

Navigating India's Industry 4.0 Landscape: The ONDC Perspective

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Abstract

Purpose- Despite its nascent stage, ONDC could be a catalyst for fostering a manufacturing production cloud. This study examined the role of ONDC (Open Network for Digital Commerce) within the framework of Industry 4.0 in India.

Design/methodology/approach- This study employed conceptual analysis to understand the potential of ONDC in the context of the industrial revolution and sustainable development in India. To fulfill the objectives of this study, the secondary data gathered from academic publications, news stories, and ONDC's official website to provide further information and analysis on Industry 4.0 and ONDC.

Findings- The findings from conceptual analysis showed that the effective implementation of ONDC is pivotal for revolutionising India's industrial landscape and driving economic growth. Further, the linkage between MSMEs and ONDC indicates that with ONDC's digital infrastructure, MSMEs can reap the benefits of global market access, facilitate e-commerce processes, receive compliance assistance, optimise logistics and gain market intelligence insights.

Originality- The evaluation of existing literature revealed that none of the previous studies reviewed the linkage between ONDC and Industry 4.0. Thus, exploring ONDC's role in the context of Industry 4.0 is not only pertinent but essential for realising its full potential in driving economic transformation.

Limitations- This study is restricted to conceptual analysis of ONDC in the context of Industrial Revolution 4.0 thus the future work must focus on gathering the data from the MSMEs businesses that adopted ONDC.

Keywords: ONDC, Industry 4.0, MSMEs, Sustainable Development, India, Digital Economy

Introduction

Industry 4.0 is characterised by the integration of digital technologies such as robotics, and additive manufacturing (3D printing), Internet of Things (IoT), artificial intelligence (AI), big data analytics, among

others, into manufacturing and industrial processes to create "smart factories" and enable more efficient, flexible, and automated production systems (Khachaturyan and Ponomareva, 2018; Bryndin, 2018) which can link the production process with sales, service and logistics. Industry 4.0's digital transformation, driven by data, is becoming a reality for firms worldwide. It is no longer just a prospect, but a reflection of how far technology adoption has progressed. Businesses globally are incorporating advanced technology into their operations to gain a competitive advantage in market timing, penetration and opportunity exploitation (Suleiman et al., 2022; Liu et al., 2023; Guryanov Andrey et al., 2018). This empowers businesses to improve operations using innovative technology. Moreover, the data generated in large volumes by intelligent devices is harnessed for faster operations and higher productivity (Tayibnapis et al., 2018; Kempegowda & Chaczko, 2018). In this context, ONDC is a component of Industry 4.0 that enables businesses to participate in the digital economy by fostering innovation, improving productivity and enhancing competitiveness across various sectors of the economy.

With this open network, manufacturers and industrial enterprises can adopt digital technologies, streamline operations, access global markets, and engage in e-commerce activities. The DigiReady Certification (DRC) portal was launched by the Quality Council of India (QCI) and the Open Network for Digital Commerce (ONDC) for the MSMEs. With this portal, the assessment and certification of digital readiness of MSMEs can be done which would enhance their digital competencies (Press Information Bureau, 2024, February 09). Thus, ONDC is a key enabler and medium for materialising the objectives of Industry 4.0 in India. Therefore, this study delves into the potential of Open Network for Digital Commerce (ONDC) in manufacturing and industrial sectors to lead the Industrial Revolution 4.0.

Literature Review

The fourth industrial revolution merges modern production methods with digital technology, forming data-driven networked organisations that can transform entire sectors. It signifies a new era of intelligent and interconnected systems (Zakoldaev et al., 2019; Yudina, 2019; Tripathi and

Gupta, 2021). Despite varying applicability across sectors, the concept of digitalisation in Industry 4.0 has disrupted all of them (Pedone and Mezgár, 2018; Ellitan and Anatan, 2020). Industry 4.0 initiatives leverage data and intelligence to aid customers in developing innovative products tailored to unique customer needs and optimising their performance. They also assist in the design and operation of autonomous factories that dynamically use intelligent assets in every process (Qian et al., 2022; Delera et al., 2022). Improved value chains, smooth transactions and accurate product delivery have all been observed in industries that have embraced digitalisation. Thus, adopting Industry 4.0 and digital manufacturing can offer businesses increased agility, flexibility and operational efficiency. The digital twins help businesses boost productivity, optimise processes, and innovate products by simulating the process. Consequently, manufacturers can evaluate modifications to a production process to identify ways to reduce downtime or increase capacity (Bhagat et al., 2022; Gebhardt et al., 2022).

