Managerial Competencies for Human Brains and Mechanical Muscles Interplay; A Study of Automotive Industries

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Abstract. Industry 5.0 is a complex phenomenon emphasising integrating advanced technologies with human-centric principles to drive innovation and productivity. Industry 5.0 requires extensive technological, managerial and organisational capabilities to create value through the seamless interplay between humans and machines. Personalised, high-quality products are available faster and cheaper when human brains work harmoniously with mechanical muscles. The Cobot-human relationship is symbiotic, strengthening humans and machines to complete production processes.

Considering how human agents will acquire the skills necessary to act autonomously and progress the techno-social revolution in an Industry 5.0 setting is critical. To be human-centric, resilient, and sustainable, industry 5.0 development is from the standpoint of distinct managers' understandings of skills, roles, and responses. Insights from the pertinent academic literature and exploratory qualitative research techniques were used to establish critical managerial competencies for long-term contribution to humanity. Primary data collected through in-depth interviews with managers in 10 different automotive industries were analysed to highlight human-centricity, resilience, and sustainability factors, which can assist automotive industries in propagating Industry 5.0 usage.

This study shall contribute to creating a paradigm shift that requires the management's role to change from profit-centricity to human-centricity, thereby improving productivity.

This study shall contribute to information system research and project management research. This research provides essential insights to business groups, policymakers, academics, and other stakeholders working to build the skills necessary for a sustainable business.

Keywords: Industry 5.0 competencies · human centricity · resilience · sustainability · managerial capabilities · automobile industry

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1 Introduction

The term "Industry 5.0" describes the subsequent stage of industrialisation, which expands on the ideas of "Industry 4.0," which emphasises automation, connection, and digitalisation. Industry 4.0 strongly emphasises the application of cutting-edge technologies to boost output and efficiency. The EU defines Industry 4.0 is "a vision of an industry that aims beyond efficiency and productivity as the sole goals and reinforces the industry's role and contribution to society". It is the 4.0 new industrial revolution focused on Humanism and ethics [1]. It is more phased towards advanced technology. AI-based Robots, IoT, blockchain, smart contracts, etc., add to the efficiency as well as productivity of the organisation. The human-centric motivation, as well as augmented resilience, emphasises sustainability. Even though CSR activities always prevailed, there was a need to prioritise people and the environment over profits, shifting the industry's emphasis. To establish a more comprehensive viewpoint than Industry 4.0, the concept of Industry 5.0 expands the organisation, becoming more human-centric, resilient, and sustainable as the main foundations of Industry 5.0. The study concludes that developing these managerial competencies is critical for the automotive industry to thrive in the future. A new product's cost can be estimated using software for manufacturing costing. It automates the costing processes and shortens the time to market new products. Based on the earlier industrial revolutions, when compared to Industry 4.0, which focused on digitising and automating production processes, Industry 5.0 goals to integrate cutting-edge technology with a human-centric strategy. This strategy strongly emphasises the value of social responsibility, resilience, and sustainability [2].

1.1 Research Question

To reflect new thinking and improve performance, changes would follow technological changes in relationships among organizational stakeholders, defined "smart" as the "changes in approaches to work, work cultures, business architecture, premises, decision making, communications, and collaboration".

1.2 Research Objectives

- Evaluate each manager's existing competence as a manager in an automotive or -organisation embracing Industry 5.0.
- Identify the critical competencies individual managers need to operate and lead successfully in an Industry 5.0 human-centric, resilient, and sustainable environment.

2 Literature Review

2.1 Manager Competencies to Promote Human-Centricity Values

Organisations can acquire specialised capabilities that prioritise the welfare and empowerment of individuals to adopt human-centric values in Industry 5.0. The human-centric approach "promotes talents, diversity, and empowerment." [3]. Humans, as a resource,

need to focus. Focusing on human resource talent will help to transition into the digital era across many industries, including education, by placing the interpersonal and human components at the centre of our activities [4]. However, the modern digital world emphasises "human-centricity" as a crucial element of the future workplace. They are integrating cyber-physical systems (CPS) into industrial processes.

