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Strategic Alliances for Technology Adoption

Alliances and Partnerships for Blockchain Adoption

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***Abstract*—This paper aims to study the relevance and importance of strategic alliances for emerging technology adoption. The case researched and discussed here is Blockchain adoption in the semiconductor industry.**

As a technology, Blockchain has been around for over a decade and is known to provide tremendous value in business transactions. However, the adoption has not gained traction mainly due to the fact that it takes a network to adopt an industrial Blockchain and cannot work in silos. Most companies are shying away from it as they haven't explored what makes a successful strategy for adoption.

A literature review was done on the similar technology adoption in the past. The nature of Blockchain and its network dependency were considered. It was clear that strategic alliances are the way to move forward. The various aspects to be considered while forming an alliance, such as understanding the core competencies, finding the right partners, and form of alliances was studied. The research converged in understanding the fact that companies should move away from the transactional business model and have the right expectations and scoping on all sides, standardization, digital integration, and a steady focus on security and privacy.

I. Introduction

The aim of an organization is to maximize the value for its shareholders and customers. Thus, they have to depend on their core competencies and optimize that. A company may have been successful and considered a leader in its niche. However, how would they move forward and explore new product markets? How would they adopt a technology that is of prime importance for entering those markets?

As far as technical capability is concerned, the company may not be competent enough to enter the market and face the incumbents and innovators head on. An organic expansion will prove to be sluggish in this scenario. Thus, it needs to use methods such as mergers, acquisitions, or partnerships. But, how do they decide what kind of partnership they want to enter with what kind of companies?

This paper aims to explore the strategies for a company to adopt an emerging technology. The adopting company, in this case, is a semiconductor manufacturing company and the technology is Blockchain.

The only popular application of Blockchain so far seems to be cryptocurrencies. The delay in adoption can be attributed to the lack of expertise, not being able to push it out to the wide range of application it is designed for, the fear of the new, or, the lack of a proper strategy for adoption.

Manufacturing companies, especially in the semiconductor domain, understand and accept the importance of Blockchain in their supply chain. However, they are having difficulty in mainstream adoption. The strategic decisions they should make for this adoption such as whether to develop internally, acquire, merge, or outsource remains a question of debate. The Blockchain is relevant only if a transaction happens and thus, is heavily dependent on the externalities and complementary support from external firms. Thus, partnerships and alliances could prove to be helpful in speeding up the adoption. This study aims to explore the feasibility of strategic alliances for the successful adoption of Blockchain through literature review.

Although literature exists on how Blockchain brings in value to an organization and what the challenges are, organizations are confused on how to adopt this new technology and make sure that it is successful and realize its full value. While many have tried adopting Blockchain, these organizations are struggling to realize the value as they find it difficult to extend it to their customers and suppliers, and even to their own different internal departments.

This study is an attempt to address this and research ways to adopt Blockchain through strategic alliances, which is an inevitable way of adopting this promising technology fast and utilizing it to the fullest.

II. Why Blockchain?

Businesses involve transactions involving two or more parties. As the number of transactions, parties, and the monetary value of the transactions increase, so does the complexity of the supply chain. How to manage this complexity and have an end-to-end visibility of the entire chain is the major concern for the stakeholders in the supply chain. To check transparency, companies will have to engage more resources or even third parties, which in turn cost them.

Another problem the industry faces is fraudulent practices and counterfeit raw materials. To avoid this, they rely only on reliable suppliers at each stage who in turn rely only on their reliable suppliers. This narrows down choices for strategic sourcing and selecting the supplier that provides the maximum value. This, in turn, increases the overall cost and reduces the profit margin of the company.

It is thus evident that visibility is extremely important for companies to avoid the so-called implicit "trust tax" that they have to pay. A solution to reduce or eliminate this "trust tax"

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altogether is in the best interests of the company. Blockchain provides the perfect solution for avoiding this. Therefore, companies of all sizes and geographical locations are trying to adopt this technology in their supply chain processes.

