tool towards sustained performance is undertaking projects [1] Existing uncertainties including external and internal disturbances hinder ongoing activities and deviates firms from their objectives. RM is key knowledge area in project management. Risk is defined by as "an uncertain event or condition that, if it occurs, has a positive or negative effect on the organization's objectives [2]." Risk influences the objectives of the ongoing activities and affects tasks that lined up. Therefore, it is essential to manage the risks which negatively impact even though its complete elimination is impossible. The impact of various types of risk can range from negligible to severe depending upon its magnitude and linkage with other risks. Risk identification is of utmost importance as no proactive measure is possible for unknown, invisible risks [3]. Various risks once identified, need proper proactive risk management plan in place to avoid its adverse effects. It is conceivable to adopt RM effectively to minimize the negative impact of these uncertainties.

Authors [4], in their investigations, found that effective RM practices contribute to increase in competitiveness. Researchers
[5] in the survey research found that organizations with matured RM processes positively influence towards attainment of objectives and lead towards greater operational excellence. Risk Management applications across the industry will protect and leverage business performance [6]. Active RM practices address and assure required industrial sustainability and greening [7]. It is essential to boost employee motivation [8] and create safety awareness, which in turn reduces industrial occupational risks [9]. Authors [10] have emphasized on growing importance of human safety consideration early in the design phase. Various articles unfolded the positive correlations between manufacturing RM integrated with supply chain RM and other allied domains with business performance [11]– [16].

Industrial sector includes manufacturing industries which transforms raw material into finished products for end use and construction industries which involves infrastructure building and development. In the upcoming industry 4.0 scenario, both domains increasingly utilizing software for enhancing product and process qualities. Manufacturing, construction, and software are vital sectors and are linked directly to the GDP of any country. Successful and consistent growth in each industry ensures the countries' growth trajectory.

Despite tremendous progress in theory and applications of process control strategies, embarrassing setbacks still exist at odds [17]. In the happening context of Industry 4.0, with the integration of numerous technologies and concepts, researches in progress reveal multiple risk sources [18], [19]. Authors
[20] presented RM application on the Internet of Things (IoT) and highlighted its importance for the manufacturing industry. The inability to foresee benefits and high costs involved in implementation limits the majority of organizations, especially SME's from setting RM practices and integrating them into routine/ formal processes [6]. The author [4] concluded that RM is an issue for SMEs because of scant resources and full- fledged and matured RM practices more likely to exist in larger sized industries. The bulk of organizations still depends upon the heuristic approach in dealing with risks, and RM

processes are still unstructured [21] Most organizations in the manufacturing sector strive to incorporate ISO 9001 based on Quality Management Systems (QMS) [22]. Although risk management is addressed in ISO 9001, still, categories of risksto be considered and managed are unclear [23] recommended that the use of the ISO 31000 standard framework [24], which is dedicated to RM, will be useful for the mitigation of unacceptable risks.

Despite the known domain, identification of CRFs and approach towards systematic and proactive mitigation remains a hurdle/ pain area for organizational management. This paper addresses this issue by identifying CRFs in the industrial sector.

This article relies on secondary data from articles published in reputed journals available online platforms across the globe to identify critical risk factors, challenges, and success factors for managing risk in various sectors. This article is organized into seven sections. Section 2 describes the paper objectiveand methodology adopted, followed by a descriptive analysis of the systematic literature review. Section 3, 4, and 5 reports scenario in Construction, Manufacturing, and Software sectorsrespectively and tabulate critical findings extracted from the literature database. Section 6 derives discussion and future research directions. Section 7 summarizes the results.

2. RESEARCH DESIGN

2.1. Research objective: Based on the preface, the articleseeks to assess the current RM scenario in various sectors and to identify, analyze significant risk factors, challenges/barriers.

2.2. Research methodology: Published articles were downloaded based on title and keyword searches on various search engines and web pages of journals. The search was carried on Google scholar and Scopus with search string: (‘Project Risk’ OR ‘Risk’, OR ‘CRF’) AND (‘Industry’, OR ‘SME’, OR ‘Manufacturing’, OR ‘Construction’, OR ‘Software’). After carefully reading abstracts of all downloaded articles, only those articles were retained, which matches the topic under study consideration. We have read each selected article in-depth. Review note for each paper was made for different categories like Author, Year of Publication, Objective of the study, Industry/sector type, Success factors, Major challenges/ barriers for RM implementations, conclusion/ understanding, and tools used. Articles were categorized sector-wise to get a full understanding of risk management scenarios in various sectors. The flowchart in figure no. 1 below shows the process followed. The following charts in figure no. 2 and 3 show publisher wise and sector-wise articles reviewed. Citation count to date for each article obtained from the google scholar database. Quality assessment for papers selected and reviewed for this study carried out by analyzing this citation database. 75 % of the articles reviewed have more than six citations, indicating the acceptance of papers by other researchers. Among the articles referred, 75 % of articles are published after 2012. It indicates that recent articles are applied for this study to incorporate the latest trends in the RM domain.