Additionally, manufacturers could consider digitally integrating end products to provide their clients with professional predictive services, including predictive maintenance capabilities. As a result, leading businesses undergoing this digital transformation may leverage new data to gain deeper operational insights, make real-time decisions, and provide new value to their clients' operations (Strange and Zucchella, 2017; Kozhevina, 2020). Additionally, Industry 4.0 will enhance organisations' competitiveness by addressing stakeholders' needs. Many companies are integrating these technologies, upskilling their workforce and hiring skilled employees. However, the complex implementation process, lack of standardised procedures and transition from old systems necessitate more straightforward guidelines for adopting these new technologies (Abdukadirova and Mirzajonova, 2021; Kraus and Kraus, 2021; de Sousa, 2022). Furthermore, real-time data from Industry 4.0 technologies can help promptly identify and fix issues, reducing downtime (Popkova and Sergi, 2020; Tolstykh et al., 2018). This will enable businesses to offer customised and context-specific products and services, enhancing customer value. Thus, Industry 4.0 is vital for the survival of organisations in the

process industry (Tarasov, 2018; Alvan and Umarbeyli, 2023). Furthermore, it requires a skilled workforce, so manufacturers need to attract and retain talent while upskilling their current workforce to meet Industry 4.0 expectations. This requires a cultural shift towards embracing technology and continuous learning. Industry 4.0, like all industrial revolutions, aims to boost productivity by merging people, technology, and data to provide a comprehensive production strategy (Celaschi, 2017; Wang et al., 2023; Firmansyah et al., 2022).

The "human-machine integration" technique, which merges human labour and machine work, enhances operations, reduces costs, and increases productivity and efficiency. Additionally, this strategy enhances working conditions for employees. There are many advantages to implementing Industry 4.0. In particular, SMEs in developing nations may outperform earlier technological waves that industrialised nations have encountered, like automation and robotics (Popkova and Haabazoka, 2019; Kumar et al., 2022). Moreover, Industry 4.0 promotes continuous data exchange among stakeholders, enhancing efficiency and planning. The proximity of stakeholders can be beneficial, and the "Ruralisation" strategy can address this by setting up regional manufacturing centres. This could lead to dispersed production facilities (Bortolini et al., 2017; Litvinenko, 2020).

Significance of the study

With rapid technological advancements, the customers have immediate access to information. This advancement in technology has paved the way for personalised and digitally connected products, which has led manufacturers to face unprecedented pressure. This integration is propelled by the advanced use of data, which businesses leverage to target consumers, make informed decisions and innovate new products and services with value-added services that not only enhance customer experience but also contribute to increased revenue and reduced operational costs (Gurjanov et al., 2018; Capello and Lenzi, 2021; Soomro et al., 2021). The evaluation of existing literature revealed that none of the previous studies have reviewed the linkage between ONDC and Industry 4.0. Thus, exploring ONDC's role in the context of Industry 4.0 is not only pertinent but essential for realising its full potential in

driving economic transformation.

Research Objectives

RO1: To identify the potential role of ONDC in facilitating Industrial Revolution 4.0.

RO2: To analyse the effect of ONDC on enhancing the export competitiveness of MSMEs.

RO3: To discuss the capacity of ONDC in leading sustainable industrial development in India.

RO4: To identify the challenges for ONDC within the context of Industry 4.0.

Data and Methodology

Data

The research employs secondary data obtained from academic publications, news stories, and ONDC's official website to provide further information and analysis on Industry 4.0 and ONDC.

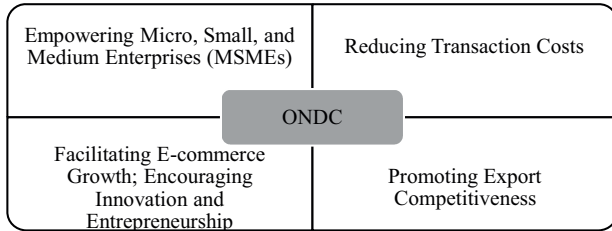
Methodology

To fulfil the research objectives, this study uses conceptual analysis. A thorough review of relevant literature, theories, frameworks and case studies related to the particular concept under evaluation is part of the conceptual analysis process (Furner, 2004). A theoretical framework for understanding ONDC's potential to support India's industrial revolution and sustainable development is provided by this conceptual analysis.

