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Study of synergies between behavioral and organizational factors impacting operational excellence in the context of Industry 5.0



Abstract: - The technological acceleration linked to the transition to Industry 5.0 imposes increasing challenges on companies particularly in sustainable operational excellence and competitiveness. The Human centric approach of industry 5.0 raises the issue of contextualizing the key behavioral factors that impact operational excellence in smart manufacturing environments.

This main objective of this study is to understand the interactions between various behavioral and organizational factors to determine their impact on the operational excellence of companies integrating emerging Industry 5.0 technologies. Using a quantitative approach, this study examined how operational strategy (OS), organizational agility (OA), leadership (L), organizational culture (OC), human resource management practices (HRMP), Training and knowledge sharing (TKS), communication (C), employee engagement (EE), and middle management engagement (MME) interact and contribute to operational excellence.

Data was collected from 100 companies from various industrial sectors. Correlation analysis was used to identify significant links between these variables. Results highlight the importance of an integrated approach, where the synergy between these factors can be optimized to improve overall performance. This study offers a holistic model where operational strategy, organizational agility, innovation, leadership, organizational culture, HR practices, communication, and engagement at different levels of the organization interact in a synergistic way.

Keywords: Operational excellence, industry 5.0, Behavioral factors, organizational agility, innovation, organizational culture.

I. INTRODUCTION

The emergence of Industry 5.0, marked by the integration of advanced technologies such as Edge computing, the Internet of Everything and collaborative robotics, introduces new challenges and opportunities for companies seeking to achieve operational excellence. Unlike Industry 4.0, which is mainly focused on technology [1], Industry 5.0 focuses on people, sustainability and resilience [2]. It aims to strengthen the role of humans in the industrial process. This means rethinking business models, ecosystems and managerial practices to foster a more resilient, sustainable and human-centred industry [3].

The ability of organizations to achieve and sustain operational excellence is increasingly scrutinized. Researchers and practitioners recognize that organizational performance is the result of a variety of behavioral and organizational factors [4]. These factors have human-centric aspects that put people at the center of operations [5]. Researchers have studied the success factors for the deployment of operational excellence initiatives [6]–[7]. Various behavioural and organisational factors have been highlighted in the existing literature.

Aligning operational strategies with overall business objectives improves business outcomes and competitiveness [8]–[9]–[10]–[11]–[12]. Typical strategies may include considering employees in the delivery of operational excellence programs, giving them a sense of belonging, motivating them by offering appropriate rewards or recognition [13]. Effective time management is essential for maximizing productivity and improving operational performance. Well-structured time management systems make a significant contribution to operational excellence [14]–[15]–[16].

Leadership style positively affects operational performance by fostering an environment conducive to excellence [8]–[9]–[17]–[14]–[18]–[19]–[20]–[21]. In addition, a study by S.S. Nair and K.A. Thomas (2020) examined the link between executive support and operational excellence in the healthcare sector in India [18]. Management

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commitment is a key factor for the success of operational excellence initiatives, without a strong commitment from senior management, improvement efforts can fail [20]–[5]–[16]–[21]–[18].

The ability to effectively manage change is directly linked to the success of operational excellence initiatives. Proactive change management makes it easier to adapt and adopt new practices [8]–[20]–[5]. Effective communication is also essential to align all levels of the organization with operational excellence goals [22]. Engaged employees are more likely to adopt initiatives aimed at continuous improvement [8]–[20]–[5]–[16]–[21]. A well-designed reward and recognition system motivates employees to achieve and maintain high standards. These systems encourage behaviors aligned with operational excellence objectives [20]–[21].

Human resources management practices, including recruitment, training, and development, play a critical role in maintaining operational excellence [8]–[9]–[17]–[14]–[19]. The successful implementation of operational excellence initiatives in an organization requires a comprehensive knowledge of tools, techniques, and the right methodology [23]. Structured training can systematically guide employees in understanding the process of implementing operational excellence [24]–[25].

A supportive, friendly, positive and adaptable organizational culture is the common denominator of organizations that succeed in maintaining operational excellence initiatives in a competitive environment [26]–[20]. Organizational culture can be improved by developing good employee relationships, using appropriate communication technologies, and creating reward and recognition systems [6]–[27]. Studies aimed at understanding the key elements to sustain operational excellence in the long term have been able to bring organizational agility together with operational excellence [28].

This compilation of behavioral factors, based on existing literature, provides insight into the elements that are critical to the success of operational excellence initiatives in various organizational contexts. However, less attention has been paid to how these factors interact to contribute to operational excellence. Studies have highlighted the impact of knowledge management, HR talent and innovation on organizational culture to build sustainable operational excellence [29]–[6]. Fok-Yew et al. elaborate a theoretical framework linking operational excellence and change management through leadership, culture, and human resource practices [11]. Other researchers have investigated the relationships and integration between the concepts of operational excellence, organizational agility, and organizational culture, highlighting the potential to further integrate these relationships in promoting sustainable and long-term operational excellence initiatives [30]. Other studies have proposed a theoretical framework linking operational excellence, organizational culture and organizational agility, based on industrial case studies [31]–[32]. The majority of studies focus on the individual impact of these factors without examining their potential synergy. The current literature has not fully explored the relationships and interactions between these levers to contribute to operational excellence in the context of Industry 5.0. This study aims to fill this gap by analyzing how behavioral and organizational factors interact to impact operational excellence in this rapidly changing technological context. The concepts of operational strategy (OS), organizational agility (OA), leadership (L), organizational culture (OC), human resource management practices (HRMP), knowledge sharing (KC), communication (C), employee engagement (EE), and middle management engagement (MME) are analyzed to assess their synergy and collective impact in the Industry 5.0 era.