Fig. 1. Flowchart

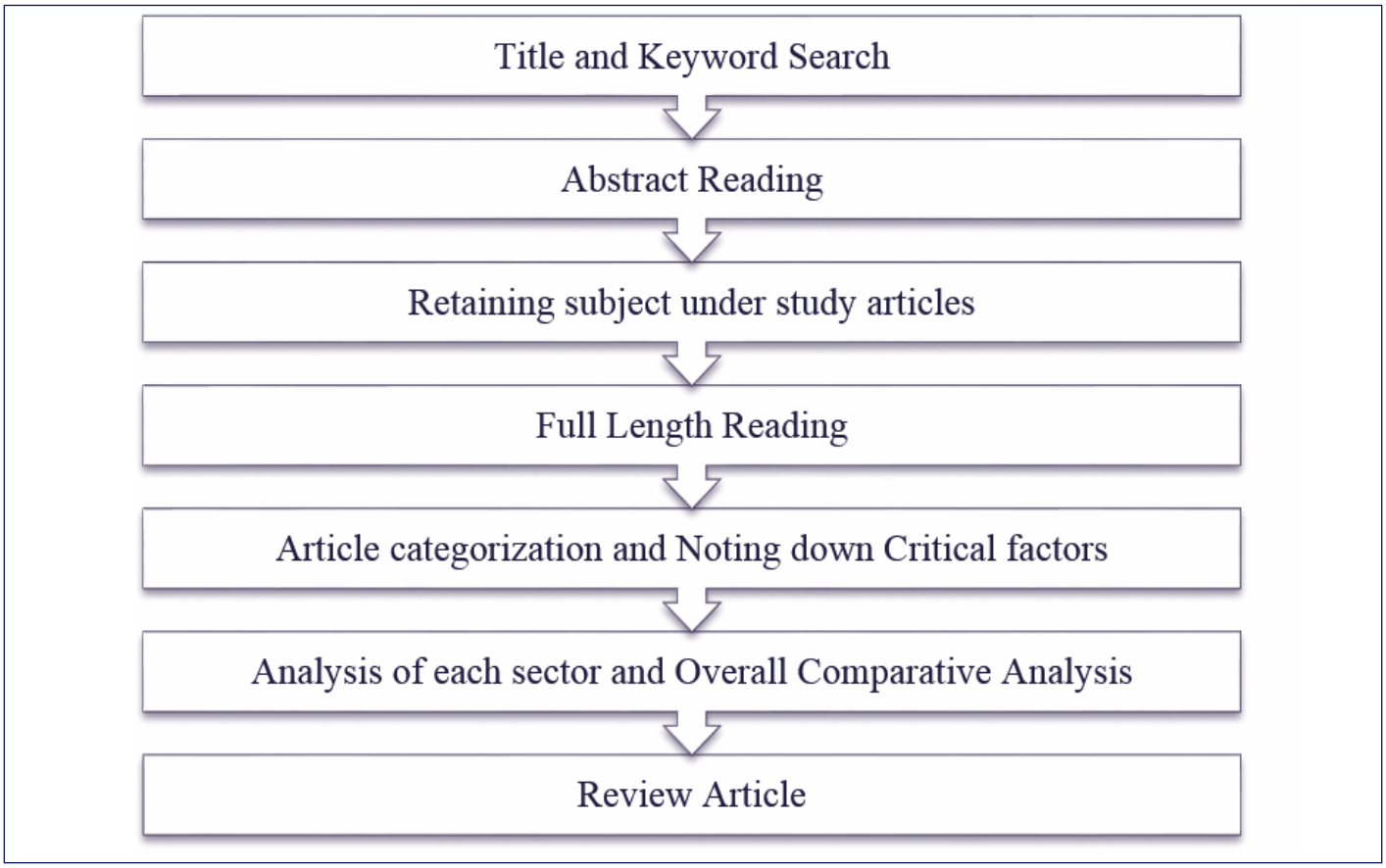


Fig. 2. Publisher wise analysis

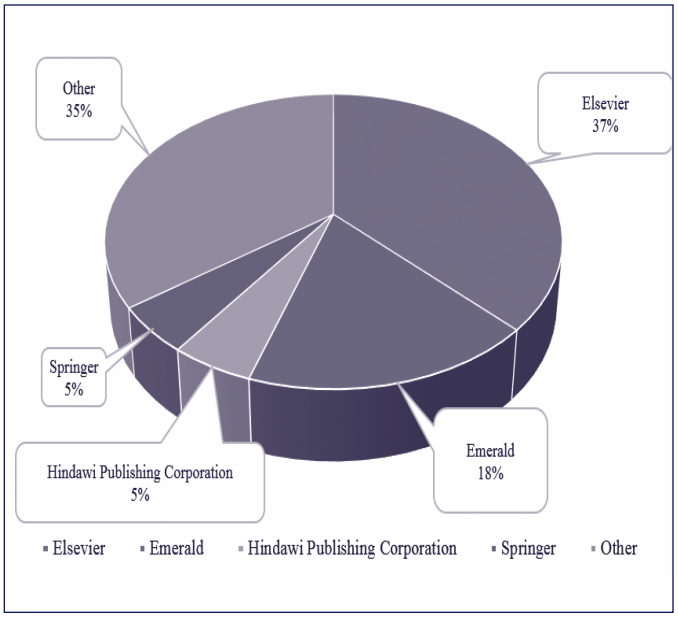
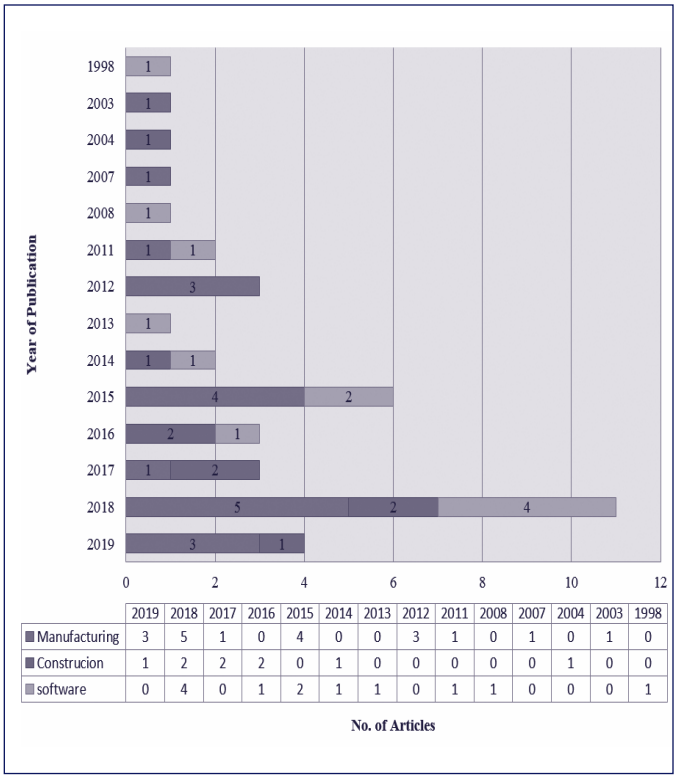


Fig. 3. Sector-wise reviewed literature



	2019	2018	2017	2016	2015	2014	2013	2012	2011	2008	2007	2004	2003	1998
Manufacturing	3	5	1	0	4	0	0	3	1	0	1	0	1	0
Construcion	1	2	2	2	0	1	0	0	0	0	0	1	0	0
software	0	4	0	1	2	1	1	0	1	1	0	0	0	1

3. SCENARIO IN CONSTRUCTION SECTOR

The construction sector is one of the vital industries across the globe in the past and will remain so in coming many more years. This sector always monitored by dedicated ministries of various states and countries as it has numerous and varied associated activities. The performance of the construction sector largely contributes to the economy of any country. Unwanted setbacks are not unexpected and surprising even though there are the latest developments over the years in the field.

The majority of the article reviewed during the literature survey followed a systematic process. The authors have carried out structured and semi-structured interviews with field expertise. The majority of authors validated their findings through various qualitative and quantitative tools and techniques, whereas few of them presented case studies. In light of risk assessment research, authors [25] have presented various risk analysis tools and techniques (RATT) from previously published literature in construction projects. A conceptual model for the selection of risk analysis tools and techniques in Build Operate and Transfer projects (BOT), presented. S. Deep et al. [26] have identified trust, commitment, and reliability as the enablers of collaboration. The author has concluded that considering these enablers will prevent the breach in partnership and thus enhancing project productivity.

