Turkish Journal of Computer and Mathematics Education *Vol.12 No.14 (2021), 1511– 1520*

Research Article

The effect of Information and Communication Technology and Procurement towards Supply Chain Integration

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Article History: *Do not touch during review process(xxxx)*

Abstract: Supply chain integration is widely considered by both practitioners and researchers a vital contributor to supply chain performance. The two key flows in such relationships are procurement and information technology. Previous studies have addressed information technology and procurement in separate studies. In this paper, we investigate the integrations of both information communication technology and procurement between supply chain partners and their effect on supply chain integration. Information technology capabilities and procurement both have significant effects on supply chain integration. This concept paper will discuss the importance of information and communication technology and also procurement in order to survive and sustain a competitive, which in turn to improve supply chain integration. Additionally, the proposed framework will be useful in any environment as it resulted from the synthesis of past literatures and studies. This study is one of the first to identify and discuss conceptually the relationship between information technology, procurement and supply chain integration.

Keywords: Information and Communication Technology, Procurement, Supply Chain Integration

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1. Introduction (Times New Roman 10 Bold)

The use of IT is considered as a prerequisite for the effective control of today's complex supply chains. Indeed, a recent study conducted by Forrester Research indicates that manufacturers are increasingly dependent on the benefits brought about by IT to: improve supply chain agility, reduce cycle time, achieve higher efficiency and deliver products to customers in a timely manner **(Dehgani&Navimipour, 2019)**.However, information technology investment in the supply chain process does not guarantee a stronger organizational performance **(Marangunic&Granic, 2015)**. In fact, the adoption of a particular technology is easily duplicated by other firms and it often does not provide a sustained competitive advantage for the adopting firms **(Dao, Langella& Carbo, 2011)**. The implementation of information technology IT in the supply chain management SCM can enable a firm to develop and accumulate knowledge stores about its customers, suppliers and market demands, which in turn influences firm performance **(Wamba et al., 2017)**. In the literature, information and communication technology (ICT) are viewed as two important enablers that help promote the sharing of information among supply chain partners. Many research studies have focused on this principle enablers in supply chains integration **(Singh & Teng, 2016)**. This variable was considered as insightful additions to the research model for further empirical investigation. Additionally, from a technological perspective, information communication technology alignment is an indicator of well-coordinated IT use throughout a supply chain that requires mutual investments and efforts made by its partnering firms. Supply chain integration (SCI) is a key component of competitive advantage whilst striving to improve organizational productivity and profitability through internal, supplier and customer integration **(Asnordin, Sundram&Noranee, 2021)**. Where close relationships among supply chain partners are lacking, organizations no longer compete profitably **(Huang, Yen & Liu, 2014)**. In addition, supply chain integration incorporates core practices required to achieve higher levels of supply chain performance **(Sundram et al., 2018)**. It has been proposed that formation and management of collaborative relationships among supply chain partners lead to improved levels of integration and performance **(Gunasekaran, Patel &McGaughey, 2004)**. For example, **Uvet et al., (2020)** found that positive outcomes of collaboration included enhancements to efficiency, effectiveness and market position by increasing the effectiveness of information technology and procurement would increase better supply chain integration and supply chain performance. However, it appears that the link between these variables are not fully established.

Thus, more research on how to achieve integration is called for, as a response to ambivalent results on the impact of information technology on supply chain integration **(Sundram, Prem &Atika, 2020)**. Supply chain integration is the strategic integration of both intra- and inter-organizational processes **(Flynn, Huo& Zhao, 2010)** and gauges the extent to which supply chain partners work collaboratively together to gain reciprocally beneficial outcomes **(Wong, Boon-Itt& Wong, 2011)**. SCI has become a major topic amongst organizations which seek to exploit the potential of the supply chain to build sustainable value **(Kannan & Tan, 2010)**. The ultimate aim is to gain effective and efficient movements of products, services, information, cash and decisions through coordinated endeavors and exchange of information in the provision of maximum value to the customer at low cost without delay **(Prajogo&Olhager, 2012)**. A lack of supply chain integration causes serious problems such as increased inventory cost, delayed procurement, lowered product quality and inaccurate product forecasts, which may jeopardize both a focal organization and all of its supply chain partners, by worsening customer satisfaction **(Yang, Hong & Modi, 2011; Rasib, Sundram&Noranee, 2021)**.