Based on the results of a field study of industrial companies, this work is part of an integrative perspective, suggesting that operational excellence is the product of multiple synergistic factors. By identifying the significant relationships between these factors, this research aims to provide a comprehensive and interdisciplinary analytical framework to maximize operational excellence through more coherent management of human and organizational resources.

II. METHODOLOGY

This study adopts a quantitative approach to evaluate the interactions between various behavioral and organizational factors and their impact on the operational excellence of industrial companies using emerging Industry 5.0 technologies. The key factors of operational excellence were determined through a literature review conducted in academic databases, notably Scopus, Web of Science, IEEE Xplore and Google Scholar.

A re-evaluation of the key behavioral factors impacting operational excellence in smart manufacturing environments was carried out with the aim of recontextualizing these factors in the context of the transition to Industry 5.0 [33].

The data was collected through structured questionnaires from operational excellence practitioners and experts from 100 companies across various industry sectors, designed to measure the maturity levels and impact levels of the following behavioral factors:

- Operational Strategy (OS)
- Change Management (CM)
- Innovation (I)
- Top Management Commitment (TMC)
- Employee Engagement (EE)
- Organizational Agility (OA)
- Time Management (TM)
- HR Practice Management (HRMP)
- Training and Knowledge Sharing (TKS)
- Leadership (L)
- Organizational Culture (OC)
- Communication (C)

The maturity levels of these factors were assessed on a five-point Likert scale (1 = very low, 5 = very high). Similarly, the degrees of impact on operational excellence were measured on a five-point Likert scale (1 = very low impact, 5 = very high impact).

An initial descriptive analysis was performed: The frequencies of maturity levels and degrees of impact for each factor were calculated to provide an overview of the data collected and to identify trends.

Most of the companies represented have medium to high maturity levels for the behavioral and organizational factors of operational excellence. The graph below (Figure 1) shows the distribution of maturity levels for each factor assessed within the companies represented.

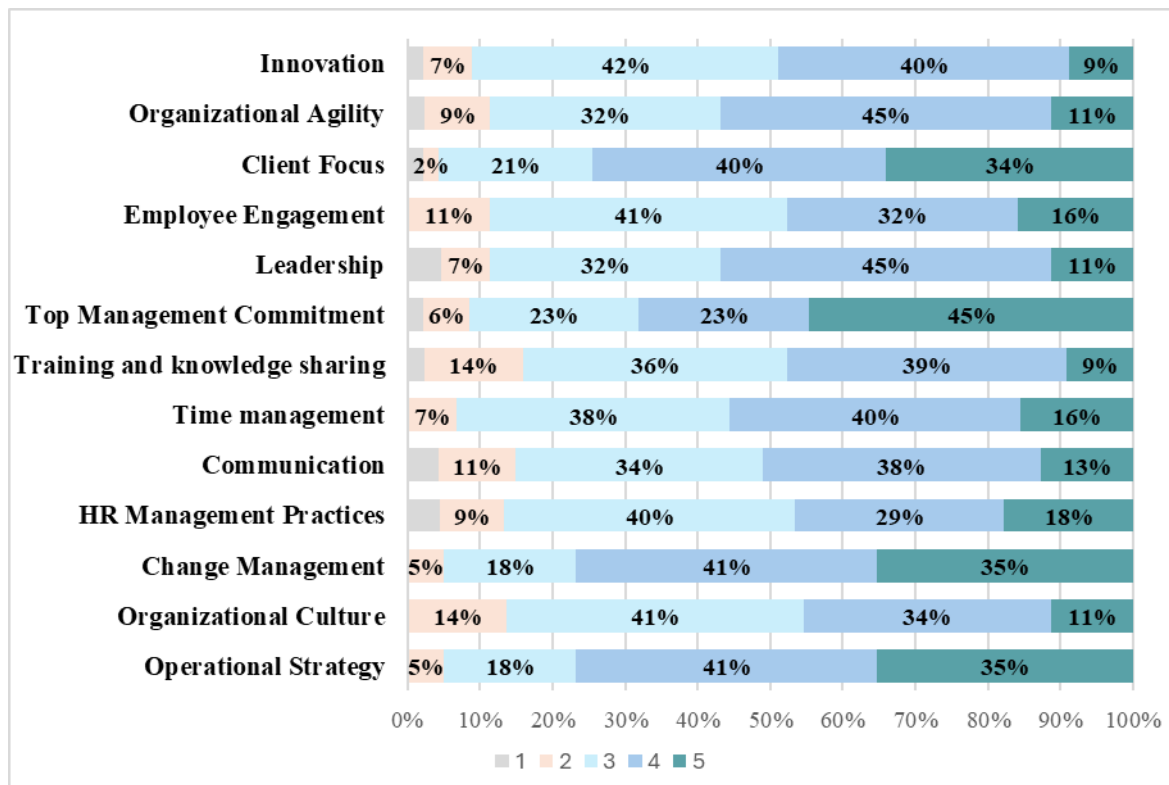


Figure1. Distribution of Maturity Levels of Behavioral Factors within the Represented Companies [33]