A standard limitation of these studies includes limited articles reviewed and small sample size while validating findings. It averts the generalization of the outcomes and limits research impact.

RM and performance management are allied fields of studies and integration of Key Risk Indicator (KRI), and Key Performance Indicator (KPI) requirements coupled with Business Process Management (BPM) will lead to leverage organizational performance [18] Authors T. K. Leong et al. [27] found that there is a significant and impactful correlation of client satisfaction and time variance with the Quality Management System (QMS). The fuzzy multi-criteria approach was adopted by researchers [28] for analysis of sustained and viable manufacturing in the cement industry using the interpretive structural model (ISM) by highlighting the interrelationship between KPIs. Authors [29] practiced Balance Score Card (BSC) as a tool to measure and manage firms' performance. The researcher [30] has reviewed the crucial factors affecting performance management and an appraisal from published literature. S. H. Mai and J. Wang [31], in their article, surveyed experienced participants in EPC hydropower construction using a checklist method for assessing risk along with its impact level on the construction process. Researchers [32] have presented fundamental criteria and evolution of project success and project management success with Risks, changes, and constraints in 3D coordinate system. D. Danesh et al. [33] kept the prime focus on review and compilation of Project Portfolio Management (PPM) decision making challenges and classification of decision-making techniques. Key challenge explained by the author is sensitivity analysis, dependencies, decision traceability, simplicity, quantitative and qualitative techniques, number of projects, trade-offs, group decision making, and hierarchical structure. The authors concluded that finding the ideal PPM MCDM technique(s) is a strenuous task.