Results and Discussion

ONDC can create an efficient, more inclusive, and resilient economy. Figure 1 shows that ONDC ensures sustainable industrial development by empowering MSMEs, reducing transaction costs, promoting e-commerce growth, making exports more competitive, fostering innovation, and improving government programs. Importantly, this open network for digital commerce (ONDC) complements Digital India, Make in India, and Atmanirbhar Bharat initiatives of the Indian government by providing a digital infrastructure for commerce that not only facilitates digital inclusion but also promotes indigenous manufacturing and drives economic self-reliance.

Figure 1: ONDC facilitating Industrial Revolution 4.0



Source: Own Compilation, 2025.

Incorporating ONDC into the manufacturing and industrial sector to lead Industry 4.0

In Industry 4.0, manufacturers can make smart choices by sharing data in real time between connected devices. The core of this revolution is the digital linking of machines, which makes operations more efficient and outputs that are

focused on results (Majstorovic and Mitrovic, 2019; Pozdnyakova et al., 2019). However, a big problem is getting all businesses, big and small, to adopt an Industry 4.0 mindset. There have been significant improvements in many areas of industry, such as the automotive industry. However, a concerted effort is needed to raise awareness of the long-term benefits. To achieve this, one needs to engage in activities such as consulting, training, audit assessments, experience centres and programs to improve skills (Safiullin et al., 2019; Götz and Jankowska, 2020; Kumar and Kumar, 2020). Therefore, incorporating the digital platform of ONDC into the manufacturing and industrial sectors is pertinent. With this ONDC platform, manufacturers and industrial enterprises can lead the Industrial Revolution 4.0. Table 1 represents the role of ONDC in leading Industrial Revolution 4.0 in the manufacturing sector

Table 1: ONDC and Industrial Revolution 4.0

Smart Manufacturing Systems ONDC enables seamless integration of digital commerce activities with production processes. Thus, incorporating ONDC platform s into smart manufacturing systems allows manufacturers to automate order processing, inventory management, and supply chain operations, optimising efficiency and reducing lead times.	
Management of Digital Supply Chain ONDC digitise supply chain processes (including procurement, logistics, and distribution), which will create transparent and traceable supply chains. Also, enabling real-time tracking of goods, inventory management, and supplier collaboration.	
Utilizing E-commerce Marketplaces (for Industrial Products) Develop specialised e-commerce marketplaces within ONDC for industrial products and equipment which will connect manufacturers, suppliers, distributors, and buyers. It facilitates transactions, product discovery, and procurement of industrial products.	rial
Collaborative Manufacturing Platforms To facilitate partnerships and collaboration among manufacturers, suppliers and service providers, establish collaborative manufacturing platforms within ONDC. This will foster innovation and accelerate product development.	
Data-driven Decision-making Harness data analytics and artificial intelligence (AI) capabilities within ONDC to derive actionable insights from manufacturing data.	
Digital Twins and Augmented Reality (AR) Integrate ONDC with digital twins and augmented reality (AR) applications to enhance the visualisation, simulation, and monitoring of manufacturing processes.	

<i>Customization and Personalization</i> Leverage ONDC to offer customisable and personalised manufacturing solutions to customers thereby implement configurators and digital design tools that allow customers to customise products according to their specifications, preferences, and requirements, enabling mass customisation and personalised manufacturing.
<i>Skills Development and Training</i> Offer workshops, certifications, and online training modules on digital commerce, advanced manufacturing technologies, and ONDC platforms to equip workers with the knowledge and skills needed to succeed in Industry 4.0. These training and capacity -building programs can enhance digital literacy and technical skills among the manufacturing workforce.
<i>Government Support and Incentives</i> Encourage the adoption of ONDC in the manufacturing and industrial sectors through subsidies, tax incentives, and grants to manufacturers, creating a supportive regulatory environment conducive to digital commerce and Industry 4.0 initiatives.
<i>Regulatory Compliance and Standards</i> Implement digital documentation, certification, and compliance management systems to ensure product quality, safety, and industry standards within ONDC-enabled manufacturing processes.

Source: Own compilation, 2025.