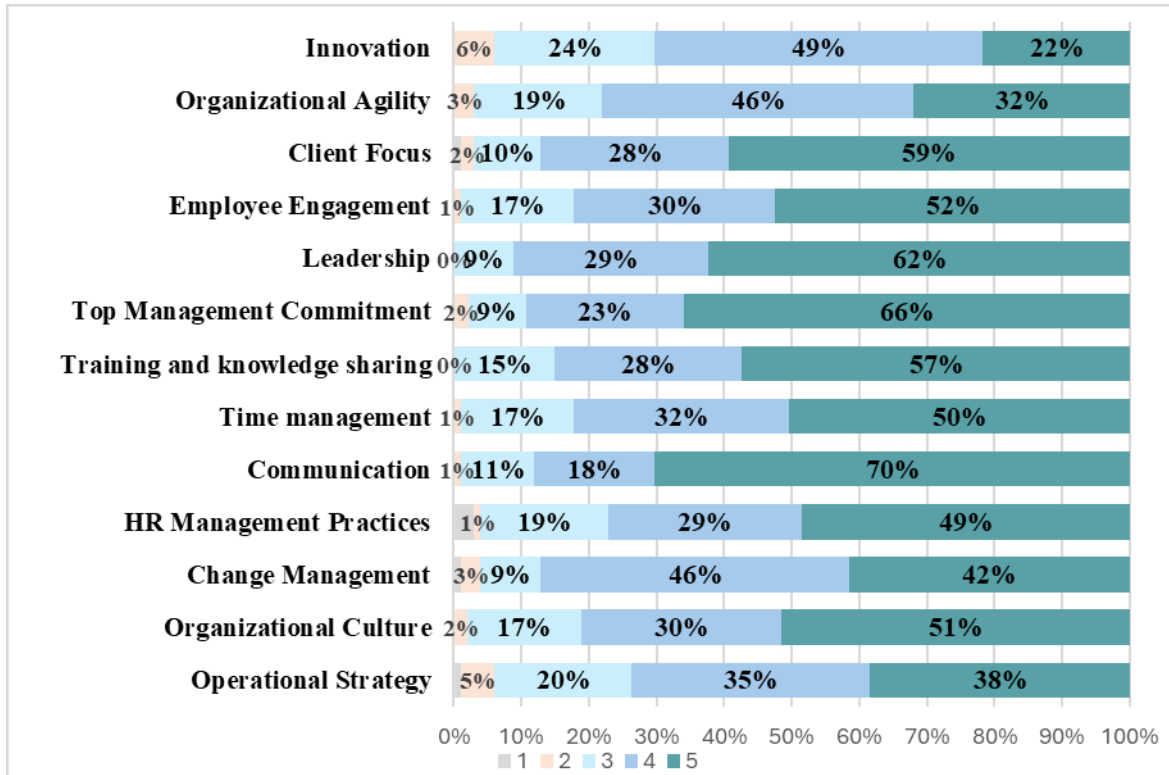


Figure 2. Impact of Behavioral Factors on Operational Excellence within the represented companies [33]

Within the companies represented, most behavioral and organizational factors are perceived as having a high impact (levels 4 and 5) on operational excellence (figure 2). This highlights the need for continued attention and investment in behavioral and organizational factors to support the transition to Industry 5.0 and maintain high levels of organizational performance.

The analysis of interactions and relationships between behavioral factors of operational excellence is at the heart of this work: Spearman's correlation coefficients were used to assess the relationships between the maturity levels of behavioral and organizational factors. Statistical analyses were performed using SPSS software, and the results were interpreted to identify key synergies and interactions between the different factors studied.

III. RESULTS:

Analyzing the correlations between the different maturity levels of behavioral and organizational factors provides valuable insights into the relationships and interdependencies between these factors.

The results of the study show significant correlations between several pairs of variables, highlighting key relationships in the context of Industry 5.0. To classify the correlations into strong, moderate, and weak relationships, the following criteria based on correlation coefficients were used:

- Strong Relationships: $|r| > 0.6$
- Moderate relationships: $0.3 \leq |r| \leq 0.6$
- Weak relationships: $|r| < 0.3$