2.Significance Of The Study

Based on previous research, there are several gaps that can be identified in the area of information communication technology and procurement in supply chain integration and in supply chain management in general. Integration appears to require appropriate organisational and operational conditions in order to be positively affected by information technology. A number of different definitions for supply chain integration and information technology have been proposed, yet variations in these definitions make comparisons of results difficult. It is not adequate to compare results on the relation between supply chain integration and information technology without comparing the actual variables and metrics that have been used for assessing the constructs. The above observations give a motivation to expand the earlier research on the relationship between supply chain integration and information technologyby developing a conceptual model that considers information communication technology and procurement and their influence on supply chain integration. Another venue for research in the current study is examining the effects of information and communication technology (ICT). In the literature, information and communication technology (ICT) are viewed as two important enablers that help promote the sharing of information among supply chain partners. Many research studies have focused on this principle enablers in supply chains performance. This variable was considered as insightful additions to the research model for further empirical investigation. Additionally, from a technological perspective, ICT alignment is an indicator of well-coordinated IT use throughout a supply chain that requires mutual investments and efforts made by its partnering firms. Thus, it manifests the level of importance that the business partners attribute to the supply chain performance. However, the level of importance that firms operating in different countries attribute to IT alignment may differ. In order to gain country-specific results, this research also aim to investigate IT alignment as a variable that influence the supply chain performance in manufacturing industry in Malaysia. The research will be carried out among manufacturing companies. They are likely to pay more attention to investing in supply chain technologies and possess a considerable amount of experience in supply chain management practices. Furthermore, the cultural setting in which they operate is also mainly country specific. The significant of this research is to indicate how important the organizations consider information and communication technology and procurement alignment as practices to promote supply chain integration with their supply chain partners.