It is perceptible from the above paragraph that there is an ardent need to integrate RM and Performance Management along with industry-specific customized tools to anticipate the outcome of this integration.

Table 1 below presents aggregate information on Risk Factors and Challenges in the construction sector.

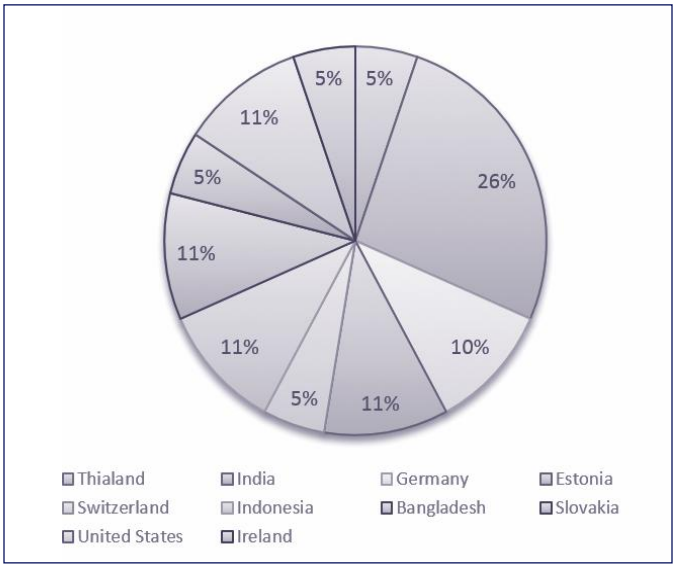
Table 1: Scenario in the Construction sector

Tools/Techniques	**Risk Factors and Challenges / Barriers**	**Authors**
Reviews of relevant kinds of literature and a conceptual model for selecting risk management process for Build-Operate-Transfer (BOT) projects	• Political risks; • Construction completion risks; • Operating risks; • Finance risks; • Legal risks.	[25]
Literature review, questionnaire survey	----------	[27]
ISM, Fuzzy Analytic Network Process (FANP)	To obtain sustainable manufacturing in cement industries	[28]
BSC (Balance Score Card) BSC designer (performance management software)	Weak use of PM Technique, Traditional (financial) performance management systems	[29]
On-site interviews, Checklist method	Poor Quality in engineering, Procurement, and construc-tion	[31]
Literature Review on Project Success and Project Management Success, Project management success enhancement model, Risks, changes and constraints in the 3D coordinate system	Linking project success and project management success	[32]
Literature Review of papers published	• Sensitivity analysis/uncertainty treatment • Dependencies identification • Decision traceability • The tendency of using a simple decision-making model • Quantitative and qualitative measures • Number of projects • Trade-offs/conflict in project selection and prioritization • Group decision making • Hierarchical structure	[33]
Literature review, questionnaire survey	----------	[30]
• Keyword-based search • Title/abstract/content analysis (Nvivo 12) • Endnote reference management software • Keyword co-occurrence network visualization • Text frequency query	• Unfair risk allocation • The commitment of parties to a contract • Reliability of subcontractor/supplier • Offshore procurement risks • Financial risk • Logistical risks • Inventory risks • Arm's length relationship, Communication Failures, Breach of trust • Regionalism, Profit Margins, Opportunism, Force Ma-jeure, Socio-Political Scenario, Communication • Failure, Competence and Project Complexity are the collaboration constraints	[26]

4. SCENARIO IN MANUFACTURING SECTOR:

The manufacturing sector remains the core and critical sector in developed as well as a developing country, which contributes to GDP growth and a prime indicator of the economic performance of any country. With a large number of activities, process and their dependencies within and outside, it is a tedious task to remain distant from adverse effects of risk which organization is facing or unaware of. Besides, there are global and local factors that contribute to the deviation of the industry from its goals. Figure 4 shows a country-specific percent contribution of articles selected for the study.

Fig. 4. Country-wise reviewed articles within the Manufacturing Sector



4.1. SME's context: Small and Medium-Sized Enterprises (SMEs) are the mainstay of any developing country. Over the years, the RM theory is well developed, but SMEs are still struggling to find its cost-effective implementation [6]. A rather significant number of SMEs are still ignorant about plus points of having RM implementations. Also, they are reluctant to appoint dedicated, trained RM certified professionals. It is a known fact that SMEs extend their efforts just to fulfill minimum regulatory requirements to incorporate RM activities because of the cost involved and the inability to foresee advantages of RM. Various studies carried out to explore the opportunity of RM implementation in SMEs. After reviewing previous literature author [34] has identified the highest priority as success factors rated through responses as meeting quality standards and specifications while clear goals/objectives and senior management support judged to be the essential success factors. SMEs that give importance to the timeline as their success criterion are more likely to have successful projects. Also, the firms with full-time project manager and proper project planning techniques in place are probably most successful. In their article, the author [17] has presented the ongoing scenario of risk management practices in manufacturing industries. This study reveals that the recognition of operational risks is substantially weak in industries. Mangers are not well versed with the latest tools and techniques to manage risks. The

4.2. authors have developed the Operational Risk Management Index (ORMI) framework to increase the performance level concerning RM. Researchers [35] after empirical investigation and SME's response to the standard questionnaire and upon further analysis author concluded that internal disturbance of employee absenteeism occurs most frequently, whereas tool shortage rarely occurs in the cases studied. The author has ranked delayed supply by regular suppliers as inimical immediately followed by 'demand fluctuation' and 'competition' as the most external disturbance. 'financial obstacles' found to be less harmful to SMEs. The revealed set of internal and external disturbance draws immediate attention of top management toward them to mitigate its negative impact.

