

# Feasibility Study of a Blockchain use in Nutraceuticals Supply Chain

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## ABSTRACT

The application of blockchain technology (BCT) is still in its nascent, and most of them are about finance; newer attention of BCT is its role in the supply chain. This work provides a feasibility study and adaptability with expectations on the use of blockchain in the nutraceuticals supply chain (NSC), objectives gauged were the feasibility, adaptability and opportunities of BCT in the NSC. The current work constitutes a theoretical framework based on two sets of questionnaires posed to prospective consumers and other possible stakeholders; the challenges and opportunities were determined through analysis of the interviews; do the stakeholders get the transparency and the trackability as they desire, is it possible to deploy supplementary information via BCT, could this be used to track nutraceuticals flow with enhanced information sharing. Further, a private blockchain as the Hyperledger Fabric framework could enhance the attributes desired to bring in the traceability and avoid counterfeit and fake sale of Nutraceuticals.

**Keywords:** Nutraceutical quality; Nutraceutical information; Questionnaire; Survey interview

## INTRODUCTION

Throughout history, human beings have been recorded for making and using medicines harnessed from natural resources to tackle various forms of health issues [1], The field of Nutraceuticals gained traction as the success of medicine was counterbalanced by the side effects and with transformations in medicinal practice have attracted the attention of both Pharmaceutical and nutritional industries, and they are aiming to acquire and include many novel Nutraceuticals for the consumers [2]. Nutraceuticals sourced from various natural products like fruits and vegetables have been reported for their multiple health benefits, when these nutraceuticals when taken as supplements they were said to diminish various health risk factors like high cholesterol, high blood pressure, etc. The list of nutraceuticals being explored and included is expanding consistently. It also matches with current trends in the market, research, and consumer appeal, hence with this expeditiously broaden interest in the nutraceutical consumption, adequate researches are unconditionally needed to gauge the nutraceuticals usage, assess its safe aspects [3]. Supply chain management (SCM) is the management of the movement of produce and services and encompasses every process that metamorphose the raw materials into end products. It associates the effective facilitation of a

business's supply-side enterprise to augment customer benefits and achieve a competitive niche in the marketplace. SCM portrays the endeavour made by suppliers to establish and enforce supply chains that are the best within economic feasibility. Supply chains includes every step from manufacturing to product outcome; to the information systems essential to manage these enterprises. In general, SCM pursuit to control or affiliate the production, transport, and circulation of merchandise. By governing the supply chain, an enterprise is capable of limiting the costs and dispatch products to the end-users rapidly, and this is achieved by harnessing full control of in-house inventories, in-house production, distribution, sales, and the inventories of the dealers [4-6]. The primary stage is in the registration and dispatch of Nutraceutical for transport. To register the handover, app users sign a smart contract. Both sides have to sign the smart contract with their private key, which generates information about nutraceuticals in transport on the blockchain. IoT technology is the use of small devices mounted on transport vehicles or in containers. Information captured from these devices can be stored and on the blockchain and monitored in real-time. This information on the nutraceuticals being shipped can be the ambient temperature (in case of cold storage), humidity, and location. Retaining this information processed by IoT devices and saved on

the blockchain provides confidence and trust in the quality of items, data rather while doing these manually by third parties. Many industries are earnestly scrutinizing blockchain technology to help them, to enhance their trade and sale. Many of these as of now have proof-of-concept implementations that have triggered interests in the Pharma sector, and this concept can be implemented for Nutraceutical also [7-10].

#### **Purpose of the study**

The purpose of this study is to look at challenges and opportunities related to the supply chain and the process for the value chain of nutraceuticals and discuss if blockchain technology could contribute to solve, improve or utilize these, providing added value or competitive advantage. Thus, this paper aims to contribute to enlighten opportunities considering this topic that would be interesting to continue to explore, and were blockchain should be applied [11].

