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Planning the application of blockchain technology in identification of counterfeit products: sectorial prioritization

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Abstract: This paper Decision making at the top level is very complex. One important responsibility of the policy makers and the governance system is to plan the safety and security to its citizen and consumers for the firms. This research address of the main concern of counterfeiting goods in today's time. This research identify the potential and needs of the distributed ledger technologies like blockchain and their application potential to combat the problem of counterfeiting in Indian economy. The research uses SWARA (Step-wise Weight Assessment Ratio Analysis)-WASPAS (Weighted Aggregated Sum Product Assessment) methodology after expert opinion gathered to understand the problem better and it results into the prioritization of application of blockchain in different industries. SWARA is applied to evaluate the weights of the criteria and WASPAS to evaluate and prioritize the alternatives.

Keywords: blockchain technology, counterfeiting, SWARA-WASPAS, identification and prioritization

1. INTRODUCTION

Today's industry is very competitive and committed to provide best possible products to the consumers. However, there are players those want to succeed overnight by offering the duplicate or counterfeit products similar to the others and known as pirated/ fake product. Recent trend shows the loss of Rs. 300 billion yearly for FMCG sector due to counterfeit products. The above factors brings the damage and loss the ecosystem. In a nutshell, the pirated products lead to (1) financial loss (2) customer safety (3) damage of the brand (Kapur, 2018). The other industries like apparel, deluxe watches, chemicals, food items, medicines, beverages, medical equipment's, toys are hit badly by counterfeit products. This scenario is across the globe. In the import of European Union up to 5 % of the products are fake. The brands those are worse hit by fake products are from US, Italy and France. The counterfeit activities include invade design rights and patents, breach of copyright and physical counterfeit product (OECD, 2016). Therefore, it is a challenge for today's supply chains to tackle with this issue. The industry has moved to fourth revolution termed as Industry 4.0, that is expected to use the internet of things (IoT), internet of services (IoS) and smart cyber-physical systems (Hofmann and Rüsch, 2017; Lu, 2017; Lee et al., 2015; Lasi et al., 2014). Industry 4.0 is expected to use and invest in the fault detection and prediction, self-learning technologies like artificial intelligence, additive manufacturing techniques and block chain technologies (Xu et al., 2018; Ivanov et al., 2016; Ivanov 2018, Xia et al., 2012). Despite of the advancement in the techniques and approaches adopted by the firms for today's business, the critical issue of piracy remains as it is and a pain point for firms. Considering the criticality of the issue with reference to Indian economy, it is important to recognize the sectors those are hard-hitted and where block chain technology find its application to identify the fake products. The blockchain technology can utilize the available data to detect the indicative fraud and is cheaper and faster. Additionally, by using the technology like block chain, one can avoid human and expert errors. Therefore, in this paper, author(s) have made an attempt to develop a mechanism for future monitoring and planning for different sectors of India with the help of blockchain technology. The SWARA-WASPAS methodology is applied for developing a decision system to address the following research questions:

R1: Which are the major sectors hit by counterfeit products?
R2: What is weightage of each sector with respect to counterfeiting?
R3: Which sectors needs to be addressed on priority to combat the counterfeiting problem?

Remainder of the paper is organized as follows: 2nd section presents the literature review. 3rd section discusses the methodology adopted. 4th section describes research findings. 5th section discusses the concluding remarks along with limitations and scope for future research.

2. LITERATURE REVIEW

Blockchain technologies can help firms in number of directions ranging from governance, internet of things, health sector, education sector, privacy and security, data management, financial and integrity verification (Drosatos & Kaldoudi, 2019; Casion et al., 2018). Other author(s) highlighted the

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potential use in health and pharmaceutical sector (Mackey & Nayyar, 2017; Mettler, 2016). Table 1 highlights the potential applications of blockchain technology in different areas. Blockchain is also expanding its application in cyber security and telecom sectors due to scope for its misuse (Taylor et al., 2019). Additionally Kamble et al. (2018) conducted a study that uses three adoption theories namely-technology readiness index, theory of planned behavior and technology acceptance model. Insecurity and discomfort have minor impact on supposed ease of use and effectiveness. Perceived effectiveness, attitude and supposed behavior control affect the behavioral intention. Supply chain professionals believe that blockchain technology can help them to drive maximum benefits in the supply chain with minimal efforts. In another study by Mackey and Nayyar, (2017) argued that blockchain technology can enable the accountable, protected, transparent and trustworthy supply chain for medicines and drugs. On the other hand, other technologies like machine learning will have to work towards detection and prevention of sale and distribution of fake drugs and medicines physically and online. The role of governments in bringing these technologies into legal framework is critical.

