Adoption of Industrial IoT (IIoT) in Auto-Component Manufacturing SMEs in India

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ABSTRACT

This article investigates the adoption of Industrial Internet-of-Things (IIoT) in Auto-Component Manufacturing SMEs (ACM SMEs) in the context of a developing country like India by using the Technology-Organization-Environment (TOE) framework. This research surveyed Information & Communication Technology (ICT) officers, managers and owners of 320 ACM SMEs in India using a structured questionnaire to understand the adoption of IIoT. The primary data was analyzed using the PLS-SEM technique. It was found that IIoT expertise, IIoT infrastructure, relative advantage, compatibility, cost, security, organizational readiness, top management support, competitive pressure, and support from technology vendors are factors that affect the adoption of IIoT. This article considered organization size as the control variable. The results show that it does not have a significant effect on the adoption of IIoT. ACM SMEs are one of the important sectors adopting IIoT. This article provides valuable insights to their managers and IIoT vendors. It also suggests key inputs to the government officials involved in the ‘Make in India’ initiative of Government of India (GoI) and Ministry of Micro, Small and Medium Enterprises (MSME).

KEYWORDS

Adoption, Auto-Component Manufacturing SMEs, Control Variable – Organization Size, Industrial IoT, PLS-SEM, TOE Framework

INTRODUCTION

The boom in technology has revolutionized the way industry manufacture or processes the products. Industrial Internet-of-things (IIoT) is a major contributor to this transformation. Kevin Ashton proposed the term IoT in 1999 concerning supply chain management (Ashton, 2009). IoT is defined as the “global network and service infrastructure of variable density and connectivity with self-configuring capabilities based on standard, interoperable protocols and formats consisting of heterogeneous things that have identities, physical and virtual attributes, and are seamlessly and securely integrated into the Internet” (Tarkoma and Katasonov, 2011). IIoT is a very comprehensive technology which has inter-disciplinary applications cutting across several areas such as communications, computer science, sensor technology and communications. IIoT is a network of systems, physical objects, applications and platforms which has embedded technology to share intelligence and communicate within the organization, outside the organization and with people (Ahmed Banafa, 2017). IIoT
enables the coordination and communication of data and data analytics between a large number of connected industrial systems and it acts as a catalyst to improve the industrial performance. IIoT is characterized by cloud computing, security, ubiquitous data, big data analytics, smart machines and seamless user experience. IIoT is used in different sectors - manufacturing, transportation and utilities. IIoT is mainly used for manufacturing operations, production, asset management and maintenance along with field service. Many manufacturers are employing automation systems such as Supervisory control and data acquisition (SCADA), Manufacturing execution systems (MES), Distributed Control System (DCS), Programmable Logic Controllers (PLC), in the manufacturing process to manage and control the motors, conveyors and robots (Markets & Markets report, 2017). IIoT is useful for manufacturing companies in a function-connected factory applications, vehicle and asset tracking, air quality management, access control (security), smart measurement of radiation gases and level of liquids and risk measurement (i-SOOP report, 2017). The power of IIoT can be harnessed in the manufacturing firms by integrating the real-time sensor data with machine learning. Big Data and machine-to-machine communication. The key applications of IIoT are in real-time monitoring, remote diagnosis, predictive and proactive maintenance (Markets & Markets report, 2017). There is the vast and extensive use of IIoT to develop the efficiency and effectiveness of manufacturing companies. The global IoT market is expected to grow from $157 billion to $457 billion by 2020 and compounded annual growth rate will be 28.5%. The manufacturing sector will globally spend around $ 40 billion by 2020 (Louis Columbus, 2017).

IoT technology is extensively studied in warehousing (Reaidyet et al., 2015), logistics (Geerts and O’Leary, 2014; Sun, 2012) and manufacturing field (Tao et al., 2014; Bi et al., 2014; Atzori et al., 2010). The prior research discusses that IIoT is an emerging technology capable of supporting next-generation manufacturing enterprises effectively (Bi et al., 2014). The Indian government initiative ‘Make in India’ supports the Indian manufacturing industry and GoI is extensively supporting smart manufacturing using IoT and it is proposed in the draft IoT policy of GoI (Draft Policy IoT, 2015).

The auto component industry is one of the important industries in the manufacturing sector and it contributes 2.3% to the Gross Domestic Product (GDP) of India and turnover of 43.5 billion USD (ACMA Report, 2017). The auto-component industry is expected to grow by 8-10% in the year 2017-18 (IBEF Report, 2018). The auto-component manufacturing sector has more than 1000 SMEs in India (MSMEINFO, 2016). Mumbai, Pune, Nashik and Aurangabad are important clusters of the automobile and auto-component companies in the western part of India. IIoT is an important area of technological innovation and advancement in the ACM SMEs. IoT market in India is expected to grow at a CAGR of more than 28% during 2015-2020 (CII & Grant Thornton report, 2017). Hence, it is necessary to understand the key drivers and study the adoption of the IIoT in the ACM SME sector. The previous studies on IoT adoption are not so mature and comprehensive with respect to the ACM SME sector. A study was conducted by Hsu and Yeh (2016) to understand the adoption of IIoT in logistic companies. There is no such study which examines the adoption of IIoT in Indian ACM SMEs, so studying the adoption of IIoT in ACM SMEs will be novel and it will add value to the ACM SMEs and the “Make in India’ Government of India initiative. The success of any technology lies in its acceptance and use (Venkatesh et al., 2008). This study investigates the adoption of IIoT in ACM SMEs in the context of a developing country such as India to fulfill this gap and provide meaningful insights. The research question is hence devised as:

RQ: To inspect and understand the factors of adoption of IIoT in ACM SMEs.

The research question is answered in this study by utilizing the Technology-Organization-Environment (TOE) Framework.
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