#### **METHODOLOGY**

A questionnaire prepared in google form was sent to prospective clients and stakeholders. The first set was to find out the status of the participants on the use of platforms and app to check the feasibility of quality and traceability of nutraceuticals, to elucidate the feasibility and role of solutions like blockchain and its impact on the nutraceutical supply chain when more information could be harnessed by the consumers which could be captured in their smart gadgets. The aim was also to target at least 100 participants involving both genders of 4 different age groups; less than 18, 18 to 40, 40 to 60 and finally 60 plus; these questionnaires were weighed on a scale of 1 to 5: where a score of 1 is for strongly disagree or minimal impact to 5 implying strongly agree or great impact [12].

#### **Questionnaire**

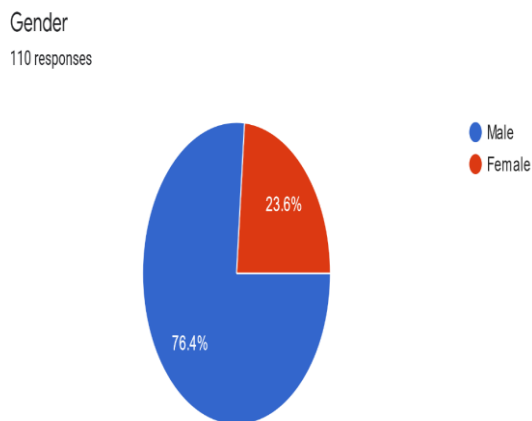
1. You would be happy if provided with a wider range of product-related information on quality
2. Would be satisfied if more info about nutraceuticals provided on safety and health benefits.

3. Will support all activities which can aid or achieve to provide factual information on nutraceuticals
4. Handling apps of play store / IOS fairly easy
5. Scanning a code (barcode, QR code, etc.) with a mobile device (smartphone, tablet, etc.) would be simple and effortless
6. We should check the product-related details carefully before purchase
7. If there would be an option to check the quality of the product it would be great?
8. Stores and supermarkets should have quality products
9. Would be happy if one can provide info on the fruits and vegetables one uses is of quality
10. Would be always good to avoid counterfeiting in nutraceuticals.
11. Increase the transparency of nutraceuticals in terms of quality is good for business?
12. Quality will come at a price
13. How far you agree that product with transparent info will influence you to buy products rather than the normally available nutraceuticals?
14. Do you think that cryptocurrency / digital currency will be the future transactions for sale and consumerism?

#### **RESULTS AND DISCUSSIONS**

The two sets of questionnaires were analysed to understand to an extent the mindset of the participant towards the use of apps and blockchain to short issues like traceability and originality of the nutraceuticals. No personal information was collected and the participants were also made aware of this, only the gender and age details were included.

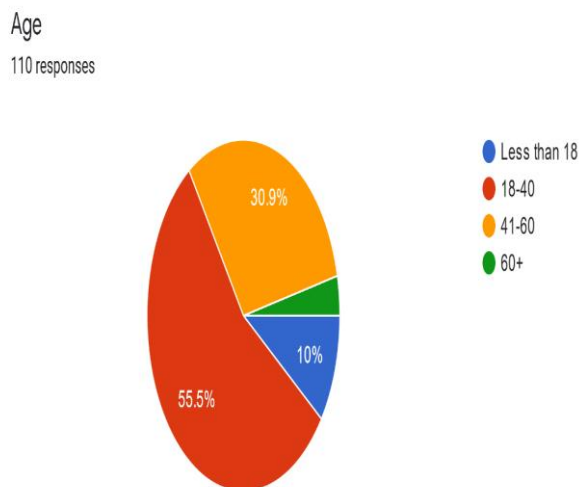
The survey thorough questionnaire was targeted to include at least 100 participants with a span of a fortnight and the google form was locked after this period and had 110 total participants, and out of these recorded 23.6% were females and 76.4% males (figure 1), when the four categories of age was compared 55.5% of the participants belonged to the age group of 18 to 40 years and the next highest number 30.9% were among 40 to 60 years age group. Only 3.6% were among 60 plus years, there were notable level of participants among under 18years (figure 2) [13].



**Fig.1: Gender distribution in questionnaire set 1**

The survey made as a google form and the link was shared and forwarded via Whatsapp and email to random participants and some stakeholders, there was no particular constrain of preference for either gender or age group to avoid ambiguity and also for the reason that the nutraceuticals are broad-spectrum and are

consumed across gender and all age groups, although for specific nutraceutical products like health care supplement or beauty care products more gender-specific as well age specific participants might though a great insight into a particular mindset about that specific product [14].