3 METHODOLOGY ADOPTED

The hybrid approach of multi-criteria decision making (MCDM) is considered in this research (Zolfani et al., 2013). This methodology can be applied to the decision making by top management and policy making in real situations. Total 20 experts have been consulted for the scores on different dimensions. After receiving the scores for the criteria 1 (C1-Potential) and criteria 2 (C2-Need) the weights have been calculated using SWARA, whereas WASPAS was used to properties the sectors for blockchain application. Appendix-A highlights the potential and need of blockchain for different stakeholders.

3.1 Step-wise weight assessment ratio analysis (SWARA) method

Experts view on criteria's determining the SWARA method. Each expert gives the importance of each criterion. In the process most important and influential criteria gets the first rank and least gets the last. SWARA is useful in the situations where priorities may exist but weights of the criteria are pivotal. SWARA's framework is different from other similar techniques such as AHP and ANP. The procedure for determining the weights on the basis of SWARA is adopted from Keršulienė et al. (2010).

3.2 Weighted aggregates sum product assessment (WASPAS)

This method is based on the weighted sum model and product model (Ghorshi Nezhad et al., 2015; Zavadskas et al., 2012). WASPAS calculation steps are as follows

3.2.1Normalized decision matrix

$\bar{x}_{ij}=x_{ij}/(\text{Opt } x_{ij})$, where $i=(1,m)$, $j=(1,n)$
If the optimum value is maximum…….. (1)
$\bar{x}_{ij}= \text{Opt } x_{ij}/ (x_{ij})$, where $i=(1,m)$, $j=(1,n)$
If the optimum value is minimum……... (2)

3.2.2 Calculations of WASPAS for the summarizing and multiplication

$(\bar{x})_{ij}$, sum= $\bar{x}_{ij}*q_j$, where $i=(1,m)$, $j=(1,n)$…….. (3)
$(\bar{x})_{ij}$, multiplication = $\bar{x}_{ij}^{(-q_j)}$, where $i=(1,m)$, $j=(1,n)$……..…(4)

3.2.3 Final alternatives calculations

$WSP = 0.5 * \sum_{j=1}^{n}(\bar{x})_{ij} + 0.5 * \prod_{j=1}^{n}(\bar{x})_{ij}$ where, $i=(1,m)$, $j=(1,n)$…..…….(5)

Table 1 Recent literature review on applications of blockchain technology

S. No	Author (s) & year	Research objectives	Level of analysis	Tool of analysis	Approach adopted	Setting	Major Findings
1	Ivanov et al., (2019)	Identify the relationship between industry 4.0, advanced tracing and tracking systems and big data analytics.	Supply Chain	Investigation Framework	Supply chain risk analytics	--	Blockchain, ERP, RFID sensors are applied in a distributed manner in sourcing, logistics and manufacturing. Big data analytics enable these data to be used by algorithms of artificial intelligence. Additionally, modern digital technologies increase capacity flexibility and demand responsiveness and can affect positively the reduction in inventory of risk mitigation in the ripple effect in proactive stage.

2	Casino et al., (2018)	Investigation of current standing of blockchain technology and its applications in business practices	Different Sectors	Mindmap abstraction	Literature Review	--	Blockchains can help in integrity verification in different domains such as insurance, counterfeiting issues and intellectual property rights. Big data and artificial intelligence can augment the transparency of technologies like blockchain. Interoperability issues of implementation in blockchain can help businesses to grow.
3	Kshetri (2018)	Investigating the impact of blockchain on supply chain quality, cost, time, risk reduction, flexibility, and dependability	Supply chain	Meta- analysis	Case study	11 cases from different industries	The cases from different domains present the different objectives of a supply chain achieved with the help of blockchain. Internet of things has a special role in blockchain based solutions and degree of deployment of any blockchain depends upon the validation of assets and individuals identities.
4	Meravi-glia (2018)	Examining the relationship between technology and counterfeiting	Supply chain	--	--	Fashion Industry	Different industries have the counterfeiting problems and concerns. Therefore, along with legal framework incorporation in the blockchain technology, the involvement of three layers, firms, public situation and consumers is very critical for the success of any new age technology to combat counterfeiting.
5	Saberi et al., (2018)	Investigate the smart contracts and blockchain technologies and their applications to supply chain management.	Supply chain	Classification	Literature analysis	--	Blockchain technology barriers for any firm can be classified as: intra-organizational, inter-organizational, external and technical barriers. Blockchains can support transactions between supply chain partners in the network.