The use of Blockchain technology in manufacturing and supply chain is a disruptive and transformative one. They provide tangible benefits to the users by enhancing the quality of products and optimizing the value chain. Some of the uses could be:

- Preventing counterfeit materials or end products from suppliers
- Tracking components at different stages in a value chain with the aid of Internet of Things (IoT)
- Smart contracts for secure document management and trust
- Preventing repetitive testing for quality checks
- Strategic sourcing with companies that do not have a history of working together, thus eliminating the "trust tax"
- Eliminating middle-men who act as validators for transactions

The market opportunity for Blockchain is huge. According to Michael Reed, Director of Intel's Blockchain Program, Blockchain will add a value of $176 billion for businesses by 2025. By 2030, this will go over $3.1 trillion, making it comparable to that of the internet. [36]

A. Blockchain Adoption in the Industry

The business opportunity for Intel for investing in Blockchain technology is immense. They have the role of a provider as well as a user. Blockchain requires high-end computational power and Intel has already contributed to the distributed ledger platform - Sawtooth Lake, the Linux foundation Hyperledger project. Hyperledger Sawtooth is a hardware-agnostic modular platform for building, deploying, and running distributed ledgers. Intel's technology leadership in high-performance computing gives them an edge in taking leadership in the development of this platform in the future.

In 2015, Intel formed a Blockchain business unit and in 2016, announced key partnerships. This involves partnerships between IBM and Microsoft for providing Blockchain-as-a-Service (BaaS). Also, Intel has partnered with industry organizations such as Enterprise Ethereum Alliance, Hyperledger, and R3 consortium.

Going forward, the organization would have to choose between various service and platform providers for furthering its technology prowess. However, they have to figure out what kind of alliance would be the best at different stages and requirements, such as:

- Technology research and development (early stage)
- Training and skill development of employees or hiring external talent
- Platform development
- Internal implementation
- Go-to-market marketing strategy
- Product distribution
- Implementation
- Ongoing support

III. Research Questions

1. What are the different stages at which a strategic alliance is of relevance for emerging technology adoption and implementation?
2. What are the factors to be considered for deciding on the kind of alliance? How do we weigh/quantify them according to their importance?
3. What are the specific factors to be considered for the specific case of Blockchain adoption?

IV. Methodology

There is a vast amount of literature available on strategic alliances for technology adoption. Blockchain as a technology is in the conceptual stage of implementation of most companies. Hence, the only information sources available are academic papers and prospective industry use cases as most companies implementing this technology have confidentiality concerns in sharing details.

As the purpose of the paper is to suggest a streamlined approach to adopt Blockchain, reviewing relevant research papers and articles dealing with similar subjects and related technology were considered and literature review was selected as the research methodology.

Although the papers on strategic alliances date back to decades, only the classic and very relevant ones dealing with emerging technology adoption were considered along with the more recent literature. Most of the literature on Blockchain technology are very recent and have generated significant interest among the academic as well as technical society. As the Blockchain technology is increasingly compared with internet, aspects such as network effect and related technologies were also considered as part of the research.

V. Literature Review

Despite being an accessible technology for a while and having tremendous benefits, Blockchain has not gained traction yet except for the cryptocurrency, whose credibility is questionable. The barrier for adoption can be attributed to the fact that no one organization can do it alone to benefit from the business value from the Blockchain implementation [19].

Organizations involved in the research on Blockchain have evolved from the conceptual stages and use cases. The Blockchain research can be broadly classified into conceptual, descriptive, and prescriptive stages. In the conceptual level, the concepts and constructs are defined, taxonomies and typologies are developed, and a conceptual framework is established. Once the framework is established, then the description of the various elements and observational facts are put forward. Empirical regularities are formed and theories

and hypotheses are defined. In the prescriptive level, more in-depth analysis and specific use case studies are done. Design artifacts will be available and architecture and structure will be clear. [20] After defining the possible instantiation, the research can move forward paving the way for realizing the business value.

A. *Importance of Networks and Partnerships*

A McKinsey study on analyzing the business value of Blockchain concludes that unstructured experimentation of Blockchain solutions without strategic evaluation of the value at stake or the feasibility of capturing it means that many companies will not see a return on their investments. Blockchain adoption is slowed down primarily because of the difficulty of resolving the "coopetition" paradox to establish common standards. Building alliances are especially important if there are high standards and regulatory barriers even if the company has a dominant market position. [35]

When Janine Grasso, VP of Blockchain strategy and ecosystem development at IBM Industry Platform is asked the question if there are strong alliance implications with Blockchain, she says, "The true design of blockchain is the industry players or ecosystem coming together and bringing it to life. Blockchain is not singular. The only way it works is with participants in an ecosystem working together, so it's very much a team sport.' [34] IBM has partnerships with several firms and have successfully adopted Blockchain for themselves and their customers.

According to another study, Blockchain networks were found to follow the Metcalfe's law. [21] Metcalfe's law states that the value of the network is proportional to the square of the nodes of the network.

$$(V \propto N^2) \tag{1}$$

This relationship came to be known as the network effect and the Metcalfe's law can be mathematically represented as:

$$V(N) = kN^2 \tag{2}$$

where k is a constant.