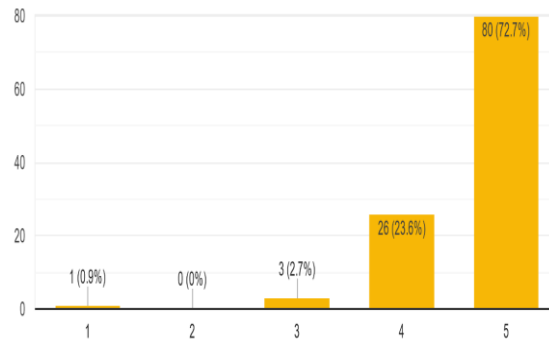


**Fig.2: Age-wise distribution of participants for questionnaire set 1**

Figure 3 projects the positive inclination of the participants and their actual willingness to know about better or wholesome information of disparate nutraceuticals products especially on the

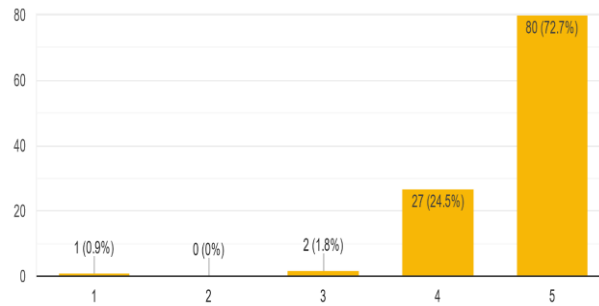
subject of quality of these nutraceuticals with 72.7% participants strongly agreeing and further 23.6% emphasising the need for quality information [15].

1. You would be happy if provided with a wider range of product-related information on quality  
110 responses



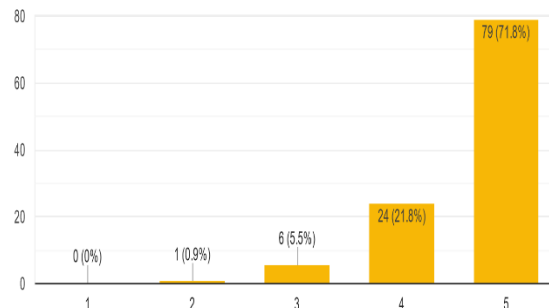
**Fig.3: Response to a wide spectrum of product-related information availability option**

2. Would be satisfied if more info about nutraceuticals are provided to ensure safety and health.  
110 responses



**Fig.4: Choice of safety and health aspect of information accesses on nutraceuticals**

3. Will support all activities which can aid or achieve to provide factual information on nutraceuticals  
110 responses

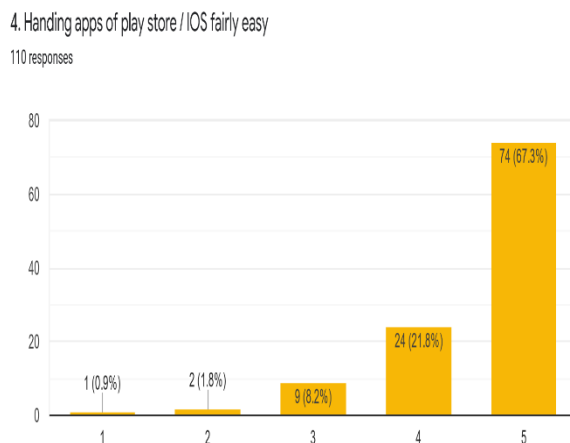


**Fig.5: Respondent's inclination to support factual information availability**

While answering the question on broader products on its safety and other added health information availability on various nutraceutical benefit on their consumption, 24.5% and 71.8%