Role of ONDC to Push MSMEs' Exports

Demand from both domestic and foreign markets can drive India's Industrial Revolution 4.0. In this situation, ONDC can help Indian manufacturers and exporters show off their products to the world by making it easier to export, enabling trade across borders and connecting Indian exporters with buyers around the world. Thus, Open Network for Digital Commerce (ONDC) can significantly promote export competitiveness for Micro, Small, and Medium Enterprises (MSMEs) in India. Table 2 demonstrates the potential of ONDC to push MSMEs exports:

Table 2: ONDC and Export Competitiveness

Global Markets Access	With the digital platform of ONDC, MSMEs can overcome traditional barriers such as geographical distance and limited market to international trade. This enables MSMEs to reach customers in foreign markets more easily.
Trade Finance and Payments	ONDC facilitate secure and efficient cross -border transactions for MSME exporters. It enables them to mitigate payment risks, manage cash flow and access working capital financing, thereby facilitating their participation in international trade.
Market Intelligence and Insights	With valuable data insights on consumer preferences, market trends, and demand patterns of ONDC, MSMEs can identify export opportunities. This means they can tailor their products and marketing strategies accordingly to target international markets more effectively.
Facilitating E-commerce	Through ONDC -enabled e -commerce platforms (online storefronts, manage inventory, process orders, and fulfil shipments efficiently), MSMEs can expand their reach and enhance export capabilities.
Optimization of Logistics	ONDC facilitates seamless logistics and supply chain management for MSME exporters by integrating with logistics providers and enabling real -time tracking of shipments. With this, MSMEs can optimise their export logistics, reduce transit times and improve delivery reliability. Consequently, this enhances their competitiveness in global markets.
Compliance Assistance	ONDC provides MSME exporters with guidance and support in navigating export regulations, documentation requirements, and customs procedures. It ensures they can meet the necessary legal and regulatory standards for exporting their products by providing tools and resources for compliance.

Source: Own Compilation, 2025.

ONDC Ensures Sustainable Industrial Development

The function of ONDC in sustainable industrial development is examined in detail in this section. Table 3 illustrates how ONDC can support more general sustainable development objectives.

Table 3: ONDC and Sustainable Industrial Development

Decent Work and Economic Growth (SDG 8)	ONDC provides a platform for businesses to access larger markets and streamline their operations. This contributes to the growth of sustainable industries and the creation of decent work opportunities.
Industry, Innovation, and Infrastructure (SDG 9)	Through its digital infrastructure, ONDC promotes innovation in business models. It facilitates the adoption of advanced technologies and enhances the efficiency of supply chains, thus driving industrial growth and infrastructure development.
Reduced Inequalities (SDG 10)	ONDC provides equal opportunities for businesses of all sizes, including small and marginalised enterprises, to participate in digital commerce. Therefore, contributes to the reduction of inequalities within society.
Partnerships for the Goals (SDG 17)	With an open and interoperable digital platform for commerce, ONDC enables collaboration, knowledge sharing, and collective action towards achieving sustainable development goals. This platform emphasises the importance of multi-stakeholder partnerships in driving socio-economic progress.

Source: Own Compilation, 2025.

Potential Challenges

India can harness the transformative potential of ONDC to drive inclusive and sustainable industrial development. However, several potential pitfalls and challenges need to be addressed to ensure the success of Open Network for Digital Commerce (ONDC) in leading Industry 4.0 such as the digital divide, skills gap, and cybersecurity risks. Lack of internet access and digital technologies can lead to a digital divide, preventing rural and remote areas from reaping the benefits of ONDC. This could result in unequal participation in ONDC-led digital commerce. Additionally, significant skills gaps in areas such as digital marketing, e-commerce management and cybersecurity could hamper the adoption and utilisation of ONDC platforms. Lastly, the increased reliance on digital platforms and online transactions through ONDC may expose businesses and consumers to cybersecurity risks such as data breaches, hacking and fraud.

Conclusion

This study examined the role of Open Network for Digital Commerce (ONDC) in driving Industrial Revolution 4.0 in India. The findings of the conceptual analysis showed that ONDC has immense potential to transform the way

industrial sectors operate, connect, and grow. Further, the linkage between MSMEs and ONDC indicates that with ONDC's digital infrastructure, MSMEs can reap the benefits of global market access, facilitate e-commerce processes, receive compliance assistance, optimise logistics, and gain market intelligence insights. Thus, the ONDC pushes the export competitiveness of MSMEs. Moreover, the analysis of the potential of ONDC in leading sustainable industrial development showed that it aligns with the Sustainable Development Goals (SDGs) related to decent work and economic growth (SDG 8); innovation, infrastructure and development (SDG 9); reduced inequalities (SDG 10); and partnerships for the Goals (SDG 17). However, several challenges such as the digital divide, cybersecurity risks and privacy concerns, infrastructure challenges, and skill gaps can obstruct the transformative potential of ONDC.

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