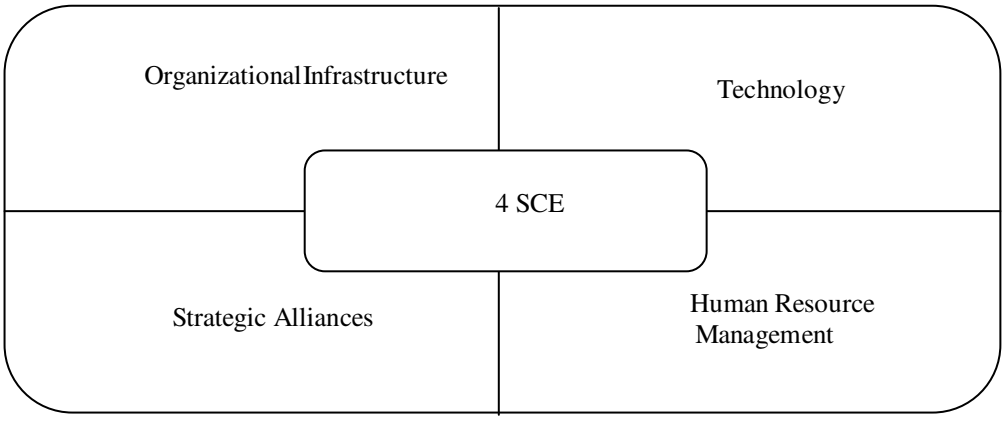


Figure 1. The four key enablers of supply chain

3.Review Of Related Studies

3.1 Information and Communication Technology (ICT)

Technological developments play an important role in retail operations, in terms of streamlining the flow of goods, services and information. Integrated and coordinated information systems are important to supply chain alignment **(Ndubisi& Iftikhar, 2012)**. Organizational managers are ultimately held accountable for organizational performance **(Green et al., 2012; Hallyburton, 2013)**. The exchange of information and knowledge is so important that supply chain partners should consider the use of an enterprise planning system to promote the exchange of information and knowledge **(Govindan et al., 2014)**. Information sharing results in benefits for all of the supply chain partners. Information and knowledge sharing can help spread the risks, costs, and gains for supply chain partners **(Stock, Boyer & Harmon, 2010)**. Organizational success first depends upon the performance of the supply chains in which the organization functions as a partner **(Wong, Boon-Itt& Wong, 2011)**. Health-care supply chain firms rely heavily on firm-specific IT infrastructure, as they help in driving operational and patient-related information from one department to the other, for example, in hospitals **(Vahatalo& Kallio, 2015)**. With such information sharing between departments, trust among the units are also enhanced that aids in coordination **(Akrout et al., 2016)**. So inside-out IT capability, although internally oriented, yet has a pivotal role in hospital operations through timely information exchange across critical units. Spanning IT capability mainly tries to unify the individual effectiveness of inside-out and outside-in IT capabilities **(Kraaijenbrink, Spender & Groen, 2010)**. Such synchronization helps in achieving effective routine and strategic performance **(Petitgout, 2018)**. IT resources aid prominently in the enhancement of operational and competitive performance in collaborative supply chains **(Fawcett et al., 2019)**. Several research opportunities in IT and SC interfaces were identified by **Lau, Tang & Yam (2010)** in their conceptual research where they argued that the IT and SC management jointly created the digitally enabled SCs. Complex SCs can be efficiently coordinated when both focal units and their allied partners are equipped with IT infrastructure at the same level **(Ritzhaupt et al., 2013). Sheffield (2019)** argued that assimilation of IT resources in supply chain management has its benefits but at a cost. Recently with development of IT, the concepts of supply chain design and management have become a popular operations paradigm. The complexity of supply chain management has also forced companies to go for online communication systems. For example, the Internet increases the richness of communications through greater interactivity between the firm and the customer **(More &Basu, 2013)**. This illustrates an evolution in supply chain towards online business communities **(Gil-Or, 2010)**. Supply chain management emphasizes the long-term benefit of all parties on the chain through cooperation and information sharing. This confirms the importance of IT in SCM which is largely caused by variability of ordering **(Prajogo and Olhager, 2012)**. There have been an increasing number of studies of IT's effect on supply chain and interorganizational) relationships **(Cao et al., 2010)**. In this paper, IT appears to be an important factor for collaborative relationships. A popular belief is that IT can increases the information processing capabilities of suppliers, thereby enabling or supporting greater relationship in addition to reducing uncertainty **(Wong, 2011)**. IT decreases transaction costs between buyers and suppliers and creates a more relational/cooperative governance structure, leads to closer buyer-supplier relationships **(Drnevich&Croson, 2013)**, may decrease trust-based interorganizational partnerships and removes a human element in buyer-supplier interaction, while trust is built on human interaction **(Ghobakhloo et al., 2011)**. The other more popular use of the IT in supply chains is in order processing applications. The most frequent use of the IT here is in order placement and order status. Over half of the firms use the IT for this purpose. The use of the IT in order processing has reduced the error rate involved in order processing. Errors can be detected more easily and corrected more quickly.