4 RESEARCH FINDINGS

With the help of SWARA and WASPAS presented in equitation from 1 to 5 research findings from Table 2 shows that footwear industry in India is facing a tough time and needs to adopt the distributed ledger technologies like blockchain and followed by handbags, cloths and fashion, packaged food and toys. During expert opinion, it has also been observed that rural economy is more prone to counterfeit than semi-urban and urban economies. The present research has unique implications for theory and practice. The current research provides the direction to the usage of blockchain especially in one of the domain of counterfeiting.

4.1 Theoretical Implications

The present study offer a number of scholarly implications. The blockchain technology helps in securing and scale the data in clinical trials (Zhang et al. (Zhang et al., 2018). Blockchain uses and track the identity and origin with the help of distributed ledger system (Conte de Leon et al., 2017). Blockchain technology can help different industries in different capacities to ensure the right processes carried out in their operations and right kind of product is delivered to the customer (Andoni et al., 2019). Further in the supply chains, different agents are involved that facilitate the movement of products to the next. Therefore, it is important to have transparent, secure and traceable supply chain at every node and is possible with the application of blockchain technologies (Sa-

beri et al., 2019). The blockchain technologies are in its evolution phase and can help in addressing number of problems.

4.2 Practical Implications

The blockchain enabled supply chains and their networks can help firms and their management to have secure, shared and distributed ledgers. The technology can help to facilitate the different transactions between partners by eliminating the intermediate networks. The firms need to be strong enough on systems part before they go for block chain adoption. The poor information systems infrastructure may lead towards limiting the adoption of the blockchain technology. Professional can apply the novel technology in distributed supply chain coordination, measuring the performance of the supply, risk and ripple effect of supply chain

Table 2 Results of WASPAS

Results	Industries	WSPi	Rank
Mobile and mobile components/accessories	I1	0.492	15
Personal care	I2	0.799	8
Auto parts and components	I3	0.799	10
Handbags	I4	0.843	2
Watches	I5	0.579	14
Medical equipment's	I6	0.638	13
Packaged food	I7	0.818	4
Footwear	I8	0.914	1
Toys	I9	0.817	5
Beverages	I10	0.809	7
Cloths and Fashion	I11	0.843	3
Electronics	I12	0.699	12
Computer software and hardware	I13	0.799	9
Drugs and medicines	I14	0.809	6
Tobacco	I15	0.796	11

Practitioners can use blockchain from different perspective such as making product related information visible to consumers and bringing the framework of standardization into the blockchain mechanism.

5. CONCLUDING REMARKS AND SCOPE FOR FUTURE RESEARCH

Author(s) answered the three research questions proposed in the introduction section and hence justifies the contribution. Keeping in view that counterfeiting is huge and critical concern for number of industries and to the creation of business network including the risk of security and safety to the consumers of the goods, more research towards strengthening the legal framework should be conducted. Blockchain can be used for better governance in terms of proof of existence, notary, law and public administration. Blockchain can help in better healthcare system. Further the blockchain can be explored for better data management from different domains. Another interesting area for government may be e-voting. Blockchain technology can be further explored for e-business performance and secured supply chain activities.

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Appendix-A

C1-Potential		**C2- Need**		
C1-1- Research	**C1-2-Practice**	**C2-1- Technological and practical prospects**	**C2-2-Collective and justifiable need**	**C2-3-Economic Need**
Compatible to the existing decision making tools	Easy to fit in the legal framework	Ability to disclose the policy between partners in the supply chain	Secure and safe transactions in the supply chain	Contribute in improving the productivity
Harmonious to the technological and scientific capabilities of the firm in supply chain activities	Ability to deal with today's counterfeiting problems	Ability of coordination and communication throughout the supply chain	Customers involvement in the supply chain using modern technologies	Strengthening of government policies
Additional support required from foreign collaboration	Compatible with the new policies of firms using technology	Development of innovation culture in the ecosystem	Fair access to technology to all the stakeholders	Ability to tackle the uncertainty and competition
Attuned with the existing structure and network for research	Compatible to work with financial constraints	Acceptance and motivation to use new technologies	Ability to mitigate the cultural differences in the supply chain	Acts as an strategic tool for the firm and economy
Friendly to operations and utilization by human beings		Ability to solve the real life problems of the firms	Improvement in the health and safety of individuals	Contribute in the market growth and ecosystem
		Developing the relationship between industry and academia		Identification of fraud at source
		Promotion of social justice and welfare		Increase in economic value