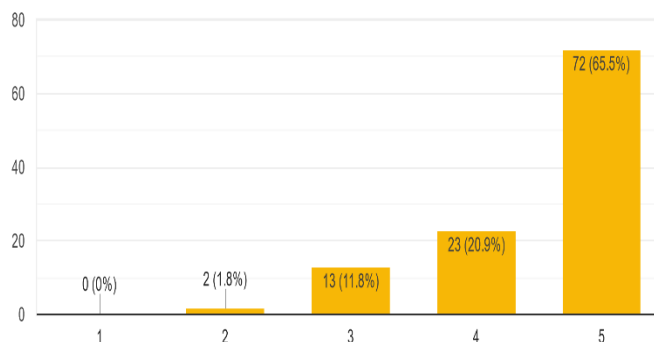
strongly agreed on the lack of information on various products particularly nutraceuticals (figure 4), the wide spectrum information regarding each specific nutraceutical product cannot be included in the packing or label but Definity can be accessed via a QR code which can be scanned with a smartphone; thus empowering the consumers with

all the information like origin, nature, produce, benefits, safety and other information. The participants were also in strong agreement on using tools or aid to gather this information with 93.6% strongly wanting to use such tools (figure 5) [16].



**Fig.6: Participant’s aptitude in handling smart gadgets**

5. Scanning a code (barcode, QR code, etc.) with a mobile device (smartphone, tablet, etc.) would be simple and effortless  
110 responses

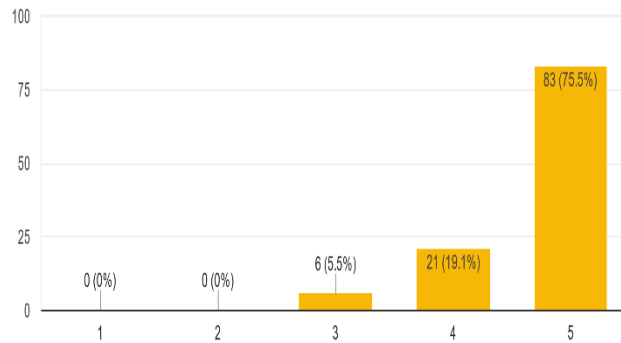


**Fig.7: Respondent’s experience with barcode QR code use with their smart gadgets**

Only 2.7% of the participant found the use of a smartphone or smart gadgets difficult and 88.9% agree that they are comfortable in using smart gadgets (figure 6), around 11.8% of the participants were neutral on the context of using apps and other similar tools as easy with 1.8%

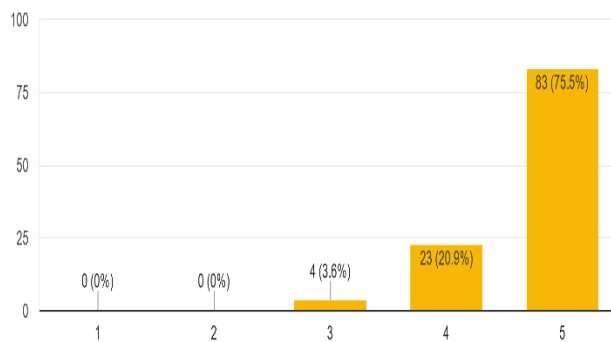
agreeing scanning barcodes and QR codes cumbersome for them, while 86.3% are quite comfortable in accessing these codes via their smart gadgets and this information also shows the participants knowledge and past exposure in using such codes (figure 7) [17,18].

6. We should check the product-related details carefully before purchase  
110 responses



**Fig.8: Importance of checking product related info prior purchase**

7. if there would be an option to check quality of the product it would be great  
110 responses



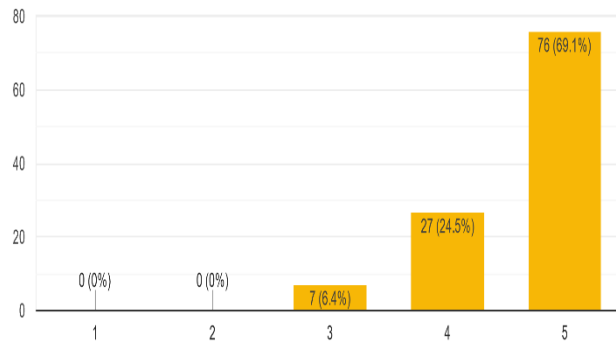
**Fig.9: Quality check feasibility options feedback**

In terms of quality check and quality-related information availability on a particular nutraceutical product irrespective of the brand, 75.5% of the respondents found it mandatory to check on the product and further 20.9% were also inclined to consider checking on the quality important (figure 8), only 5.5% were neutral and none disagreed on compromising the quality and

this point was further gauged with question 7, where when the participants were asked if they would welcome an option accessible to then to check on the quality via an App or a tool, the same number of people agreed strongly and positively on their interest to find more options to know about product-related information especially on the quality of the nutraceutical (figure 9) [19,20].