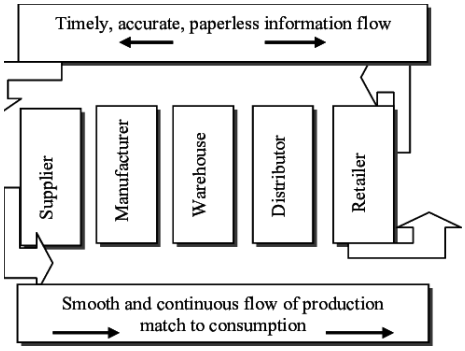


Figure 2. Role of information technology in supply chain integration

3.2 Procurement

Procurement refers to the function of purchasing inputs used in the firm's value chain, not to the purchased inputs themselves. Purchased inputs include raw materials, supplies, and other consumable items as well as assets such as machinery, laboratory equipment, office equipment, and buildings. Ceasing to be a secondary business function, procurement has played a fundamental role in organization's management by being responsible for purchasing specific resources from the external part of the enterprise required by internal operations. In the literature, procurement and purchasing are sometimes discussed as interchangeable terms; however, there are authors **(Abbasi&Mohamadi, 2020)** who distinguish procurement as an evolution of purchasing which was fundamentally focused on cost-reduction in the past. Consequently, procurement is no longer considered a simple business function accountable for planning, implementing, evaluating and controlling purchase decisions **(Lemke, Clark & Wilson, 2011)**; it also encompasses the management of resources and suppliers **(Hingley et al.,2013)**. Internally, procurement managers provide information (such as suppliers' capacity, logistics data, pricing and discounts and new products information) to other functions and internal customers taking responsibility to supply procurement with their needs **(Roh, Hong & Min, 2014)**. Thus, cross-functional integration between procurement and other functions is fundamental to increase visibility of the flows and, consequently, allow for more reliable decision-making from managers **(Chiang, Kocabasoglu& Suresh, 2012)**. In this regard**, Foerstl et al. (2013)** point out, in one of their study's propositions, the importance of developing a cross-functional team in purchasing and supply management. In summary, procurement has become widely recognized as an important function, responsible for increasing competitiveness within an unstable environment **(Prajogo&Olhager, 2012)**, influencing positively the organization profitability **(Hussain, 2020)**, and contributing as much as other functions to business continuity **(Ellegaard& Koch, 2012)**. It is, therefore, evident that procurement plays a fundamental role in any organization. By doing so, this function is capable of managing relevant internal and external organizational issues which may help create supply chain resilience. Having the right components parts and process resources at the right time at the right prices is very important for firm performance in terms of cost, quality, delivery and innovativeness. These are essential activities in procurement. A core function of procurement is thus to quickly secure such critical resources at low costs that meet the firm's needs. As such, it stands to reason that higher levels of procurement performance (capability) will support the overall performance of the firm **(Pearcy &Dobrzykowski, 2012)**. It is widely held that firms that achieve better lead time and lower costs tend to realize improved firm integration **(Matopoulos, Kovacs & Hayes, 2014)**. Lead time will support a firm's goals with regard to responding quickly to customers thus improving sales, while lower costs influence the overall profitability of the firm. While these and other forms of procurement can prove to be beneficial, the supply chain management professional's decision-making process can be complicated by the fact that these tools vary in many respects, including their ability to facilitate supply chain integration within and across firms. The purpose of the procurement process in supply chains is to ensure that organizations have the supplies required to meet the demand **(Holm, Rudis& Wilson, 2015)**. **Mauliddina (2020)** describes different features that help characterize the procurement process in supply chains. The author explains that goods and services enter the supply chain through different sources. Goods can be acquired in different ways such as in bulk or stored at the vendor until needed **(Falasca& Zobel, 2011)**, and the procurement of goods can be done using local or global suppliers **(Blecken, 2010)**. Local procurement, whenever possible, has the advantages of faster delivery times and lower transportation costs **(Holm, Rudis& Wilson, 2015)**. Local procurement can also help in the recovery of the affected region by stimulating the local economy. In addition, local procurement can generate competition between organizations and result in shortages **(Wong, 2011)**.

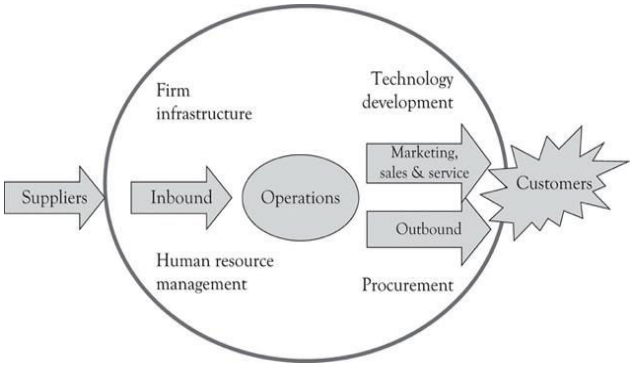
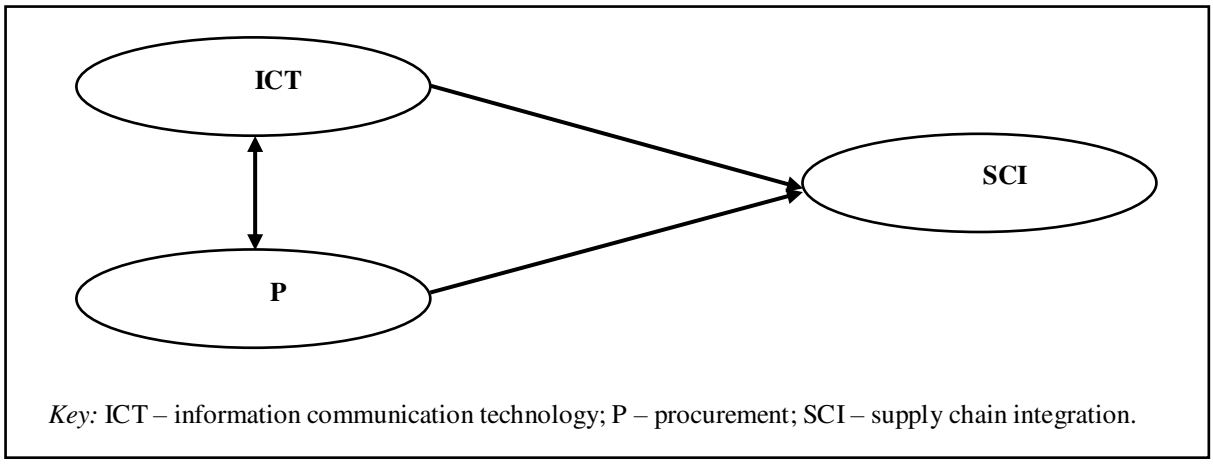


