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A Study on Application of Web 3.0 Technologies in Small and Medium Enterprises of India

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Abstract

The purpose of this study is to explore how small and medium enterprises in India has identified the opportunities and challenges in adopting the Web 3.0 technologies to improve their productivity and efficiency. After an in-depth literature review, researchers framed a semi-structured questionnaire with open-ended questions for collecting responses from managers working in 40 Indian SME's representing five key economic sectors. The collected data was analyzed, and themes were encoded using the NVivo 11 computer-assisted qualitative data analysis software. Content analysis was used to analyze the data collected with the semi-structured interviews. This study identified five key themes and 12 subthemes illustrating the key advantages and challenges as perceived by the managerial leadership of SMEs. The five key themes identified in this study include integration of data and services, the creation of new functionalities, privacy and security, financial and technological challenges, and organizational challenges. The results of this study will benefit the organizational leadership of SMEs in planning and developing their short-term and long-term information systems strategies and will enable SME leaders to make optimal use of their information technology assets, improving the productivity and competitiveness of the firms. Web 3.0 technologies are considered as emerging technologies, so the advantages and challenges of using these technologies for SMEs have not been explored in the context of emerging economies, such as India.

Keywords: Information technology, Web 3.0 technologies, SMEs, Qualitative analysis, India.

JEL Classification Code: I21, L96, M15, N35.

1. Introduction

The World Wide Web is recognized as one of the fastest growing publication medium offering a broad range of growth opportunities for Small- and Medium-sized Enterprises (SMEs). Internet usage has exponentially increased with an estimated growth rate of over 500% in the last decade (Rudman & Bruwer, 2016). The World Wide Web is a service that runs on the Internet. At the earlier stages of the World Wide Web, also referred to as Web 1.0, the Web was characterized by the static informative

characteristics. The next phase of the Web evolution, Web 2.0., was characterized by more interactive experience, such as the social networks, Wikis, and blogs. Web 2.0 collaborative technologies include platforms, such as podcasting, social networking as well as a list of technologies, including AJAX, RSS, XML, and web APIs that form the basis for these platforms (Vajjhala, 2015; Lee, DeWester, & Park, 2008). As said by Rudman and Bruwer (2016), Web 3.0 provides an integrated experience for the users as the machines understand and catalogue data similar to the way humans do these tasks. According to Kreps and Kimppa (2015), Web 3.0 is a phenomenon in which we are no longer users but part of applications that emerge and disappear. According to Lassila and Hendler (2007), semantic web or Web 3.0 technologies are the symbioses of web technologies and a subset of artificial intelligence, namely, knowledge representation. With the advent of Web 3.0 technologies, every type and size of the industry has received considerable benefits including small and medium enterprises. But the situation in developing and the under-developed world is completely different and there

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is no proper use of any technology particularly in SME's has raised some doubts. To get clear first-hand information, the researchers have taken up this research with an objective to study the opportunities and challenges in adopting the Web 3.0 technologies.

2. Literature Review

2.1. Web 3.0 Technologies and It's Significance in Business

The web is entering a novel phase of development which is persistent and brings enormous advantages to the world. There has been much deliberate debate on these web developments throughout the globe. "Web 3.0" refers to a third generation Internet-based services that collectively comprise what might be called 'the intelligent Web' — such as those using semantic web, micro-formats, natural language search, data-mining, machine learning, recommendation agents, and artificial intelligence technologies — which emphasize machine-facilitated understanding of information in order to provide a more productive and intuitive user experience" (Spivack, 2007). According to Garrigos-Simon, Lapiedra-Alcamí and Ribera (2012), Web 3.0 means that "intelligent machines can read, understand, interrelate and manipulate data from cyberspace, allowing this process to be adapted by different users or firms according to their own needs". In other words, there is a vast amount of data out there in cyberspace. Today's technology allows users to access, adapt, reconfigure and utilize this to meet their unique requirements. In the due course of time, Web 3.0 definition expanded as a third-generation of the Web enabled by the convergence of several key emerging technology trends: a) broadband adoption; b) Mobile Internet access, and c) Mobile devices. The Web 3.0 will be more connected, open, and intelligent, with semantic Web technologies, distributed databases, natural language processing, machine learning, machine reasoning, and autonomous agents (García, 2008). Lee (2006) said, "people keep asking what Web 3.0 is and the Web is only going to get more revolutionary". The Web 3.0 technology has the following features: a) Semantic Web improves web technologies in order to generate, share and connect content through search and analysis based on the ability to understand the meaning of words, rather than on keywords or numbers; b) Artificial Intelligence combines this capability with natural language processing. In Web 3.0, computers can understand information like humans in order to provide faster and more relevant results. They become more intelligent to satisfy the needs of users; c) 3D Graphics:

The three dimensional design is being used extensively in websites and services in Web 3.0; Museum guides, computer games, ecommerce, geospatial contexts, etc. are all examples that use 3D graphics; d) Connectivity with Web 3.0, information is more connected thanks to semantic metadata. As a result, the user experience evolves to another level of connectivity that leverages all the available information; e) Ubiquity: The content is accessible by multiple applications, every device is connected to the web, and the services can be used everywhere (Lee, 2006).