This was initially used to study and predict the pricing and profitability of the cryptocurrencies, one of the applications of Blockchain. [22] But, it can have the extended application in digital contracts and supply-chain related aspects of Blockchain as well.

Many organizations are already following the path of alliances and partnerships for adopting Blockchain. Chinese government partnering with ChinaLedger and Shenzhen Consortium is an example of this. The Ministry of Industry and Information Technology Software Services Division Director Xie Shaofeng said in a press statement that Blockchain's application has universal significance and called on the government and industry bodies to pool the wisdom of collaborative innovation. [32]

Another example of a successful collaboration between two firms is the alliance between the consulting firm PwC and BitSE. Here, they are focusing on making the best out of PwC's extensive consulting & advisory experience and their reputation as an expert in providing organizational transformation assistance and BitSE's knowledge and innovation in Blockchain and related technology. [33]

From these examples, it is evident that Blockchain has to take advantage of strategic alliances for getting into the mainstream. The best way to do this is to build partnerships or bring your partners to the Blockchain network. Whether this integration would be horizontal or vertical, what aspects to consider, how much to share, and what kind of partnerships to consider, etc. form the rest of this paper.

B. *Blockchain Supply Chain and Integration Strategy*

Although supply chain is not specifically called out in the success of a product or an organization, it is the backbone of the success. Ensuring operational and supply chain excellence are priorities for most companies. The many technological advancements that happen in and around the discipline is an evidence to this. [24]

Thus, if Blockchain adoption is done to advance the supply chain prowess of an organization, especially in the semiconductor industry where strategic sourcing is of prime importance, the initiative is going to be a central and enormous one, owing to the benefits of Blockchain and the importance of the supply chain to the success and competitiveness of the organization.

Blockchain is going to be an integral part of the organizational supply chain and companies would want to handle most of it by themselves. A very good understanding and continued engagement are required for the success of the implementation of Blockchain. Hence, outsourcing and franchising as options can be ruled out. Also, the outsourcing business model has now come of age and most companies prefer to look at it as a collaborative business partnership with a close link with the high-level strategic initiatives of the organization. One major role played in this change is the way information technology (IT) is getting centralized and is becoming a core and business-defining aspect of the organization. [25] Considering the implementation and operational aspects of Blockchain, the transformation will have to happen as any IT transformation would, as the technology adoption lifecycle remains the same for both.

Apart from broadly studying of the strategic alliances and frameworks, the maturity models of the Blockchain technology needs to be studied separately. The maturity model exists broadly [27] and capability maturity model (CMM) has been used to evaluate software development processes [28]. According to the ACM Computing Classification System [29], the indicators of technology maturity are: [26]

- Networks
    - The networking effect and the networking complexity of the implementation have to be considered.
- Information systems
    - The architecture, upgradation, integration, storage, scalability, maintenance, and business efficiency of the systems are of concern.
    - It is clear that one organization alone may not have the capabilities to provide for all of these requirements.
- Computing Methodologies
    - The important factors here are the standardization and computational complexity of the systems.
    - As it can be easily deduced, standardization across the network and collaborating systems can happen only when different parties from the network agree and standardize the systems and methods. A platform-independent system may require more time to evolve.
- Security and privacy
    - Blockchain itself stands for increased security and privacy, however, cooperation from the different elements and participating organizations are required.

It is clear from the study that it will be economically and operationally taxing for participating organizations to rely on a transactional business model in the case of adoption of Blockchain. Thus, a mutually beneficial and collaborative partnership model is envisioned.

C. Strategic Alliances

In order to form a successful partnership, the venturing organizations need to answer the following questions and select the fitting model:

- What type of strategic alliance would be the best?
    - Joint ventures
    - Outsourcing
    - Licensing
    - Franchising
    - Research
- Apart from these general types of partnerships, it has to be decided whether the companies involved are going to jointly approach the adoption with how much equity of each, or to form a separate equity alliance or a non-equity alliance. [23]

Strategic alliances and partnerships, along with vertical and horizontal integrations have changed the transactional nature of the marketplace to a relationship-based one. [4] The relationship can be either an arms-length relationship or a long-term collaborative one. Depending on the nature of the requirement, this can be decided. The supply chain will put a lesser value on long-term partnership than traditional supply chains because of technology expenditures, opportunities, supply chain management costs, & organizational culture. However, this paper by Williams L, R., et al. does not clearly specify which strategy is better for what scenario.