K. Mahmood et al. [36], in their paper has mentioned the ept of Virtual Enterprise for SMEs. For small enterprises, i.e., grouping with other enterprises is known as the 'virtual enterprise' (VE). The authors described Fault Tree Analysis (FTA) and matrix diagram for VE, which shows the risks & its impact as well as the probability of risk occurrence. There is tremendous scope for making RM a reality in the SME context. Cost-effective approaches, development of tools for training and upskilling professionals, and, more importantly, setting benchmarks, making SMEs believe in positive outcomes after RM implementation is a way forward.

4.3. Tools and Techniques applied: Numerous tools are used by researchers to arrive at a conclusion and interpret complex interdependencies. The authors [37] utilized Data Envelope Analysis (DEA) to reveal the productivity of engineering projects based on identified input and output variables during the case study. In the research, authors [38] have implemented the risk assessment approach and FMEA techniques, which evaluates as a system, product/ process design, actual process, or service for understating how failure is possible. Authors

[39] have used techniques like ISM and MICMAC analysis, which provides the optimum solution to minimize the risks. The author explained that for future research, researchers could use some other methods like structural equation modeling (SEM), Multi-Criteria Decision Making (MCDM) techniques like (ANP and AHP). S. Luthra et al. [40], in their study, tried to establish the linkage between hurdles in implementing Sustainable Supply Chain Management (SSCM) in the Indian automobile sector using ISM methodology. Researchers [41] mentioned that the large size of the matrix formation ISM method could be used with other software for better results. The methods used in this research paper are the Delphi method, House of Risk (HOR), ISM, Aggregate Risk Potential, Risk Priority Number (RPN). Authors [42] have identified barriers and identified their interdependencies using ISM, MICMAC analysis. [43] After explaining the importance of supplier selection, in order to make the best choice out of available alternatives, suggested the method known as TOPSIS, which shows two ideal solutions as positive & negative. The author

[44] utilized the Fuzzy Analytic Network Process (ANP) method to analyze the current performance level and highlight the areas for improvement in order to achieve sustainable maintenance after taking appropriate action. Several studies [3], [45] demonstrated in their article, dependence and driving

power diagram of risk categories in international projects by ISM Methodology along with MICMAC Analysis. The authors formulated various strategies using the TOWS matrix to overcome the risks. There are a significant number of statistical and Multi-Criteria Decision Making (MCDM) tools are utilizedby numerous researchers. The generalization of findings is stilla matter of concern.

4.4. General approaches: There are other generalized approaches adopted by researchers in the RM domain. R. Dandage et al. [46] have emphasized an appropriate balance between strategic and operational concerns. The author has pointed out that an integrated informational approach to capturing the experience of others may enhance the business executive's overall effectiveness. The author [47] has mentioned two types of risks as internal and external, which comprise strategic, compliance, financial, operational risks, which furthermore classified into several types of risks. The author also mentioned that the future identification of risk shouldbe analyzed based on its strength, weakness, impact on other variables. In their article [48], while investigating complexity drivers in discrete manufacturing and process industry author has highlighted that most applied methods in the industry do not address the internal complexity influencers, like corporate culture, organizational structure, and product structures and technologies. The regulatory and political factors, as well as other minor external factors, are causing the main complexity in the process industry. In the article [49] in the context of recent technological developments, the authors suggested developing an innovative approach to risk identification and analysis in the cyber-physical production system (CPPS) capabilities effectively. The author concluded that by synchronizing with the latest trends in production technology, the present assessment scenario of interdependent risk assessment in production could further be enhanced. Authors [50], in their research paper, emphasized that waste disposal and material recycling are distributed towards the green environment. The risk factor observed are lack of modern technology, lack of management participation, and management foresight are of great concern. In his paper [51], the author has explained an uncertain risk assessment for the bus manufacturing industry. The authors used the supply chain operations reference (SCOR) model for finding the most uncertain risk. The reactive approach to risk isprominent in the majority of the small to medium enterprises. SMEs rely on the heuristic approach of risk treatment. A knowledge management approach, integrated with RM, will bebeneficial for effective RM practices.

Table 2 below aggregates information on Risk Factors and Challenges in the manufacturing sector.