2.2 Manager Competencies to Promote Strategic Resilience

According to the European Commission, a resilient approach is where companies are agile and flexible and change by adapting to new technology. However, organisations high on flexibility and agility are only sometimes resilient [5]. Effectiveness and profit enlargement are significant factors of the business. The addition of flexibility and adaptability concerning the "lean" version is specifically motivated by the importance of competence. Some anti-fragile organisations learn to foresee, respond and earn systematically from the crisis to guarantee stable and long-lasting performance [6].

2.3 Manager Competencies to Promote Sustainability

An organisation focused on sustainability is fully aware of its responsibilities to various stakeholder groups. Such a company deliberately enhances its social and ecological performance while considering socio-technical concerns. Reconciling divergent and competing requirements within an evolution towards more sustainable business practices might take time [7].

3 Research Methodology

3.1 Qualitative Study

This research used the grounded theory technique to better understand managerial competencies in Industry 5.0. The study also examines the ideas and insights of managers directly involved in providing goods and services related to the automotive sectors in emerging economies.

3.2 Data Collection

After approaching 25 organisations initially, we conducted in-depth interviews with ten managers from 10 automotive industries with headquarters in Pune and the Pimpri-Chinchwad automotive industry belt. Nine in-person interviews and one telephone interview were conducted over three months. The managers we spoke with were knowledgeable about industrial procedures and had over five years of experience.

One is in a leadership position inside the autonomous organisation. The Mahratta Chamber of Commerce, Industries and Agriculture (MCCIA) database, a network and advocacy organisation for Indian businesses in Pune, contained information on the sample of managers. We utilised the following selection criteria to decide which managers would be qualified for this study's interviews: (1) deliver products and services in their respective organisation, (2) have the authority to move company resources as needed, and (3) be responsible for increasing organisation performance. The organisations and people had to remain anonymous due to the sensitive information provided in these interviews. Identifier codes were given to each organisation and its members to achieve this anonymity. Ten individuals across ten organisations were interviewed (Table 1).

Table 1. Anonymised Organisation & Participant Breakdown

Manufacturing Industry code	Individual code	Position	Industry
O1	I1	Managers	Electronics/Electrical
O2	I2	Assistant Manager	Engineering
O3	I3	Managing Director	Aerospace
O4	I4	CEO	Chemical
O5	I5	Technology con-consultant	Automotive
O6	I6	Managing Director	Engineering
O7	I7	Assistant Manager	Automotive
O8	I8	Management consultant	Electronics/Electrical
O9	I9	Managing Director	Automotive
O10	I10	Assistant Manager	Automotive

3.3 Data Analysis and Findings

All of the interviews were recorded and then transcribed verbatim. The coding strategy was used independently by the two researchers who participated in this study to analyse the data. The independent assessments' results helped build the human-centricity, resilience, and sustainability factors. Thematic analysis by NVivo 12 Pro software was used to analyse the transcribed interviews and significant themes related to sustainable development functions like human centricity.

Manager Competencies to Promote Human Centricity

According to Table 2A, out of 10 respondents, six agree that employee empowerment is a significant aspect of human centricity. Industry 5.0 is all about enhancing the digital transformation of enterprises through the effective fusion of people and technology so that they may work more productively together in a secure setting. Even though less than 50% of the respondents agree with diversity and inclusion, a company like Accenture

Table 2. Human Centricity Factors in Industry 5.0 Context

Manager Competencies to promote Human-centricity	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	Total
Employee Empowerment	√		√		√	√		√		√	6
Diversity and Inclusion		√			√		√			√	4
Work-Life Balance	√		√		√	√	√	√	√	√	8
Skill Development and Lifelong Learning	√		√		√	√	√	√	√	√	8
Ethical and Transparent Practices	√		√			√		√			4
Customer-Centric	√			√	√	√	√	√		√	7
Social Responsibility	√		√		√		√		√		5