8. Stores and supermarkets in should have quality products

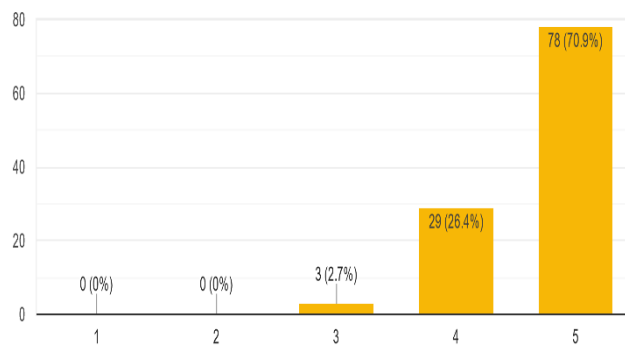
110 responses



**Fig.10: Choice of quality product in stores and supermarkets**

9. would be happy if one can provide info on the fruits and vegetables one uses is of quality

110 responses



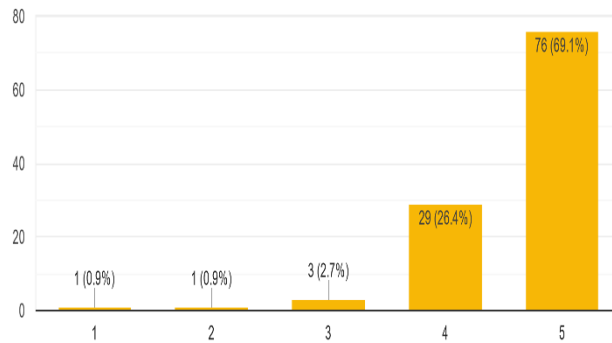
**Fig.11: Availability of info on perishable products**

The participants also wanted availability only quality certified products in the stores and supermarket with 93.6% wishing for such uncompromised produce available for their consumption, while 6.4% reacting neutral (figure 10), but these respondents wanted information available to them on perishable items like fruits and vegetables, especially on account of quality as

very limited info can be gleaned by the consumers daily and they rely on the trust of the merchants and vendors who supply these merchandise, as evident from figure 12 with 97.3% of the participants showing their eagerness to garner quality-related information on perishable items (figure 11) [21,22].

10. Would be always good to avoid counterfeiting in nutraceuticals.

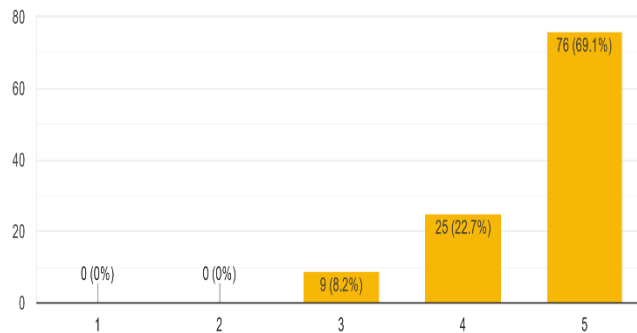
110 responses



**Fig.12: Minimizing fake nutraceutical products**

11. Increase the transparency of nutraceuticals in terms quality is good for business?

110 responses



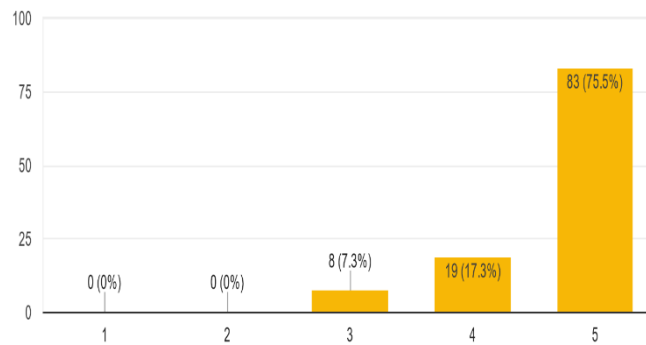
**Fig.13: Increased transparency impacting business**