Figure 3. Analytical approach for strategic planning

3.3 Supply Chain Integration

Combining something in such a way that it becomes a full part of something else is what is known as integration **(Danese&Bortolotti, 2014)**. More specifically, supply chain integration are network links of an organisation or firm with its business partners such as customers and suppliers by integrating their relationships, functions and processes **(Hassini, Surti& Searcy, 2012)**.**Stevens & Johnson (2016)** outlined two perspectives of supply chain integration which encompasses internal integration and external integration. According to **Prajogo&Olhager (2012)**, the aspect or perspective of internal integration involves establishing close relationships between various functions in a business organization or a firm such as material management, order management, inventory and warehouse management. The perspective of external integration encompasses **(Abbasi&Mohamadi, 2020)** forward integration of resource flow from ultimate supplier to manufacturer and later to the customer or end-user and **(Akrout et al., 2016)** backward integration of information from ultimate customers, to manufacturers, to ultimate suppliers **(Leuschner, Rogers &Charvet, 2013)**. **Sheikh & Rana (2014)** view that supply chain integration can be achieved successfully by firms in a supply chain through strategic partnering among trading partners in a supply chain and effective knowledge sharing practices. Furthermore, this successful and well-integrated supply chain could advance organizational performance in terms of diversity capabilities and productivity **(Som, Cobblah&Anyigba, 2019; Lisi, Zhu & Yuan, 2020)**. The SCI construct comprises three dimensions including internal, supplier and customer integration to capture multidimensionality **(Flynn, Huo& Zhao, 2010; Wong, Boon-Itt& Wong, 2011; Rasib, Sundram&Noranee, 2020)**. Internal integration refers to the extent to which a manufacturer re-engineers its own organizational strategies and processes into synchronized processes to satisfy its customers' demands **(Yang, Hong & Modi, 2011)**. The expansion of cross-functional teams that tend to focus on their process requires a seamless flow of resources and relevant information in supply chains and removal or minimisation of barriers between functional boundaries to surmount the shortcomings of specialisation **(Sgro et al., 2020)**. Internal integration facilitates cooperation amongst internal functions **(Wong, Boon-Itt& Wong, 2011)**. It focuses on functions or departments within the manufacturers via an integrated process across them. An absence of internal integration and heterogeneity of each team's aim may cause redundant work and waste resources, which undermine quality and cost performance **(Ketokivi& Choi, 2014)**. In addition, internal integration fosters relevant knowledge and information sharing **(Wu, Chuang & Hsu, 2014)**. By sharing knowledge pertaining to value-adding activities across cross-functional teams, they can facilitate modern supply chains, which in turn promote greater integration of suppliers and customers **(Asnordin, Sundram&Noranee, 2020)**. External integration comprises supplier and customer integration. A multitude of activities between a focal firm and suppliers underpin supplier integration, including information sharing and collaboration in planning and joint production development in dealing with inter-organizational boundaries **(Liu et al., 2020)**. Integration in a broader organisational sense has been defined by **Turkulainen&Ketokivi (2012)** as "the quality of the state of collaboration that exists among departments that are required to achieve unity of effort by the demands of the environment". The integration of information flows across supply chain partners is labelled "information integration", while the integration of physical flows is represented by the coordination of decision- making among partners on operational processes and is labelled "coordination of operational decisions". Coordination is defined after **Dutton &Ragins (2017)** as "the process people use to create, adapt and re-create [supply chain] organizations".