asserts that organisations use a human-centric approach. The strategy may grow adaptable and resilient in challenging and unpredictable social and economic settings [26]. 80% of the respondents agree that work life is a challenge, and Industry 5.0 will give flexible working arrangements, which are becoming increasingly common in industrialised nations. However, it is unclear how they will affect their health and happiness. Lifelong learning is an important aspect where Companies have been obliged to evolve, embracing continuous learning (lifelong learning) to provide their employees with the training and skills necessary. For the new professional responsibilities to reduce this training gap. As shown in the table, 70% of the respondents agree on ethics and transparency. Industry 5.0 asserts that it will move away from technical productivity methods and towards a more human-centred strategy. Socio-technical interoperability between people and AI systems is a necessary first step.

Manager Competencies to Promote Resilience

Industry 5.0 also emphasises the importance of resilience in disruptions such as natural disasters and pandemics. Developing flexible and adaptable manufacturing processes enables quickly responding to changing conditions. It also involves implementing risk management strategies that can mitigate the impact of disruptions.

According to Table 3, resilient organisations can maintain their enthusiasm under stress, handle disruptive changes, and adapt. They recover quickly after failures. They also conquer significant obstacles without acting dysfunctional or hurting other people. Hence, more than 70% of the respondents agree that strategic thinking, adaptability and flexibility are substantial factors in Industry 5.0. Also, 60% more than half of the respondents agree with Making Decisions in an Uncertain and building stakeholder relations. In our rapidly changing world, organisations frequently face challenging decisions that must be made quickly and effectively. However, risk and uncertainty can significantly affect decisions, which might bother and worry organisations. Examines the challenges of choosing wisely in risky and ambiguous circumstances and provides insightful guidance, including scenario planning and prototyping, communication, and risk management. According to psychological research, organisations with emotional

Table 3. Resilience Factors in Industry 5.0 Context

Manager Competencies for Resiliency	I1	I2	I3	I4	I5	I6	I7	I 8	I9	I10	Total
Strategic Thinking	√									√	8
Adaptability and Flexibility		√	√	√	√	√		√		√	7
Management of Risk	√	√	√			√		√	√	√	7
Making Decisions in an Uncertain		√	√			√		√	√	√	6
Leadership and Emotional Intelligence	√	√	√		√			√	√	√	7
Building strong relationships with stakeholdersers	√	√		√	√	√		√	√	√	8
Continuous Learning and Personal development	√	√	√	√	√	√			√	√	8
Crisis management		√	√		√	√		√	√		6

intelligence may also be crucial in high-stress battle circumstances where cognitive performance is limited. This lack of cognitive function frequently occurs in stressful and high-pressure professional contexts. It is noticed that 80% of the organisations agree that EI is important, and 60% agree that crisis management and the capacity to thrive despite disaster risk. Also, managers can prepare for, deal with, withstand, and recover from disasters. e.g. Covid crisis management with work from home, especially in the manufacturing sector.

Manager Competencies to Promote Sustainability

Sustainability is a vital component of Industry 5.0. The industry aims to decrease carbon footprint and curtail waste through renewable energy sources and sustainable manufacturing practices. It comprises the usage of eco-friendly materials and the implementation of circular economy principles.

Table 4. Sustainability Factors in Industry 5.0 Context

Manager Competencies for Sustainability	I1	I2	I3	I4	I5	I6	I7	I 8	I9	I10	Total
Environmental Awareness	√		√		√	√		√	√	√	7
Strategic Planning for Sustainability		√			√		√	√		√	5
Sustainable Innovation:	√		√		√		√	√	√		6
Performance Measurement and porting	√		√		√	√		√	√	√	7
Collaboration and Partnerships	√	√	√			√	√	√	√		7
Circular process	√			√	√	√	√	√		√	7
Sustainability values		√	√		√	√	√				5

According to Table 4, 7, out of 10 respondents agree that organisations must emphasise environmentally friendly practices using cutting-edge technology. Manufacturing operations comprehensively apply renewable energy sources—like solar or wind energy. Performance measurement and reporting, where 7 out of the 10 respondents agreed, mentions that Organisations can assure compliance with environmental laws, industry standards, and sustainability frameworks by measuring and reporting on their sustainability performance. Organisations can identify gaps or areas of non-compliance and take corrective measures to align with applicable legislation and standards by routinely monitoring and reporting their sustainability performance. A circular process where Industry 5.0 technology can make manufacturing processes more resource-efficient by increasing product lifespan, decreasing waste, and optimising output. For instance, IoT sensors and data analytics can optimise energy and material to ensure that resources are used effectively throughout the production cycle. Sustainable values out of 10,7 respondents agreed. To share information and best practices values in sustainability, organisations should.