About 95.5% of the respondents felt that the market is overwhelmed with fake and counterfeit nutraceutical products and felt that blockchain-enabled Apps; involvement of QR code and barcode could mitigate these undesirable quality compromised products, ensuring the availability of only the original and quality ensured nutraceuticals

(figure 12). Around 91.8% of the respondents felt strongly and also agreed that the availability of good quality nutraceuticals at the endpoint for consumers would also impact positively on the sale and business at large of various nutraceutical brands (figure 13) [23, 24].

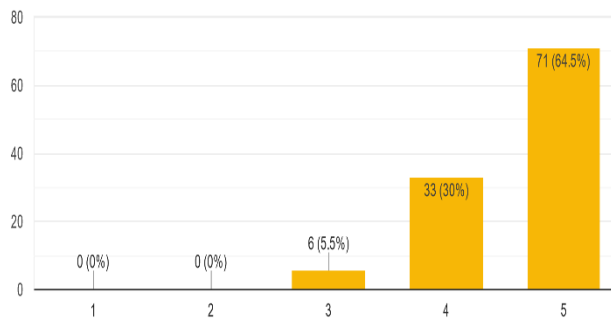


12. Quality will come at a price  
110 responses



**Fig.14: Does quality impact cost?**

13. How far you agree that product with transparent info will influence you to buy products rather the normally available nutraceuticals?  
110 responses



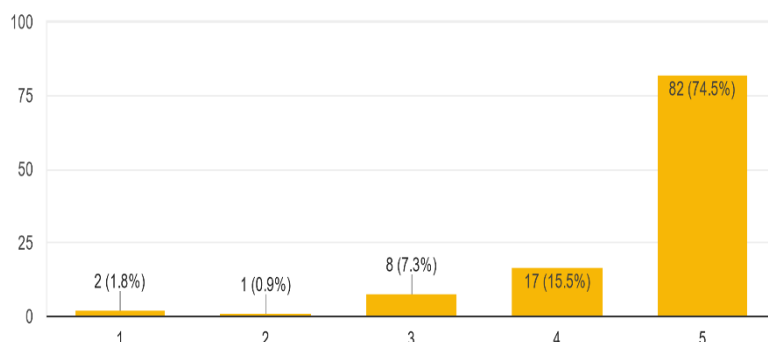
**Fig.15: Preference for nutraceuticals with transparent information rather than conventional products**

About 92.8% of the respondent either agree or strongly agree that quality has a price and they are willing to pay to access better quality nutraceutical product which could be only validated by tools like BCT endorsed apps which can enable the user to scan barcode or QR code to presume the quality of any nutraceutical product the consumer use at

their end (figure 14), only 7.3% were neutral and none were ready to compromise quality on account of cost, further 94.5% agree for the need of transparency on the products especially nutraceuticals and this additive will influence their decisions to buy such product rather other or conventional products (figure 15) [25-27].

14. Do you think that crypto currency / digital currency will be the future transactions for sale and consumerism?

110 responses



**Fig.16: Impact of crypto or digital currency on consumerism**

The public is aware or informed about bitcoin (cryptocurrency), they might not have a deep understanding of the concept, but most of the respondents have heard about the terms and they also understand the emphasis and future impact of these form of transactions being more transparency in payment via smart contracts and BCT with 90% of the participant agreeing to its future role (figure 16) [28, 29].

## CONCLUSION

In analysing the response of questionnaire of the participants it is quite evident that there is a lack in tools or aids to check on the quality, deeper information on produce including nutraceuticals and the consumers ready to pay a price to access quality nutraceutical products and gain information about their products like origin, originality, components, safety and health attributes of each nutraceutical related consumables. An overwhelming majority of the respondents agree strongly on the need for such smart gadgets empowered apps or tools and results projected a negligible number of neutral respondent and none were averse to the use of blockchain technology and the current environment is open to such modern platform, supporting the feasibility of such contraptions to enhance consumerism.

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