Table 1: Correlations between behavioural factors in represented companies

		OS	CM	I	FC	TMC	EE	OA	TM	HRMP	TKC	L	OC	C	
Spearman's rho	OS	Correlation Coefficient	1.000	.649**	.476**	0.168	.675**	.593**	.669**	.388**	.624**	.435**	.569**	.605**	.425**
		Sig. (2-tailed)		0.000	0.001	0.260	0.000	0.000	0.000	0.007	0.000	0.002	0.000	0.000	0.003
	CM	Correlation Coefficient	.649**	1.000	.448**	.365*	.507**	.543**	.669**	.423**	.614**	.648**	.691**	.642**	.580**
		Sig. (2-tailed)	0.000		0.002	0.012	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000
	I	Correlation Coefficient	.476**	.448**	1.000	0.070	0.255	.469**	0.250	.455**	.454**	.358*	.462**	.336*	.467**
		Sig. (2-tailed)	0.001	0.002		0.641	0.084	0.001	0.090	0.001	0.001	0.013	0.001	0.021	0.001
	FC	Correlation Coefficient	0.168	.365*	0.070	1.000	0.260	.294*	0.277	0.172	0.187	.362*	0.216	.415**	.410**
		Sig. (2-tailed)	0.260	0.012	0.641		0.077	0.045	0.060	0.247	0.208	0.012	0.145	0.004	0.004
	TMC	Correlation Coefficient	.675**	.507**	0.255	0.260	1.000	.624**	.586**	.401**	.582**	.543**	.534**	.551**	.500**
		Sig. (2-tailed)	0.000	0.000	0.084	0.077		0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000
	EE	Correlation Coefficient	.593**	.543**	.469**	.294*	.624**	1.000	.562**	.436**	.536**	.603**	.420**	.523**	.374**
		Sig. (2-tailed)	0.000	0.000	0.001	0.045	0.000		0.000	0.002	0.000	0.000	0.003	0.000	0.010
	OA	Correlation Coefficient	.669**	.669**	0.250	0.277	.586**	.562**	1.000	.468**	.511**	.386**	.353*	.507**	.431**
		Sig. (2-tailed)	0.000	0.000	0.090	0.060	0.000	0.000		0.001	0.000	0.007	0.015	0.000	0.002
	TM	Correlation Coefficient	.388**	.423**	.455**	0.172	.401**	.436**	.468**	1.000	.392**	.611**	0.245	.319*	.514**
		Sig. (2-tailed)	0.007	0.003	0.001	0.247	0.005	0.002	0.001		0.006	0.000	0.097	0.029	0.000
	HRMP	Correlation Coefficient	.624**	.614**	.454**	0.187	.582**	.536**	.511**	.392**	1.000	.623**	.596**	.704**	.472**
		Sig. (2-tailed)	0.000	0.000	0.001	0.208	0.000	0.000	0.000	0.006		0.000	0.000	0.000	0.001
	TKC	Correlation Coefficient	.435**	.648**	.358*	.362*	.543**	.603**	.386**	.611**	.623**	1.000	.587**	.566**	.645**
		Sig. (2-tailed)	0.002	0.000	0.013	0.012	0.000	0.000	0.007	0.000	0.000		0.000	0.000	0.000
	L	Correlation Coefficient	.569**	.691**	.462**	0.216	.534**	.420**	.353*	0.245	.596**	.587**	1.000	.766**	.569**
		Sig. (2-tailed)	0.000	0.000	0.001	0.145	0.000	0.003	0.015	0.097	0.000	0.000		0.000	0.000
	OC	Correlation Coefficient	.605**	.642**	.336*	.415**	.551**	.523**	.507**	.319*	.704**	.566**	.766**	1.000	.638**
		Sig. (2-tailed)	0.000	0.000	0.021	0.004	0.000	0.000	0.000	0.029	0.000	0.000	0.000		0.000
	C	Correlation Coefficient	.425**	.580**	.467**	.410**	.500**	.374**	.431**	.514**	.472**	.645**	.569**	.638**	1.000
		Sig. (2-tailed)	0.003	0.000	0.001	0.004	0.000	0.010	0.002	0.000	0.001	0.000	0.000	0.000	

** . Correlation is significant at the 0.01 level (2-tailed).
 * . Correlation is significant at the 0.05 level (2-tailed).

3.1 Overview of Strong and Significant Correlations

The operational strategy has several strong correlations with other variables. Notably, the correlation with top management engagement is $r=0.675$, $p<0.01$. This indicates that top management commitment is crucial for the effective implementation of the business strategy. When management is heavily involved, the company's strategy is clearer and better executed at all levels of the organization. Similarly, the correlation between operational strategy and organizational agility is $r=0.669$, $p<0.01$ suggesting that well-defined operational strategies allow companies to adapt quickly and effectively to market changes. Organizational agility is therefore an essential part of successful operational strategies. Change management also shows a strong correlation with operational strategy ($r=0.649$, $p<0.01$), indicating better strategic alignment in the presence of effective change management.

For human resource management practices, the correlation with the business strategy is $r=0.624$, $p<0.01$. Effective HR practices are essential for the successful implementation of operational strategies. Strategic talent management, including employee training, development, and motivation, is closely linked to achieving strategic objectives. The correlation between operational strategy (OS) and organizational culture (OC) is $r=0.605$, $p<0.01$, indicating that well-defined operational strategies are often supported by a strong organizational culture. Shared values and practices facilitate the alignment and execution of operational strategies. Leadership shows the strongest correlation with organizational culture, at $r=0.766$, $p<0.01$. This result suggests that leadership is a determinant of organizational culture, strongly influencing values, norms, and behaviors within the organization.