Table 2: Scenario in the Manufacturing sector

Tools/Techniques	Risk Factors and Challenges / Barriers	Authors
literature review and Practical Experience Conceptual framework of the active executive scoreboard	Strategic and operational concerns balance	[46]
Monkey Survey Tool, SPSS, t-test, Pearson correlation	• Complexity of tasks • Dynamic environment • Tight timelines	
Face-to-face interviews, Structured and semi-structured questions, Data envelop analysis approach (DEA), Sensitivity Analysis, Cross Project Learning, Excel Solver	• Lack of top management commitment; • Low priority to performance management; • Not having a performance management culture; • Management putting a low priority on implementation and people unable to foresee enough benefit from performance management	[37]
Qualitative, Quantitative method's, Risk evaluation using impact and likelihood of occurrence (Risk map)	To identify the barriers which disrupt the management growth & to maintain the business trends to make the desired reputation in a highly innovative world	[47]
Literature Review and Personal Experience with Multiple Case studies	• The gap between perception and strategy formulation about risk; • Gap between strategy formulation and implementation; • The gap between recognition and resolution; • Wrong assessment of potential risks	[17]
Empirical investigation with a multi-method research approach (a combination of a questionnaire-based mail survey involving 212 SMEs and five in-depth case studies)	• Unexpected warranty claims, • Late delivery to market, • Lower than expected productivity. • Variable product quality, • Unexpected defect rate, • More than the estimated cost, • Unexpected production downtime, • Unexpected operational disruption, • Lower production than expected, • Rejection as an impeding factor, • Accidents as an impeding factor	

Tools/Techniques	Risk Factors and Challenges / Barriers	Authors
Risk Assessment Tools, Risk Handling	To identify and categorize the risks in production companies in two ways: Before the risk occurrence& After the risk occurred. People's ability, lack of knowledge, inappropriate materials and techniques used, the relationship amongst workers, and highly skilled operators.	[38]
Literature review, Delphi technique, MICMAC analysis, ISM	• Rapidly growing population, • Imported goods from abroad • Unemployment • Global competition • Changing technologies	[39]
ISM\MICMAC Analysis, Literature review	• Unawareness among society about sustainability • sustainability in the supply chains. • Political instability • To implement SSCM • Lack of trust in supply chain members • Technical obstructions	[40]
Delphi method, House of Risk (HOR), ISM, (ARP) Aggregate Risk Potential, (RPN) Risk Priority Number	Delivery and people, lack of LM and SQCDP knowledge among the worker, improper SQCDP meeting activity, complaint of LM implementation has not been appropriately addressed, and delay in product delivery	[41]
Delphi method, Survey, Interview technique	the gap between the discrete manufacturing industry and the process industry.	[48]
Literature Review Analysis, ISM, MICMAC	• Inertia of employees • Avoidance of talking about risk • The high cost of risk management • Lack of top management support • Lack of formal training to employees • Cultural difference • Lack of cooperation between employee and top management • Cross-functional conflicts • Lack of resources • Failure to clearly define the risk	
Risk Assessment	To identify the risks for the virtual enterprise of SME's and managing it by different risk assessment methods.	[36]
Previous research work, Risk assessment, ISM, CPPS	The dynamization of product life cycles, the penetration of new technologies, resource shortages, and demographic change are such challenges.	[49]
TOPSIS	skilled supplier selection and to maintain a reputation in business trading	[43]
Interpretive Structural Manufacturing (ISM)	Unclear government policies and regulations, negligence of environment and lack of management foresight	[50]
ISM, FANP	To obtain sustainability and improve maintenance in the rubber industry	[44]
AHP, FAHP, SCOR Model	Uncertainty in supply chain/uncertainty about the future	[51]
Literature survey, feedback from project professionals, Interpretive structural modelling (ISM), MICMAC, strategy management tool threats, opportunities, weaknesses, and strengths (TOWS) matrix	• Financial- and economic-related risks • Contractual- and legal-related risks • Design-related risks • Political risks • Cultural risks • Technical-related risks • Fraudulent practices-related risks • Health-related risks	[3]

5. SCENARIO IN SOFTWARE SECTOR:

There is a surge of embedding software technology in the industry 4.0 scenario in every possible sector [18] However, with the induction and integration of software, industries are increasingly susceptible to unexplored risks. The author, in his article [52], identified risk factors and observed that the most serious risks perceived are outside of direct control of the project manager. Also, the Delphi survey approach was used, which involved brainstorming sessions, rating, and ranking of factors.