4 Discussion

Industry 5.0, which emphasises human-centricity, strives to establish a harmonious partnership between people and machines in which technology enhances rather than replaces human talents. This method produces superior results in innovation and problem-solving and enhances job satisfaction, engagement, and productivity. The following are the factors that play a significant role in Industry 5.0

4.1 Human Centricity

- **Employee Empowerment:** Organisations ought to promote an atmosphere that gives employees agency and promotes active engagement. Such an environment encourages open communication, involves workers in decision-making, and offers career advancement opportunities. Employees who feel empowered are more driven, engaged, and willing to contribute to the organisation's success [8].
- **Diversity and Inclusion:** Small and medium-sized businesses (Organisations) should appreciate diversity and foster inclusive workplaces that value and respect individual differences. Encouraging diversity in hiring procedures, ensuring every employee has an equal opportunity to succeed, and building an inclusive and respectful workplace atmosphere is vital [9].
- **Work-Life Balance:** The work-life balance entails providing flexible work schedules, encouraging healthy work habits, supplying tools for stress management and preserving one's mental and physical well-being. Supporting work-life balance increases productivity, job satisfaction, and employee satisfaction [10].
- **Skill Development and Lifelong Learning:** Organisations should support lifelong learning and invest in their personnel's ongoing skill development. Staff members learn new skills and information through mentorship programmes, workshops, and training sessions [11].

4.2 Competencies for Resilience

It is adept at organising and leading teams in stressful situations while maintaining composition and making wise choices. They know the significance of effective communication, resource allocation, and quick problem-solving in crises. Strategic thinking.: Resilient organisations can strategise and foresee upcoming difficulties and disruptions. They know the broader market dynamics, technical developments, and new trends that could impact the sector. They can direct the - organisation towards resilience by considering various circumstances and creating proactive measures [12].

Adaptability and Flexibility. Resilient organisations are adaptive and flexible in the face of change. To respond to unforeseen occurrences and changes in the market, they can swiftly modify their plans, procedures, and business practices. They welcome innovation and constantly seek new advancement chances [13].

Management of Risk. Resilient organisations are adept at recognising, evaluating, and controlling risks. They thoroughly know the business's possible hazards and take proactive steps to reduce them. Risk management frameworks, creating backup plans, and ensuring operations continue during a disruption [14].

They are Making Decisions in an Uncertain World. Resilient Organisations are skilled at making defensible choices in complex and challenging circumstances. Before making strategic decisions, they acquire and analyse pertinent data, communicate with stakeholders, and consider various viewpoints. They can make prompt judgements to guide the organisation towards resilience because they can easily take calculated risks [15].

Leadership and Emotional Intelligence. Resilient organisations have excellent leadership and emotional intelligence. Especially in trying circumstances, they can motivate their colleagues and effectively communicate. They are sympathetic to the worries of their employees since they are aware of how emotions affect people. Resilient organisations build a supportive workplace environment that encourages teamwork, trust, and Resilience [16].

They are Building Solid Relationships. Relation with stakeholders and collaborating are two skills resilient organisations possess. They actively interact with vendors, clients, business partners, and other relevant entities to promote cooperation and learning from one another. They use these connections to strengthen their resilience and adjust to shifting market conditions [17].

Continuous Learning and Personal Development. Resilient organisations are often dedicated to their personal growth. They stay current on business trends, technological developments, and resilient best practices. They actively support their team members' progress as professionals by looking for possibilities for professional development [18].