Being able to set up a standard with one's product helps in increasing the installed base. A strategic pricing for licensing and products should be envisioned as it is impractical in the current dynamic business world for a theoretically optimal pricing and fixed loyalty schemes. [5] Strategic alliances help in lieu of or along with licensing, as the partners develop complementary products. The benefits of strategic alliances are: wide initial distribution, co-opts competitors, reduces consumer confusion by building market expectations, and an increase in the supply of complementary products which may result in superior technology. The drawbacks are the appropriation of technology, increased competition in the end market which results in lower profit margins. Patent or copyright protection may not be sufficient to pre-empt competition. High barriers to imitation may also act as an incentive for other companies to develop a similar or superior solution all on their own.

With complementary products, new industry standards will be developed. If the company is short of resources in a particular area, it is better to go for the passive licensing method. Selective partnering is useful when firms lack critical complementary resource that partner possesses, high barriers to imitation, and when the partner is also a potential capable competitor. [5] The article is very much in alignment with the subject matter as it deals with established companies, such as Intel and Microsoft, that have the capability to set industry standards. It discusses setting standards, forming alliances, and developing a winning strategy with a reference to Porter's five forces. There is also discussion about when companies can consider strategic alliances with potential partners. Our requirement matches the scenario where there are high barriers to imitation, and there is a need for an ecosystem with complementary products, it is better to enter into selective partnering.

The strategy is decided upon taking into consideration the industry and firm characteristics. Temporal competitive pressure also becomes a deciding factor for developing the strategy. According to the 1995 paper by Kotabe, M. & Swan, K. S., this has a direct effect on the product innovativeness. [6] 905 new product innovations since 1988 were studied for the role of if strategic alliances in high-technology new product development, which discusses the role of strategic alliances for product innovativeness. The first hypothesis of the article says that products of cooperating firms tend to be more innovative than the products of one single firm. The second hypothesis is that products from a horizontal linkage of the partnership tend to be more innovative than a vertical linkage. The next hypothesis says that the products of smaller companies are more innovative than those from larger companies as the former ones have the intent to make it more

innovative in order to compete with the larger firms and gain sufficient market share to be in the business. It is hypothesized that when companies across different industries come together to develop a product, it tends to be more innovative. The other factors considered in the study was industry, strategic linkages, temporal aspects, and nationality.

Although the paper (Kotabe, M. and Swan, K. S., 1995) provides the importance of strategic alliances and type of alliance, it is very focused on the product innovativeness, which is only one aspect of our study. Also, the researchers had done a regression analysis of the available data and the correlation was not found to be high. The methodology was not sufficient for providing an all-rounded study on the topic as a clear understanding of which variable contributes to what level of product success is not available. However, it provided a list of important aspects that affect product innovativeness which can be extrapolated to the new technology adoption. [6]

According to Hoffman E. et al., the key factors taken into consideration for an alliance are firm size, organizational structure, integration of supply chain strategy with overall corporate strategy, past financial performance, supply chain partner pressure, transaction climate, and environmental uncertainty. The model is aimed to clarify the supply chain diffusion process. The accuracy of the model is tested using a survey. This paper written in 2017 also recognizes supply chain management as an important area for information technology innovation and investment. The study found out that larger and more decentralized firms are more likely to adopt technology in the supply chain. Being less successful in the previous years is a motivating factor for technology adoption. Organizations, where supply chain strategy is integrated into organizational strategy, are more likely to adopt technology to improve their supply chain. The external factors that affect the decision are the pressure from supply chain partners or a favorable transaction climate with supply chain members. [7]

Apart from that, the paper by Hoffman, E. et al. verifies various factors that might positively or negatively foster technology adoption in the supply chain strategy. However, it doesn't talk about how they do it or what happens once they do in terms of their relationship with their supply chain partners, which was the motivation behind studying the paper. The positive aspect is that the paper guides to look into some important aspects that affect the supply chain strategy, which might be the same factors that have an effect on the strategic alliance or relationship with the supply chain partners. [7]

Another aspect to be considered is the network beyond formal alliances. The top executives of an organization play a major part in this. Social networking of firm executives is assessed in terms of propensity to network, strength of ties, and network prestige. The variables considered are whether the alliances are related to technology or not, whether they support alliances, what the propensity and scope of networking are, the strength of ties, network prestige, age and size of the firm, and executive age. Two-block regression analysis was done on the variables to check the correlation between the number of alliances. Of all the variables, the propensity to network, the strength of ties, and prestige of network members were found to have the maximum effect on the success of alliances. The study tries to find out the important aspects that firms look for while considering a partnership with smaller firms. The paper also differentiates between technological and support alliances. [8]

