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# Dynamic Capabilities and Resilience in the Manufacturing Sector: The Role of Digitalisation and Automation in Adapting to Market Volatility

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## Abstract

Manufacturing firms in general create and execute manufacturing strategies based on the extent to which their environment is uncertain. Being flexible is a part of manufacturing strategy to improve their performance in such situations. This study examines how the manufacturing industry has confronted an increasingly volatile environment encompassing unforeseen disruptions that can severely impact operational continuity and

competitiveness. A systematic literature review was conducted and ended up with 99 studies, which were selected from 562 studies for the purpose of identifying key themes and providing insights into the manufacturing industries. It is observed that organisations seeking to maintain a competitive advantage develop capabilities that not only enable them to recover from challenges created by their stakeholders and communities but also to adapt and thrive in a constantly changing environment. A crucial element for achieving this resiliency is the development of dynamic capabilities, which allow companies to anticipate and proactively respond to environmental changes. The ability to detect and swiftly react to signals is essential for ensuring long-term sustainability. It is found that dynamic capabilities become more effective when they are combined with strategies supporting digitalisation and automation. This study reveals that digitalisation and automation are the key components in the modernisation of industrial operations. These technologies optimize operational efficiency and also enhance an organisation's ability to withstand disruptions, such as those caused by the COVID-19 pandemic. The adoption of digital tools improves flexibility, effectiveness, and adaptability in manufacturing processes that lead to strengthening organisational resilience. This literature review highlights that a resilience-oriented design approach from the early stages of the manufacturing process facilitates the creation of operational configurations that can swiftly adjust to unforeseen changes. This proactive approach not only ensures business continuity but also fosters innovation, driving companies to explore new opportunities and maintain competitiveness in a highly dynamic global market.

## Keywords
Resilience, Dynamic Capabilities, Digitalisation, Manufacturing Resilience.

## Biographies
**Cristian Rincón-Guio** is a university researcher and lecturer specializing in Management, Operations, Production, and Project areas. Currently pursuing a PhD in Engineering with a focus on Industry and Organizations at the Universidad Nacional de Colombia, he holds a Master's degree in Hydrocarbon Industry Management from the Universidad de Viña del Mar, and a specialization in Project Management from UNIMINUTO. With extensive experience in academia and industry, Cristian has been recognized as an Associate Researcher by Colombia's Ministry of Science, Technology, and Innovation (MINCIENCIAS). He serves as a peer reviewer for academic journals and national research projects and has participated in evaluation processes for Colombia's Ministry of Education. His research contributions have been published in high-impact international journals such as the Journal of Industrial Integration and Management. His work explores diverse topics, including resilience in manufacturing strategy, sustainability in agribusiness, and logistics 4.0. Cristian has also presented findings at esteemed conferences, including the International Conference on Industrial Engineering and Operations Management. As an educator, Cristian designs and delivers courses in Operations Management, Supply Chain Optimization, and Project Evaluation, with a strong emphasis on fostering critical thinking and innovative problem-solving skills. He has developed methodologies and active learning strategies to enhance student engagement, focusing on bridging theory with practical applications. His current research interests include green supply chain management, technological innovation, and strategies for resilient manufacturing in volatile and uncertain environments.

**Nathalia Orozco-Morales** is a research professor in the Artificial Intelligence specialization at Corporación Universitaria Minuto de Dios – UNIMINUTO –(Colombia). Master in Artificial Intelligence and professional in Physical Engineering, with experience in integrating advanced technologies and scientific methods into educational and research projects.

**Juan Sebastian Martínez** is full-time professor at the Institución Universitaria Politécnico Grancolombiano (Colombia), serving as the coordinator of the Virtual Industrial Engineering Program and the curriculum leader of the institution. He holds degrees as an Industrial Engineer and Public Accountant, with a master's in Industrial Engineering from the National University of Colombia and a Master's in Finance and Financial Management from EUDE University in Spain. Currently, he is pursuing a Ph.D. in Education Sciences at the National University of La Plata in Argentina. His areas of interest focus on the productive and logistical development of agricultural producers, as well as technological innovation for learning and curriculum development.

**Luis Rabelo**, Ph.D., was the NASA EPSCoR Agency Project Manager (2009-2011) and is currently a Full Professor in the Department of Industrial Engineering and Management Systems at the University of Central Florida (Orlando, Florida). He earned dual degrees in Electrical and Mechanical Engineering from the Technological University of Panama and master's degrees from the Florida Institute of Technology in Electrical Engineering (1987) and the

University of Missouri-Rolla in Engineering Management (1988). He received a Ph.D. in Engineering Management from the University of Missouri-Rolla in 1990, where he also did Postdoctoral work in Nuclear Engineering in 1990-1991. In addition, he holds a dual M.S. degree in Systems Engineering and Management from the Massachusetts Institute of Technology (MIT). He has over 300 publications, three international patents used in the Aerospace Industry, and has supervised 45 M.S. and 54 Ph.D. students as an advisor and co-advisor. He has provided consulting services for NASA, NSF, ONR, NIST, Lockheed Martin Corporation, Boeing, USSF, Tyco and others. His experience includes Ohio University, BF Goodrich Aerospace, Honeywell Laboratories, National Institute of Standards and Technology, NASA and MIT. He has received numerous awards, including ONE NASA in 2006, the Panama Technological University Alumni of the Year in 2008, Fulbright Scholar in 2008, Two NASA Group Achievement Awards, the Emerald Literati Network Awards for Excellence in 2007, the Arch T. Colwell Award of Merit in 2004 from the Arch T. Colwell Society of the Society of Engineering and Technology in 2004. Colwell Merit Award in 2004 from the Society of Automotive Engineers (SAE), the Hispanic Engineers National Achievement Corporation (HENAAC) Education Award in 2011, the 2011 Engineer Educator of the Year from the U.S. Council of Engineers and the 2013 SAE International Joseph McFarland Award.

**Birasnav Muthuraj** is a Professor of Management at Southern School of Business. He is also the Director of Experiential Education at Southern School of Business. Prior to joining the faculty at Southern School of Business, he was a faculty at New York Institute of Technology, New York. Leveraging his more than twelve years of teaching experience, he develops experiential business courses, organizes experiential education programs with industries, and engages Southern undergraduate and graduate students and global students to attain experiential learning goals. In particular, he is proud of an experiential learning activity, Explore California during Spring Break, which provides opportunities for students to visit more than ten manufacturing and service industries located throughout California and address the challenges faced by these industries. His research findings appeared in high quality widely recognized journals such as Journal of Business Research, Computers & Industrial Engineering. His findings have also been briefed for top-level managers in practitioner journals such as Strategic Direction. He has presented his research findings in reputed conferences organized by Decision Sciences Institute, Production and Operations Management Society, and British Academy of Management. He and his colleagues received a best paper award in the 19$^{th}$ Global Conference on Flexible Systems Management. His research proposals attracted many national and international research grants. In specific, he won 2012 Emerald/EFMD MENA Management Research Fund for his research proposal. He and his colleagues received 2020 Fulbright-Hays Program Grant for their work, Academia and Society – Collaboration Across Borders: A Virtual Exchange Program. His team has also received several research grants from Mallah Family Foundation, New Jersey. He received his PhD in Management Studies from Indian Institute of Technology Roorkee. His consulting experience ranges from national to multinational manufacturing and service industries. Teaching Interests: Operations Management, Supply Chain Management, Quantitative Methods. Research Interests: Green Supply Chain Management, Social Capital in the Buyer-Supplier Relationship, Total Quality Management, Leadership.