Organizational culture is also strongly correlated with human resources management practices ($r=0.704$, $p<0.01$). Effective HR practices contribute significantly to a positive organizational culture, strengthening employee motivation and engagement. Another significant correlation is that between organizational culture and communication, at $r=0.638$, $p<0.01$, indicating the importance of communication practices in developing and maintaining a strong organizational culture. Human resource management practices show a strong correlation with knowledge sharing ($r=0.623$, $p<0.01$). Human resource management practices that include continuous training and knowledge sharing are crucial for skills development and talent retention.

Top management engagement and employee engagement also have a strong correlation, at $r=0.624$, $p<0.01$. The support and involvement of leaders play a crucial role in employee motivation and engagement. In addition, the correlation between employee engagement and training and knowledge sharing is $r=0.603$, $p<0.01$. This suggests that training and knowledge-sharing opportunities are key to maintaining and strengthening employee engagement, contributing to increased performance and a collaborative work environment. Time management and training and knowledge sharing are correlated with $r=0.611$, $p<0.01$. The correlation between training and knowledge sharing and communication is $r=0.645$, $p<0.001$. Transparency, clarity and frequency of communication enhance skills development and knowledge dissemination initiatives, contributing to a more informed and collaborative work environment.

Change management shows strong correlations with several key factors, highlighting its crucial role in operational excellence. A significant correlation with leadership ($r=0.691$, $p<0.01$) indicates that the success of change initiatives depends on effective leadership that can guide teams through organizational transitions. In addition, the correlation with organizational culture ($r=0.642$, $p<0.01$) suggests that an adaptable culture that is open to change facilitates transition processes. Change management is also linked to knowledge sharing ($r=0.648$, $p<0.01$), allowing teams to better understand and adapt to new processes. Organizational agility promotes rapid and competitive adaptation to change ($r=0.669$, $p<0.01$). Human resource management practices ($r=0.614$, $p<0.01$) and effective communication ($r=0.580$, $p<0.01$) also play an important role, preparing employees for the new requirements.

3.2 Overview of moderate correlations

Moderate correlations provide additional information about the interactions between the variables being studied. The key correlations of Top Management Commitment with Organizational Agility ($r=0.586$), Time Management ($r=0.401$), Human Resource Management Practices ($r=0.582$), Training and Knowledge Sharing ($r=0.543$), Leadership ($r=0.534$), Organizational Culture ($r=0.551$), and Communication ($r=0.500$) show that Top management engagement is a central factor influencing many organizational dimensions. Similarly, Employee Engagement shows significant correlations with Organizational Agility ($r=0.562$), Time Management ($r=0.436$), Human Resource Management Practices ($r=0.536$), Leadership ($r=0.420$), and Organizational Culture ($r=0.523$), indicating that high employee engagement is associated with better organizational performance. Human resource management practices and ongoing training are essential to maintain and strengthen this commitment.

Innovation is strongly influenced by employee engagement ($r=0.469$), and leadership ($r=0.462$), highlighting the importance of creating an environment that encourages creativity and risk-taking. Correlations with Human Resource Management Practices ($r=0.454$), Training and Knowledge Sharing ($r=0.358$) indicate that Human Resource Management Practices and training also play an important role in providing employees with the skills to innovate, which can create a stimulating and motivating work environment.

Organizational agility can be supported by effective time management ($r = 0.468$) and human resource management practices ($r = 0.511$). The correlation with Organizational Culture ($r = 0.507$) and Communication ($r=0.431$) shows that organizational culture and communication also play important roles. Agile organizations tend to have a strong organizational culture, highlighting its importance in maintaining and improving organizational agility.

The correlations of Human Resource Management Practices with Leadership ($r=0.596$) and Communication ($r=0.472$) demonstrate that effective leaders and clear communication are necessary to implement successful Human Resource Management practices, thereby contributing to employee satisfaction and performance. Training and knowledge sharing are essential for the development of organizational culture ($r = 0.566$). An organizational culture that values continuous learning, supported by appropriate leadership, is crucial to maximizing the benefits of training programs.

3.3 Clusters identified

The dendrogram below visually represents the hierarchical relationships and grouping of factors identified in our study.