As said by Rudman and Bruwer (2016), the technologies associated with Web 3.0 technologies include identifiers, structures, and languages. Identifiers include uniform resource identifiers (URI) and uniform resource locators (URLs), providing a standard way for resources to be used and accessed by other computers. Structures include metadata, resource description framework (RDF), resource description framework schema (RDFS), and intelligent agents (IA). Languages include extensible markup language (XML), simple object access protocol, and structured query language and a simple protocol, ontology web language (OWL) and RDF query language (SPARQL). RDF facilitates the storage of data in a flexible schema allowing storage of additional types of data that was not foreseen initially at the time of design of the schema. RDF also allows the creation of web-like relationships between data that is not easily done in a relational or object-relational database (Lassila & Hendler, 2007). Some of the functionalities and technologies of Web 3.0, also referred to as the semantic web, including big data, cloud computing, interoperability, intelligent agents, collaborative filtering, and smart mobility. Some of the fundamental difference between Web 2.0 and Web 3.0 technologies include features such as semantic web, openness, interoperability, global data repository, 3-D virtualization, and distributed cloud computing. The primary driving forces behind Web 3.0 include artificial intelligence and machine learning (Hussain, 2012). Web 3.0 is expected to address the lack of structure and organization that were the major issues with Web 2.0 by linking information from disparate sources and systems (Yen, Zhang, Waluyo, & Park, 2015).

In every size and type of business, persistent decision making with great pace is essentially required in every part of the world which is a great challenge to the think-tank of every organization. Managers in the present days highly cut-throat competitive business world have to take decisions at the operational, tactical, and strategic plan. In the enhancing trend of customer expectations in every business sector, the myriad number of risks is very common which needs immediate and cautious attention from the managers to win the hearts of the customers. For this kind of attention in finding a productive solution to the risks identified by the

managers, they need a lot of information to evaluate which in turn to introduce fruitful decision into the action. Since its inception, the Web has engaged on greater importance as a source of information for managers which is very comfortable to get required information about the products marketed by the clients (Web 1.0) and also know what the belief that customers have of products (Web 2.0) we passed from read-only to read-write paradigm. All these developments made grow the amount of information available and increased the difficulty of managers in filter the important facts, and in structuring information coming from different sources and in various formats.

The Web 1.0 connects pages with information, the Web 2.0 connects people and the Web 3.0 is about linking and connecting web of data but transforming it in knowledge. With the web 3.0 is expected that search engines produce different results by the user: one user, one question, one result according to her profile. The web 3.0 will organize and assembles the pages found in a search engine, by themes, topics. The idea is to read, analyze and identify the directions of semantically words so as to relate the information to each other (Almeida, Santos, & Monteiro, 2013). The Web 3.0 is the answer to the contextualization of existing information by specific user need. The information provided will also depend on the resources held by the services provider and on the characteristics of devices used to access the Internet (Naik & Shivalingaiah, 2008). In a business perspective, the construction of the Web 3.0 is based on three pillars: the datastore and provision of services in the cloud; social media and user-generated content to add personal or perspectives that provide value to third parties; migration to a protocol that will facilitate the device connectivity (IPv6).

With the Web 3.0 trust and privacy reach a greater role, enabling the identity management in order to ensure the authenticity and the user education promoting good practices of Internet use, may be growing business areas. Business flows should be reformulated in such a way as to promote connectivity and automation, promoting the relationship with the customer and providing mechanisms which adapt to their reality and contemplate different types and sources of data. On the other hand, there will also be some benefits for the company: great opportunity for rethinking strategies and business processes, better targeted marketing; improvement in operational efficiency and reduction of costs. With the Web 3.0 trust and privacy reach a greater role, enabling the identity management in order to ensure the authenticity and the user education promoting good practices of Internet use, may be growing business areas. Business flows should be reformulated in such a way as to promote connectivity and automation, promoting the relationship with the customer and providing

mechanisms which adapt to their reality and contemplate different types and sources of data (Verizon, 2010). Web 3.0 provides mammoth opportunity to improve business along with the prospect to create new business. The web 3.0 will add features that will allow the consumer to benefit from vastly personalized experience; context-aware, precise response; efficient management of time spent on the Web; much more personalized Web experience (Sabbagh, Acker, Karam, & Rahbani, 2011). Web technology and social networking in recent years are changing the way the world does business in every part of the globe.