U. Ojiako et al. [53] has focused on project measurement

criteria reassessment. The author pointed out that Measures forproject performance and project progress are interconnected. Authors [54] in their research article, utilize the MCDA approach for parameter ranking and impact assessmentmeasurements of project performance. A means-end analysis was used as one tool and software for the judgment matrix. with this approach, the manager can assess the current health of the project. Also, various alternatives and their impact can be forecasted. The author [55] has reviewed published articles in the 2000s decade on fuzzy quality function deployment (FQFD) and discussed various models proposed on FQFD in detail. Linear and nonlinear programming, Metaheuristic methods, Hybrid models, MCDM, Models proposed to prioritize customer needs; Author discussed Fuzzy group decision-making models in detail. The author has presented problems associated with proposed models and highlighted lessstudied topics and provided way forward. Researchers [56] hasidentified a positive relationship between project managementperformance and various variables associated with it on project success. The author highlighted that Project Management Performance covers close to 50% variance in the success of a project. The author has recommended that the industry should invest in staff training, and there should be a proper evaluation system of performance in place. For sustenance, it is important to invest in building processes and systems. Authors [57] has presented TQM themes in the IS Project quality context, interdependencies with influential factors are discussed. In their published article, authors [58] have highlighted a need for development and enhancement of approaches to identification,assessment, and mitigation of risks about innovative designs. The authors reviewed the concept of CPM and PERT and presented the algorithm of the project's timing risk mitigation,project budget deficit risk assessment, and mitigation. The author has summarized that Such an algorithm implies consecutive systematic implementation of management phases and matching of assessment results with risk treatment measures. M. Padalkar et al. [59] in their research concluded that theory building in PM requires a "Non-Deterministic" perspective, which will reveal new areas to explore in orderto get new insight. The author [60] has Carried out a systematic literature review on failed projects. Major findings from this analysis are the average number of publications increased from
1.7 articles per year in 1998–2004 to 7.7 articles per year in 2005–2016.There are more publications on project success than that of project failure. The author concluded that the unwillingness of revealing failure data of companies leads to less no. of publications in the domain. Results of this research highlights the growing importance of a hybrid organization structure using projects as a tool to increase competitiveness. Authors concluded that developed countries influence the existing literature on project failure; the Author discussed common research themes like project failure factors (PFFs), the ranking of PFFs, Interdependence, failure criteria, risk mitigation strategies, the risk associated with failure, failure forecast, and after-effects. The author proposed a conceptual Input Process Output (IPO) model. [61] have summarized that successful control of R&D risk improves the profitability of products while mitigating the failure rate of R&D projects. This paper suggested a systematic approach to prioritize the factors to manage R&D risks. For this, the Authors appliedthe two main techniques of the FMEA and DEMATEL for analyses the influence of risk factors derived from the stage- gate model. [62] in their paper, the author has pointed out how project-oriented organizations are different from project-based organizations and explored the innovation parameter. The author has developed a conceptual model for an innovative project-oriented organization. In a three-step approach adoptedby the author [63], Novelty, Technology Complexity and Pace (NTPC) diamond framework was used to classify projects selected for study. In Engineering & Construction (E&C), IS/ IT and NPD sectors within- and cross-sector analyses were performed to derive key insights. So as managerial implications, managers can foresee and execute risk strategy proactively. Table 3 below aggregates information on Risk Factors and Challenges in the software sector.

Table 3: Scenario in the Software sector

Tools/Techniques	Risk Factors and Challenges / Barriers	Authors
Delphi survey approach in-volves brainstorming sessions,rating and ranking of factors.	• Lack of top management commitment to the project • Failure to gain user commitment • Misunderstanding the requirements • Lack of adequate user involvement • Failure to manage end-user • expectations • Changing scope/objections • Lack of required knowledge/skills • in the project personnel • Lack of frozen requirements • Introduction of new technology • Insufficient/inappropriate staffing • The conflict between user departments	[52]

Tools/Techniques	Risk Factors and Challenges / Barriers	Authors
• Semi-structured interviews • Non-Random Purposive Sampling • Manual Coding of Data using matrices and coding form	Unclear set of measurement criteria that aligns to strategic objectives of the organization	[53]
• Unstructured interviews with decision-makers, • Bibliographic research, • Multicriteria decision aiding methodology – constructivist (MCDA-C).	• Projects proposed do not fulfill the clients' and the executives' expectations • Normative view	[54]
literature review	• No equal attention to all phases of QFD • Lengthy, time-consuming calculation of the models • Use of an inappropriate fuzzy number • Changing customer preferences • Less attention to risk analysis	[55]
• European Foundation of Quality Management's • Business Excellence Model EFQM • Project Management Perfor-mance Assessment (PMPA) • online questionnaire survey • literature review • Pearson's r correlation • Linear regression • Principal Component factor Analysis (PCA)	The link between PM performance and project success is hard to model involving complex constructs often with insufficient accuracy and detail, leading to findings that are fragmented and incomplete. Insufficient understanding of the relationships between PM Performance and Project Success. the inherent complexity of the constructs results in problems with modeling and in analyzing their inter-rela-tionships	[56]
Semi-structured interviews	lack of agreement on the definition of IS project success and on influential factors, that is, success and failure factors	[57]
literature review, algorithm of project's timing risk miti- gation, budget deficit risk assessment and mitigation	Risk of non-realizability of an innovative idea and the group of risks related to failure to achieve the basic project parameters including the timing risk, project budget deficit risk and the risk of failure to achieve the innovation's targets	[58]
Literature Review, thematic evolution, Snowball Search, Keyword Search,	Continued adherence to determinism or empiricism	[59]