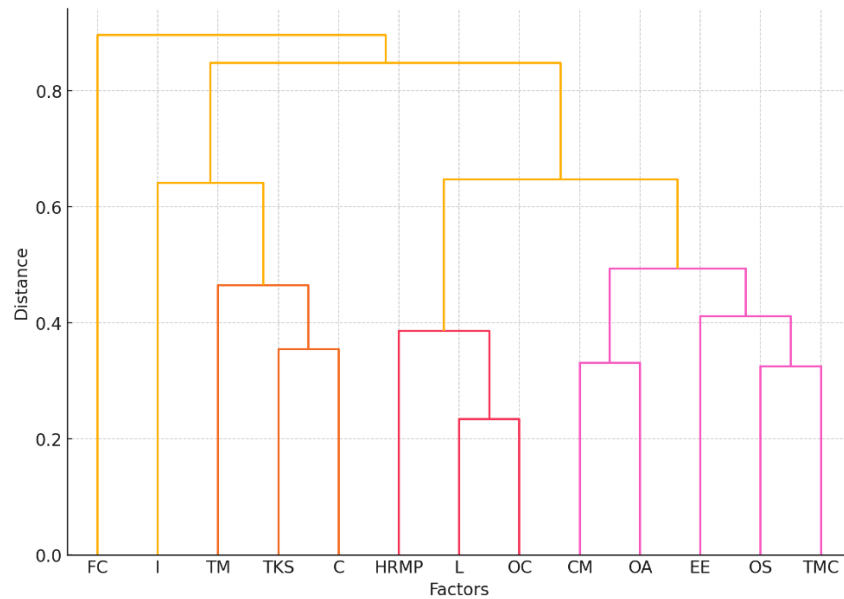


Figure 3. Dendrogram of Behavioral Factors Clustering

The first cluster includes the factors of Training and Knowledge Sharing (TKS), Time Management (TM), Communication (C), Innovation (I), and Customer Focus (FC). The factors within this cluster exhibit a strong synergy that is fundamental for achieving operational excellence in the context of Industry 5.0. By combining these elements, companies can improve their internal performance and respond to external requirements in an agile and proactive way.

The second cluster includes Human Resource Management Practices (HRMP), Leadership (L), and Organizational Culture (OC). These factors contribute to the construction of a coherent organizational base. They emphasize the importance of a robust and well-integrated organizational framework to increase operational excellence.

The third cluster includes Change Management (CM), Organizational Agility (OA), Employee Engagement (EE), Operational Strategy (OS), and Executive Engagement (TMC). This group of factors is critical for implementing and managing the transformations needed to adopt Industry 5.0 technologies and practices. Together, these factors create a solid foundation for innovation and continuous improvement, which are important for operational excellence in the advanced technology environment of Industry 5.0.

IV. DISCUSSION

The results of this study highlight the interdependent relationships between the different behavioral and organizational factors of operational excellence in the context of Industry 5.0. The presence of many strong correlations (36 correlations) indicates a significant interdependence between several behavioral and organizational factors, essential to operational excellence. By focusing on strong relationships, businesses can achieve quick and significant gains. A large number of moderate relationships (98 moderate correlations) suggests that improving several factors simultaneously could be beneficial. Taking a holistic approach, considering multiple factors at the same time, allows companies to maximize their performance and achieve operational excellence. Weak relationships, although lower in priority, can still provide useful information for specific interventions or one-off improvements.

The results show the importance of an integrated approach to optimize operational excellence in the context of Industry 5.0. Human resource management practices ensure that the organization has the skills and talents to succeed. Professional development and recognition policies can strengthen a culture of learning and excellence. Leadership shapes organizational culture and can instill HR practices that align employee values with the organization's goals. Strong leadership is essential to guide the organization through the technological changes and cultural transformations inherent in Industry 5.0. It creates a climate of trust and innovation, fostering a culture of continuous improvement and calculated risk-taking. Understanding and meeting customer expectations is fundamental to operational excellence [5]

Change management is crucial to facilitate the transition of existing processes to new methods and technologies. Effective change management reduces employee resistance, minimizing disruption and accelerating the adoption

of new technologies. This management is facilitated by a strong commitment from senior management, ensuring active support and the mobilization of the necessary resources. Organizational agility allows for rapid adaptation to changes, which, in turn, increases employee engagement by creating a flexible and responsive environment. This includes process flexibility, speed of decision-making, and the ability to pivot strategically. A high level of employee engagement leads to improved overall performance, as motivated and involved employees are more productive, more innovative, and more likely to adopt new technologies. A good organizational strategy helps achieve desired goals by providing the right direction to team members and using effective communication between stakeholders [33].

Organizational culture represents the values, beliefs, and behaviors shared within the company. It profoundly influences the way employees interact, make decisions, and adopt new technologies. A company's culture affects all aspects of operational excellence. A culture focused on quality and continuous improvement is essential to support operational excellence initiatives [20]–[21]. These elements combined can create an environment for success and growth in the context of Industry 5.0.

V. CONCLUSION

The results of this study, based on empirical data, provide insight into the internal dynamics of companies and the levers of operational excellence, allowing for strategic recommendations to strengthen competitiveness and organizational resilience. The study highlights the need for consistent and interdisciplinary human and organizational resource management to take full advantage of Industry 5.0 technologies.

A holistic model where operational strategy, agility, innovation, leadership, organizational culture, HR practices, communication, and employee engagement at different levels interact synergistically to improve overall performance. This integrated approach helps to strengthen operational excellence and foster a culture of innovation and continuous improvement.

This study provides a significant input to the understanding of complex dynamics. to understanding the complex dynamics between behavioral factors impacting operational excellence in the context of Industry 5.0. By providing a comprehensive analytical framework, it offers insights for practitioners and researchers wishing to improve operational excellence. Companies that can optimize the synergy between these different factors will be better positioned to thrive in the Industry 5.0 era.