Key: ICT – information communication technology; P – procurement; SCI – supply chain integration.

Figure 4. Conceptual Framework

4.Objectives Of The Study

- To find out whether there is a positive impact of information communication technology (ICT) on supply chain integration (SCI).
- To find out whether there is an associationbetween information communication technology (ICT) and procurement (P).
- To find out whether there is a positive impact of procurement (P) on supply chain performance (SCP).

5.Hypotheses Of The Study

- There is a positive impact of information communication technology (ICT) on supply chain integration (SCI).
- There is an association between information communication technology (ICT) and procurement (P).
- There is a positive impact of procurement (P) on supply chain performance (SCP).

6.Discussion

The conceptual paper has been able to come up with some exploration results and findings that lead to useful conclusions. These are seen to be of significant importance to academicians and researchers, as well as practitioners in the areas of information and communication technology, procurement and supply chain integration. The following are some of these identified useful results, presented as contributions, as well as implication to the theory and practice. Next, the introduction of information and communication technology, procurement and supply chain integration in a firm definitely touches other practices that may be in existence in the firm. Also, the introduction of this information technology is bound to be coupled with the procurement that matches the integration in supply chain. This is poised to attract research attention in firms for the purpose of avoiding clashes and possible duplications of efforts within one firm. Thus, it is suggested that firms introducing these practices should align and prepare themselves to do such studies for smooth operations.

7.Implications

7.1 Theoretical Implications

This study contributes to the existing body of knowledge by examining the relationships between extended information communication technology, procurement and integration in supply chain management in the manufacturing industry in Malaysia. This contribution is derived from the attempt to test the impact of information and communication technology and procurement on supply chain integration. Previous studies **(Chin, Tat &Sulaiman, 2015; Lindh &Nordman, 2017)**, have investigated direct link between supply chain practices and performance. Therefore, by examining whether or not information technology has an impact on supply chain integration in the context of manufacturing industries; this study will contribute to the resource-based view [RBV] literature **(Caridi et al., 2010)**. In addition, by combining the extended variables of information communication technology and testing them in a single setting, this would allow the study to generate a comprehensive framework of the relationships between the variables. Further, the study establishes both theoretical and empirical argument to justify that the relationship between the variables exists. This knowledge lends an important hand in the study and advancement of theories related to relationships between information and communication technology, procurement and supply chain integration. Also, it will be helpful in studying or in the search for best practices in terms of the study variables for varying business environmental conditions.

7.2 Practical Implications

An additional information on information technology and procurement can be gained by the leaders in the organizations. It could be useful for the leaders to improve or raise the factors mentioned above that can give advantages to the culture in the organization in the future. The outcomes of this study can be used by the management in organizations for the progression of business practices to produce better employees. This study also might be helpful and support for the organizations in increasing their supply chain integration. From this study, it helps the organization as a guideline to improve the information communication technology and procurement among employees of the organization in the future. It also gives an idea to the management on how important the supply chain integration that affected by the employees' practices. For the organization, they can propose something to ensure that the employees are satisfied with their job and can maximize their effort in making sure a better supply chain integration for the organizations.

8.Conclusion

In conclusion, this study is one of the first to identify and discuss conceptually the relationship between information and communication technology, procurement and supply chain integration. Nevertheless, there could be limitations that exist while conducting research based on this conceptual approach. The limitations can be addressed in future research work that may focus on studying the relationships among variables used for this paper, as well as in related areas of current and past researches. Firstly, the limitation of sample size; it is suggested that works in this area should use different data sets to re-validate the model and constructs used. Moreover, future studies should strive, whenever possible, to collect large enough samples of data to allow for full analyses to be conducted within one study. This will permit the avoidance of using special techniques such as item parcelling.Furthermore, there is a great need to study other links between the concept paper suggested variables as this exploration has not been able to consider all the possible relationships that may exist among the variables. Also, not to forget to involve future studies in the area of modern technology usage and IT, as these are identified as important elements to appropriately procurement and supply chain integration.

9.Acknowledgements

The authors gratefully acknowledge Institute of Graduate Studies, Faculty of Business and Management, UniversitiTeknologi MARA (UiTM) for providing the financial assistance to publish this research paper.

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