Effective Annualized Citation Rate (EACR)		
Systematic Literature Review (SLR) till 2016 and Concep- tual Project monitoring and evaluation framework based on I-P-O model	Most of the published literature focuses on the Case Study method with Qualitative Analysis, which restricts the generalization of the findings.	[60]
Integration of FMEA, Stage-Gate Model and DEMATEL	Market assessment error, low competence, and insufficient R&D Resources results monitoring errors, low competence, and discrepancy with corporate strategy	[61]
Literature Review, Project Management case studies	Conservative approach, opportunistic behaviour	[62]
Literature Review, Integrated Framework of NTCP (Novelty, Technology, Complexity, and Pace)	Schedule risk in E&C sector projects, resource risk in IS / IT sector projects, and scope risk in NPD sector proj- ects are the most prominent project risk categories. Projects involving lower degrees of novelty, technology, and complexity are highly susceptible to schedule risks, and those with increased technology and complexity levels are susceptible to resource risks. Projects requiring high novelty are more vulnerable to scope risks, and those with high technology and complexity are susceptible to resource risks. Scope and resource risks are major risk categories for high-novelty, high-tech, medium-complexity, and regular-pace projects.	[63]

DISCUSSION AND FUTURE SCOPE

Various critical risks are identified and presented in this article. Top management plays a crucial role in monitoring internal processes and assessing the impact of external factors and taking decisive actions. Authors [64], [65]and [66] have reported positive linkages of top management commitment and effective risk management. Therefore, it is important to tackle risk related to top management commitment. Industries should mitigate supplier related risks as delay or disruption in supplier delivery hurts the project timeline [67]. Selection process of suppliers and quality procedures followed at supplier's end have significant impact on product quality, production timelines and profit [68]. Employee related risks are employee incompetency, miscommunication, underestimating employee capability, employee overconfidence, unethical activities, which may lead to inferior product and process quality. [69] recommended guidelines to manage risks originating from unethical and fraudulent practices in business. Inaccurate capturing of customer needs and errors in translating them to technical specifications give rise to design-related risks. Not adopting DF'X' in early-stage effectuate the backpedaling of activities in subsequent stages of product development [70]. It is essential to boost employee motivation [8] and create safety awareness, which in turn reduces industrial occupational risks [9]. There are cost impacts of poor quality processes [71], and adopting a quality mindset, in-depth implementation of quality tools, can minimize negative consequences [72]. Inappropriate tools and techniques may lower productivity and produce inferior quality products and adversely impact brand value. Neglecting to address reliability issues may lead to warranty related risks.

Future research directions include in depth investigation into each sector and identification of critical risk factors coupled with actual survey with adequate sample size for generalization of findings. Prioritization of risk factors for better formulation of mitigation strategies, dependencies identification to reduce complexity are the potential areas for further investigation. Researchers can demonstrate what benefits can be achieved through implementation of RM in SMEs with proper justification of tools used.

Further researcher can look into the construction sector, the adoption of a strategy/approach that encompasses a variety of projects and can be generalized to a greater extent. There exists a gap in the integration of RM and performance Management, which needs to be bridged. Manufacturing sector RM practices are visible in large size companies; hence cost-effective approach focusing on SMEs can push boundaries of RM applications. Knowledge Management (KM) and RM integration will help in strengthening decision making, particularly for reactive RM approaches to reduce severity and loss due to risks. Software RM is matured in theory and applications in studied context, but the upcoming Industry 4.0 scenario has opened the possibilities of new risks of unknown category and impacts. Software RM for effective handling of real-time data, data security, storage, internet of things are some critical domains.

6. CONCLUSION

This article provides insights into the RM domain by revealing critical areas of concern in industrial sectors. The article has managerial implications and reveals CRFs in various domains. Identified CRFs will help managers in formulation of proactive mitigation strategies to leverage business performance, understanding what RM can contribute and what new tools can be used effectively. The article also highlights the way forward to future research conduct where findings coupled with actual survey can bring out new sector specific meaningful insights.

The Critical Risk Factors (CRFs) identified across sectors are political factors, problems associated with knowledge transfer/ training, strategic issues, sensitivity and dependencies analysis, poor decision making, lack of top management commitment, improper portfolio management, improper monitoring and control, issues related to organizational structure, supplier relationship issues, reactiveness and reactiveness approaches, strategy formulation and implementation gaps, social risks, financial risks, lack of agreement, lack of in-depth risk assessment, safety risks, and complexity involved. Even though articles in the Manufacturing and Software sector have not identified factors in the financial domain primarily, the other explained risk areas eventually degrade the financial aspects of any industry. Most of the referred articles cited here are literature review based in all sectors, and most of them used tools like Delphi Survey, AHP, FMEA, MCDA, DEMATEL, ISM, MICMAC, Fuzzy Analytic Hierarchy Process, statistical analysis, conceptual framework and its validation using a casestudy, software models etc.

To sum up, this literature review of research in progress revealed the critical risk factors (CRFs), significant challenges/barriers in the industrial sector, and widely used tools in construction, manufacturing, and software (IS/IT) sector.

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