REFERENCES

- [1] X. Xu, Y. Lu, B. Vogel-Heuser, and L. Wang, "Industry 4.0 and Industry 5.0—Inception, conception and perception," *Journal of Manufacturing Systems*, vol. 61, pp. 530–535, Oct. 2021, doi: 10.1016/j.jmsy.2021.10.006.
- [2] European Commission. Directorate General for Research and Innovation., M. Breque, L. De Nul, and A. Petridis, *Industry 5.0: towards a sustainable, human centric and resilient European industry*. LU: Publications Office of the European Union, 2021. Accessed: Oct. 27, 2023. [Online]. Available: <https://data.europa.eu/doi/10.2777/308407>
- [3] M. Borchardt, G. M. Pereira, G. S. Milan, A. R. Scavarda, E. O. Nogueira, and L. C. Poltosi, "Industry 5.0 Beyond Technology: An Analysis Through the Lens of Business and Operations Management Literature," *Organizacija*, vol. 55, no. 4, pp. 305–321, Nov. 2022, doi: 10.2478/orga-2022-0020.
- [4] J. T. Aguilera and D. A. M. Treviño, "Critical Success Factors for the implementation of Operational Excellence," 2019.
- [5] V. Sunder M and A. Prashar, "Characterization and Examination of Operational Excellence Deployment Failures: Mediation Effect of Technical and Behavioral Failure Factors," *IEEE Trans. Eng. Manage.*, vol. 70, no. 6, pp. 2080–2092, Jun. 2023, doi: 10.1109/TEM.2021.3071294.
- [6] V. Swarnakar, A. R. Singh, and Anil. Kr. Tiwari, "Evaluating importance of critical success factors in successful implementation of Lean Six Sigma framework," presented at the 1ST INTERNATIONAL CONFERENCE ON ADVANCES IN MECHANICAL ENGINEERING AND NANOTECHNOLOGY (ICAMEN 2019), Jaipur, India, 2019, p. 030048. doi: 10.1063/1.5123970.
- [7] V. Swarnakar, A. R. Singh, and A. K. Tiwari, "Evaluating the effect of critical failure factors associated with sustainable Lean Six Sigma framework implementation in healthcare organization," *IJQRM*, vol. 38, no. 5, pp. 1149–1177, Apr. 2021, doi: 10.1108/IJQRM-07-2020-0243.
- [8] O. Fok-Yew, H. Ahmad, and S. Baharin, "Operational Excellence and Change Management in Malaysia Context," *JOMS*, pp. 1–14, Oct. 2013, doi: 10.5171/2013.957636.
- [9] R. M. Shehadeh, Z. M. F. Al-Zu'bi, A. B. Abdallah, and M. Maqableh, "Investigating Critical Factors Affecting the Operational Excellence of Service Firms in Jordan," *jmr*, vol. 8, no. 1, p. 157, Jan. 2016, doi: 10.5296/jmr.v8i1.8680.