Other aspects to be considered are the governance properties of different alliance types which helps to develop a simplified market-hierarchy continuum of alliances. With this background, an empirical study is done on the appropriability hazards and governance. [9] The study was done on 2707 manufacturing firms based in the UK by Tian F. in 2016. The factor for hypothesizing was the breadth and depth of the external search for innovation, of how radical it is. The external search breadth and depth describes a firm's strategies for accessing knowledge from external firms for innovation purposes. Regression was done on the data. The study concluded that firms that are open to search for knowledge outside their organization rank high in innovativeness and can get rid of organizational myopia. However, if the breadth and depth go beyond a tipping point, it will have a negative impact on the cost and time, and in turn, on innovativeness. Therefore, the focus should be on identifying and deriving knowledge from the key resources. Thus, the paper by Tian F. does not connect directly with the requirements of the project. However, the breadth and depth of external search are important points to keep in mind while the organization ventures for the alliance.

Global competition highlights knowledge asymmetries in terms of availability of information and the capacity to assimilate the information. Nine international alliances were studied for knowing more about how the inter-partner learning is achieved. It also suggests that partners may have competitive or collaborative aims and how to make the best of the situation. Many managers have the paranoia of losing the core competence and competitive edge to the partner once the partner has internalized the learning. The different aspects that contribute to the success or failure of the alliance are studied. The two basic processes in alliances are value creation and value appropriation – whether the market and competitive logic of the venture is strong and how the plan is implemented combining the resources and complementary skills. According to the 2018 article by Francisco, K. & Swanson, D., success lies in developing skills and knowledge with minimal dependency on the partner. [10]

The paper does a qualitative analysis on bringing about success in a partnership, which, however, is not verifiable. The takeaway is that dependency on a particular partner should be minimized while partnering. This is in the context of similar firms from different geographies. How this theory can be extrapolated into other scenarios need further analysis. [10]

VI. Discussion

The barrier for Blockchain adoption can be attributed to the fact that no one organization can do it alone to benefit from the business value or lack of a proper adoption strategy. Companies should figure out the conceptive and descriptive stages themselves so that they will have a fairly good idea about their resources and capabilities. This analysis will help them understand and address the gaps through strategic alliances.

What are the different stages at which a strategic alliance is of relevance for emerging technology adoption and implementation?

From the study, it is evident that at every stage from concept development to the different stages of supply chain, strategic alliances can create value. However, there are also contrasting views on this as it is better for the company to develop the conceptual framework, develop a plan, and then approach potential partners. This would depend on the level of technical prowess and robustness of the present technology framework of the company. Before entering into the decision-making process, companies are advised to thoroughly assess the maturity of its IT framework and value creation points.

It is indisputable that a strong supply chain is essential for a firm to remain competitive and strategic sourcing plays a big role in it. This calls for a mutually beneficial and collaborative partnership between the companies rather than outsourcing or franchising. Otherwise, external analysis of the Blockchain adoption will involve all the factors involved in any other IT product adoption or digital transformation which usually depends heavily on outsourcing.

Alliances are important even when the company enjoys market dominance, particularly in an industry with high standards and regulatory barriers. The supply chain part of the business is one of them and new technology adoption, that too a disruptive one such as Blockchain definitely requires high standards and regulatory scrutiny. There are several examples where companies have partnered and created a synergetic ecosystem.

What are the factors to be considered for deciding on the kind of alliance? How do we weigh/quantify them according to their importance? What are the specific factors to be considered for the specific case of Blockchain adoption?

Strategic alliances and partnerships, along with vertical and horizontal integrations have changed the transactional nature of the marketplace to a relationship-based one. Our requirement matches the scenario where there are high barriers to imitation, and there is a need for an ecosystem with complementary products, it is better to enter into selective partnering. The key factors taken into consideration for an alliance are firm size, organizational structure, integration of supply chain strategy with overall corporate strategy, past financial performance, supply chain partner pressure, inter-partner learning opportunities, trust in the partner, dependency on the partner, executive network, transaction climate, and environmental uncertainty.

VII. Conclusion

Strategic alliances among complementary or vertical and horizontal partners were found to be the preferred method for adopting Blockchain technology as cooperation and synergy are inherent in the process. Certain aspects are more important than others and that depends on the context and firm, which is explained in the paper.

Future research involves studying similar technology adoption that has been successful and comparison study of development using in-house methods and strategic alliances. The research has to be tested and substantiated with known examples and industry experts' opinion. The aspects listed in the literature are not exhaustive. As technology and interactions evolve, the aspects will be revised accordingly.

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