2.2. SMEs in India

As mentioned by Potluri, Lee, Khan and Vali (2012), the Government of India first time after independence introduced the Industrial Policy Resolution, 1956 which was reserved 128 items exclusively for small-scale sector besides the establishment of Small Scale Industries Board (SSIB). SMEs are considered as the backbone of the economy of developing countries, such as India where the SMEs contribute 40% of total exports, contributing significantly to employment generation every year (EISBC, 2017). As per the Section 7 of Micro, Small & Medium Enterprises Development Act (2006, MSMED Act) and was notified in September 2006, Small and medium scale enterprises (SMEs) are understood in India as enterprises where the investment in plant and machinery or equipment is between Rs. 25 lakhs (US \$ 0.04 million) to Rs. 10 crores (US \$1.6 million) in case of a manufacturing industry and between Rs. 10 lakh (US \$ 0.02 million) to Rs. 5 Crore (US \$ 0.8 million) in case of a service sector enterprise (MSMED Act, 2006).

The criterion for a firm to be considered as an SME varies depending on the sector of the enterprise. In the manufacturing sector, a business is categorized as a small-sized company, if the investment in the plant and machinery is more than 25 lakh INR but does not exceed five crore INR. A firm in the manufacturing sector is considered as a medium-sized enterprise if the investment in the plant and machinery is more than five crore INR but less than ten crore INR. However, in the service sector, the categorization of a firm as a small- or medium-sized firm is a bit higher in the context of investment in equipment. In the service sector, a firm needs an investment of more than 10 lakh INR but less than two crore INR for categorization as a small-sized firm while the amount should be between 2 crore and five crores for categorization as a medium-sized firm (DCMSME, 2017).

The Small and Medium Enterprises (SMEs) play an important role in economic growth and in promoting equitable development all over the world. The very

existence of SME sector is inevitable equally in developed, developing or underdeveloped nations. The major advantage of this sector is its pivotal role through its contribution to industrial output, exports, and crucial role in employment generation at low cost. The labour intensity of the SME sector including micro firms is much higher than that of large enterprises. The MSMEs constitute over 90% of total enterprises in most of the economies thereby generating the highest rates of employment growth and account for a major chunk of industrial output and exports. SMEs play a nurturing role in country's development and economy because they offer effective, efficient and flexibility features (Hallberg, 2000). The SMEs are critical in the economic and social development of the country, often acting as a nursery of entrepreneurship.

SME sector of India is considered as the backbone of economy contributing to 45% of the industrial output, 40% of India's exports, employing 60 million people, create 1.3 million jobs every year and produce more than 8000 quality products for the Indian and international markets. With approximately 30 million SMEs in India, 12 million people expected to join the workforce in next 3 years and the sector growing at a rate of 8% per year, Government of India is taking different measures so as to increase their competitiveness in the international market (EISBC, 2017).

2.3. Web 3.0 Technologies – Opportunities for SMEs

Web 3.0 technologies provide several opportunities that SMEs can leverage to improve efficiency and performance. According to Rudman and Bruwer (2016), organizations need to be prepared to acquire knowledge about the opportunities and adverse impact arising from Web 3.0 technologies. Some of the key opportunities offered to organizations, especially the SMEs, include automation of processes, producing information much faster and an improved level of access. For instance, SMEs would be able to use cloud computing technologies to take advantage of big data which would enable these organizations to analyze raw data and convert it into useful information improving their decision-making processes.

Big data includes data from different perspectives and dimensions, including volume, velocity, variety, and veracity. Big data is not just data created by humans, but largely by machines in what we refer to as the internet of things or Web 3.0 technologies. Large-sized organizations have the resources to take advantage of big data and have already identified their organizations as data-driven, and nine out of ten organizations recognized information as the fourth factor of production, the first three being land, capital, and labour.

Innovation is essential to the success and sustainability of SMEs (Gobble, 2013). Hence, SMEs need to be prepared to leverage Web 3.0 technologies to take advantage of the tremendous potential offered by the advent of big data. Today, most of the SMEs particularly in India has clearly identified ecommerce is another channel to reach each and every corner of the market with great pace. From an ecommerce perspective, the aim of Web 3.0 is to capitalize on the expansive social web network. Through new and enhanced methods of interpreting internet user's habits, it's possible to learn more of the specifics interests of the shopper (inside and outside of their current behavior) and bring them a very personalized ecommerce shopping experience (SiliconAngle, 2013).