4.3 Ownership of Their Social Duty

This ownership of social duty includes participating in CSR programmes, lending a hand to neighbourhood projects, and considering their activities' social and environmental effects. Organisations can contribute to community development, have experience in sustainability projects, and behave ethically as businesses. By fostering these competencies, organisations can establish a workplace emphasising individuals' well-being, development, and empowerment. As a result, the organisation experiences an uptick in employee happiness, productivity, and overall performance.

Environmental Awareness: Organisations must be well-versed in sustainability- its concepts and ecological challenges. They should be current on environmental laws, new fashions, and sustainable living guidelines. Because of this awareness, they can include environmental factors in decision-making processes, encouraging sustainable practices [19].

Strategic Planning for Sustainability: Organisations must be able to create and practice sustainability strategies consistent with the organisation's objectives and core values. They should consider sustainability's environmental, social, and economic facets when creating long-term strategies. Organisations can direct the organisation towards sustainable practices by establishing and incorporating precise sustainability objectives into the company plan [20].

Environmental Awareness: Effective organisations know the significance of engaging with stakeholders to promote sustainability. They should foster partnerships with suppliers, consumers, employees, communities, and regulatory agencies to identify sustainability goals and work together on sustainability projects. The organisation can reduce their influence on the environment and improve resource efficiency by implementing sustainable procurement procedures, making the most of its energy use, and embracing circular economy ideas [21].

Sustainable Innovation: The organisation may promote innovation for sustainability by developing a culture of creativity and supporting the investigation of sustainable technology and practices [20].

Performance Measurement and Reporting: Organisations should set up systems to track and evaluate the company's sustainability performance. The organisation's dedication to accountability and openness is demonstrated by effectively porting internal and international sustainability performance [22].

Change Management and Employee Engagement: Organisations must have excellent change management abilities to lead sustainability programmes successfully. Employees should be made aware of the value of sustainability, given the opportunity to participate in decision-making, and given training and information on sustainable practices. Organisations may help adopt sustainable behaviours by encouraging employee involvement and developing a sense of purpose [23].

5 Conclusion and Implications of Industry 5.0

Industry 5.0 technology synergy promotes human-centricity, sustainability, and resilience by fusing human and technological strengths. It recognises the value of men in the production process, develops their abilities through interaction with robots, and encourages a positive work atmosphere. It promotes sustainable practices by minimising resource usage and relying on renewable energy sources. Finally, it improves resilience by enabling agile and adaptable production systems and utilising data-driven decision-making. Industry 5.0 provides the way for a more inclusive, sustainable, and resilient future by upholding these ideals [24].

Industry 5.0 helps create a more environmentally friendly and sustainable industrial ecosystem by maximising energy and material utilisation. Industry 5.0 recognises the need for resilient systems that can adjust to and bounce back from setbacks. Industry 5.0 provides real-time data collecting, analysis, and decision-making by fusing technologies like the Internet of Things (IoT) and artificial intelligence (AI). This run time data makes preventive maintenance, predictive analytics, and quick response to unplanned events possible, reducing downtime and enhancing industrial processes' overall resilience. Additionally, Industry 5.0 promotes flexible manufacturing and decentralised production, allowing businesses to respond quickly to shifting consumer needs and supply chain disruptions [25].

Actively seek collaborations and partnerships with external organisations, including NGOs, research institutions, and industry associations. Organisations can learn about new sustainable values, exchange experiences, and use group efforts to address sustainability concerns by joining sustainability networks and projects. Organisations should uphold the highest ethical standards and encourage openness throughout their business operations. Ethics entails acting honestly and responsibly, ensuring workers are treated fairly, and engaging in ethical business practices. Organisations gain the trust of their staff, clients, and stakeholders by acting with integrity and ethics. Organisations should focus on their consumers' demands and preferences when designing products and services to meet their expectations, undertaking market research, actively listening to customer feedback, and constantly updating products based on feedback [26]. Organisations may establish lasting bonds and client loyalty by strongly emphasising customer satisfaction.

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