- [10] M. H. A.-A. A. Wahab, M. Ismail, and M. N. Muhayiddin, "Influence of Internal and External Environmental Factors on Operational Excellence of Manufacturing Sectors in Malaysia," *IJARBS*, vol. 9, no. 2, p. Pages 961-970, Mar. 2019, doi: 10.6007/IJARBS/v9-i2/5654.
- [11] O. Fok-Yew and H. Ahmad, "The Effect of Change Management on Operational Excellence moderated by Commitment to Change: Evidence from Malaysia," vol. 9, no. 2, 2014.
- [12] Manori P. Kovilage, Saman T.W.S. Yapa, and Champa Hewagamage, "A Comprehensive Definition for 'Operational Excellence,'" *VJM*, vol. 8, no. II, Nov. 2022, doi: 10.31357/vjm.v8iII.6089.
- [13] R. Iyede, E. F. Fallon, and P. Donnellan, "An exploration of the extent of Lean Six Sigma implementation in the West of Ireland," *IJLSS*, vol. 9, no. 3, pp. 444-462, Aug. 2018, doi: 10.1108/IJLSS-02-2017-0018.
- [14] V. R. Boya, "Operational Excellence In Pharmaceuticals – A Case Study On Factors Influencing Operational Excellence And Their Importance," vol. 6, no. 1, 2019.
- [15] V. R. Boya and K. S. S. Rao, "An Effective Time Management System will play a Vital Role in Achieving Operational Excellence in Pharmaceuticals," vol. 8, no. 1, 2019.
- [16] E. O'Callaghan, O. McDermott, G. Walker, and M. Southern, "Critical Success Factors for Operational Excellence in the Pharmaceutical Industry: Insights from a Qualitative Study," in *Lean, Green and Sustainability*, vol. 668, O. McDermott, A. Rosa, J. C. Sá, and A. Toner, Eds., in *IFIP Advances in Information and Communication Technology*, vol. 668., Cham: Springer International Publishing, 2023, pp. 193-203. doi: 10.1007/978-3-031-25741-4_17.
- [17] M. H. A.-A. A. Wahab, M. Ismail, and M. N. Muhayiddin, "Factors Influencing the Operational Excellence of Small and Medium Enterprise in Malaysia," *IJARBS*, vol. 6, no. 12, p. Pages 285-297, Dec. 2016, doi: 10.6007/IJARBS/v6-i12/2496.
- [18] S. S. Nair and K. A. Thomas, "Relationship between leadership support and operational excellence in health care sector: A study of Indian health care managers," *Journal of Healthcare Quality Research*, vol. 35, no. 2, pp. 117-122, Mar. 2020, doi: 10.1016/j.jhqr.2020.02.002.
- [19] B. Saeed, A. Mahmood, R. Tasmin, and A. Hafeez, "Exploring The Impact Of Transformational Leadership And Human Resource Practices On Operational Excellence Mediated By Knowledge Sharing: A Conceptual Framework," vol. 9, no. 02, 2020.
- [20] J. Antony et al., "An empirical study into the reasons for failure of sustaining operational excellence initiatives in organizations," *TQM*, vol. 35, no. 7, pp. 1569-1587, Sep. 2023, doi: 10.1108/TQM-05-2022-0176.
- [21] J. Antony et al., "Critical success factors for operational excellence initiatives in manufacturing: a meta-analysis," *Total Quality Management & Business Excellence*, vol. 34, no. 9-10, pp. 1152-1172, Jul. 2023, doi: 10.1080/14783363.2022.2157714.
- [22] V. R. Boya, Dr. K. S. S. Rao, and (Research Guide), Associate Professor & RPAC Chairman, Koneru Lakshmaiah Education Foundation (K. L. University), Vaddeswaram, Guntur District, Andhra Pradesh, India., "Effective Communication Role in Accomplishing Operational Excellence in Pharmaceuticals," *IJITEE*, vol. 8, no. 9, pp. 242-245, Jul. 2019, doi: 10.35940/ijitee.H6972.078919.
- [23] G. Yadav and T. N. Desai, "A fuzzy AHP approach to prioritize the barriers of integrated Lean Six Sigma," *International Journal of Quality & Reliability Management*, vol. 34, no. 8, pp. 1167-1185, Jan. 2017, doi: 10.1108/IJQRM-01-2016-0010.
- [24] J. Antony and S. Gupta, "Top ten reasons for process improvement project failures," *IJLSS*, vol. 10, no. 1, pp. 367-374, Mar. 2019, doi: 10.1108/IJLSS-11-2017-0130.
- [25] V. Swarnakar, A. Bagherian, and A. R. Singh, "Modeling critical success factors for sustainable LSS implementation in hospitals: an empirical study," *IJQRM*, vol. 39, no. 5, pp. 1249-1280, Mar. 2022, doi: 10.1108/IJQRM-04-2021-0099.
- [26] R. McLean and J. Antony, "Why continuous improvement initiatives fail in manufacturing environments? A systematic review of the evidence," *International Journal of Productivity and Performance Management*, vol. 63, no. 3, pp. 370-376, Apr. 2014, doi: 10.1108/IJPPM-07-2013-0124.
- [27] A. G. Psychogios, J. Atanasovski, and L. K. Tsironis, "Lean Six Sigma in a service context: A multi - factor application approach in the telecommunications industry," *International Journal of Quality & Reliability Management*, vol. 29, no. 1, pp. 122-139, Jan. 2012, doi: 10.1108/02656711211190909.
- [28] A. M. Carvalho, P. Sampaio, and E. Rebentisch, "On Agile Metrics for Operations Management: Measuring and Aligning Agility with Operational Excellence," in *2019 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*, Macao, Macao: IEEE, Dec. 2019, pp. 1601-1605. doi: 10.1109/IEEM44572.2019.8978806.

- [29] N. Asril, Z. Zulkifli, and L. Putriana, "Building Sustainable Business Excellence Through Knowledge Management, Innovation, Learning Agility, Talented HR, Organizational Culture as Mediator," *Journal of Education Technology Information Social Sciences and Health*, vol. 2, no. 2, pp. 750–769, Sep. 2023, doi: 10.57235/jetish.v2i2.498.
- [30] A. M. Carvalho, P. Sampaio, E. Rebentisch, J. Á. Carvalho, and P. Saraiva, "Operational excellence, organisational culture and agility: the missing link?," *Total Quality Management & Business Excellence*, vol. 30, no. 13–14, pp. 1495–1514, Oct. 2019, doi: 10.1080/14783363.2017.1374833.
- [31] A. M. Carvalho, P. Sampaio, E. Rebentisch, J. Á. Carvalho, and P. Saraiva, "The influence of operational excellence on the culture and agility of organizations: evidence from industry," *IJQRM*, vol. 38, no. 7, pp. 1520–1549, Jul. 2021, doi: 10.1108/IJQRM-07-2020-0248.
- [32] A. M. Carvalho, P. Sampaio, E. Rebentisch, H. McManus, J. Á. Carvalho, and P. Saraiva, "Operational excellence, organizational culture, and agility: bridging the gap between quality and adaptability," *Total Quality Management & Business Excellence*, vol. 34, no. 11–12, pp. 1598–1628, Aug. 2023, doi: 10.1080/14783363.2023.2191844.
- [33] I. Boumsisse, M. Benhadou, and A. Haddout, "Study of behavioral levers enhancing operational excellence in the context of the industry 5.0 transition," *International Journal of Engineering Trends and Technology*, vol. 72, no. 8, pp. 265-278, 2024. Crossref, <https://doi.org/10.14445/22315381/IJETT-V72I8P126>
- [34] V. Swarnakar, A. R. Singh, J. Antony, A. K. Tiwari, and E. Cudney, "Development of a conceptual method for sustainability assessment in manufacturing," *Computers & Industrial Engineering*, vol. 158, p. 107403, Aug. 2021, doi: 10.1016/j.cie.2021.107403.