2.4. Web 3.0 Technologies – Challenges for SMEs

Web 3.0 requires a complete reconstruction of the Internet and Information Technology (IT) infrastructure, and this will require organizations to be prepared to make changes in their existing infrastructure to take advantage of the potential of the technological advancements. Some of the challenges of using Web 3.0 technologies would include the increased risk of privacy of data because of different privacy laws across the various countries. The nature of semantic web, vagueness, and the uncertainty associated with the use of Web 3.0 technologies will offer new challenges to organizations intending to leverage Web 3.0 technologies. Web 3.0 technologies are evolving at a rapid pace, and this has provided challenges to researchers still developing internationally acceptable standards for using these technologies (Hussain, 2012).

3. Research Methodology

The research was a qualitative, multisite, exploratory case study using in-depth personal interviews to identify and explore how SMEs in India can leverage Web 3.0 technologies to improve their productivity and efficiency. The interviews provided an understanding of how managers perceive the usefulness of Web 3.0 technologies. These interviews also provided significant information on the major opportunities and challenges that the managers foresee in the adoption of Web 3.0 technologies. Qualitative case studies are appropriate when the focus of the research is on insight into a phenomenon rather than testing a hypothesis (Merriam, 2009). The exploratory nature of the research makes a qualitative research method a more appropriate option than quantitative methods. In this case study, data were collected from multiple sites in five important economic

sectors representing a significant proportion of SMEs in India. Multiple methods were used to collect data, including interviews, field notes taken during interviews, and archived documents. Qualitative, audio recorded, in-depth interviews with 40 managers were the primary method of data collection.

The central research question driving the study is the following: How can Indian SMEs benefit and leverage from Web 3.0 technologies to improve their efficiency and performance? Two more research questions were created to structure this study:

- a) What are the opportunities for Indian SMEs to leverage Web 3.0 technologies?
- b) What are the challenges for Indian SMEs intending to leverage Web 3.0 technologies?

4. Analysis and Discussion

Narrative analysis was initially considered as the data analysis technique, but finally, content analysis was adopted because the content analysis is based on theoretical categories and the investigator's substantive interests as compared to linguistic interests (Franzosi, 2010). As recommended by Creswell (2012), a comprehensive review of interview transcripts was performed before the commencement of analysis. Also, some analysis was performed during the data collection process to allow direction in the course of data collection (Bogdan & Bilken, 2007). NVivo® 11 which is Computer-Assisted Qualitative Data Analysis Software (CAQDAS) software was used for this study. NVivo software has several advanced features for analyzing qualitative data, including in-vivo coding, case and theme coding, comparison diagrams, relationship coding, and matrix coding. Table 1 shows the demographic information of the respondents. Respondents with varied experience, age, and gender were chosen to alleviate any bias because of these demographic factors.

Table 1. Demographic statistics

Category	Criteria	Representation of Respondents (%)
Gender	Male	57%
	Female	43%
Age	20-30 years	28%
	30-40 years	32%
	40-50 years	22%
	>50 years	18%
Experience	1-5 years	24%
	5-10 years	48%
	>10 years	28%

This study identified five key themes and 12 subthemes illustrating the key advantages and challenges as perceived by the managerial leadership of SMEs. The five key themes identified in this study include integration of data and services, the creation of new functionalities, privacy and security, financial and technological challenges, and organizational challenges.

5. Practical Implication

Web 3.0 technologies are the emerging technologies that could provide significant benefits to SMEs in developing countries. The results of this study will benefit the organizational leadership of SMEs in planning and developing their short-term and long-term information systems strategies. This research will enable SME leaders to make optimal use of their information technology assets, improving the productivity and competitiveness of the firms. Web 3.0 technologies are considered as emerging technologies, so the advantages and challenges of using these technologies for SMEs have not been explored in the context of emerging economies, such as India. This study will add value to the limited literature on the potential benefits and challenges associated with the use of Web 3.0 technologies.

6. Conclusion and Limitations of the Study

The objective of this study was to identify the opportunities and challenges faced in adopting and leveraging Web 3.0 technologies. This study identified some of the key underlying Web 3.0 technologies that SMEs in developing countries, such as India can adopt and use in their businesses to improve their efficiency and productivity. SMEs need to innovate as they have limited financial and human resources continually. This study identified five key themes, namely, integration of data and services, the creation of new functionalities, privacy and security, financial and technological challenges, and organizational challenges. Researchers intending to pursue future research could investigate the cost-effectiveness factor in the context of limited financial and human resources available to SMEs in developing countries.

The research was limited to the 40 SMEs from five key sectors in the states of Andhra Pradesh and Karnataka. India is a large and culturally diverse country, so the findings of this study in the context of technology acceptance may not apply to the other Indian states. As only 40 medium-sized enterprises were included in this study, the findings of

this study may be biased toward medium-sized enterprises as opposed to small-or micro-sized enterprises. The study is limited by the honesty of the participants' responses during interviews and the amount of time available to conduct the study. The validity of the study is limited to the reliability of the instruments used. Also as the SMEs represent the five major economic sectors in India, some of the findings may not apply to other economic sectors.

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