

# Reconsidering Supply Chain Management Paradigms: A Question of Efficiency<sup>†</sup>

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*This paper aims to re-evaluate the value system of Supply Chain Management (SCM) by examining the elements of paradigms that are embedded in the theories and practices. Conceptual analyses are made on the meaning of optimization of supply chain by efficiency pursuit. Limitation of rational decision making, theories of stock minimization, lead time shortening, value-added services, supply chain integration, systemization and professionalization due to the limitation of information obtainable and the complexity of the economy are pointed out. The author suggests that currently prevailing SCM paradigms are static and efficiency in supply chains should be measured dynamically, taking different time spans into account. In the face of growing concern over unequal distribution of wealth and the scarcity of natural resources with the vast Asian population participating in the global market, the traditional division of labor and comparative advantage theories are now subject to reconsideration. Future studies in this field should take into account the Asian value system of modesty, diligence and long-term orientation on the basis of benevolence, trust and harmony. A cross-disciplinary and cross-cultural analyses of the SCM paradigm has rarely been done. This paper claims to raise questions on the existing paradigm in this field and contributes as an explorative study to the restructuring of SCM theories.*

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## Introduction

How Supply Chain Management (SCM) theories have dealt with efficiency is important to note when we study the theories. Doyle (1964) said, “logistics is an art, not a science.” His definition of military logistics—“all things and all actions necessary to support combat wherever, whenever and whatever those requirements may be”—is in principle applicable to the idea of business logistics. However, logistics has changed its sphere from art to a higher level of discipline which has been making substantial contribution to the general management theories.

In recent decades, the development of sophisticated material handling equipments and Information and Communication Technology (ICT) has improved the accuracy and efficiency of operations by collecting information and analyzing data to make decisions based on that. In other words, logistics has been dedicated to finding solutions by developing technology and management skills. Hutchinson (1987) called this systems logistics and predicted its ICT-centric development, but at the same time, he rightly

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warned that future logistics would be influenced more by social rather than technical problems. Logistics and SCM have taken into account the development of various fields in management studies and established their own stream of academic discipline. However, the social part of the problems as Hutchinson predicted is yet to be studied. Supply chains were extended further across borders in the 1990s, thanks to the ICT revolution. It was even spurred by geopolitical upheavals such as the end of the Cold War and China's introduction of market economy. The increase in transportation capacity helped enhancing the trend on the principle of economies of scale, overcoming distance and enjoying comparative advantage. The cross-border division of labor which Smith (1776) advocated, has steadily and been progressing on a worldwide basis.

The ongoing globalization of the economy has apparently caused unification of the SCM theories. Management takes up issues relevant to decision making which can lead to enhanced profitability of a firm. A theory can be accepted by practitioners only when they recognize its applicability to the solution for the problem they are facing in the real world. However, how the people want to solve the problem depends on the concept of values that is inherent in their mind. For example, some people are attached to a substantial profit for the year while others see small but sustainable profits for a longer term as more valuable. In other words, management theories are influenced by time frames. This is where paradigms have relevance in examining the validity of a theory.

This paper addresses the issue by re-examining the paradigm of rationality (Simon, 1947) which is embedded in the logistics and SCM theories. The use of the word paradigm here follows Kuhn's (1962) definition: "A consensus of the general rules for solutions that the people in a specific field of science or profession share and follow."

This paper reviews what the existing SCM theories have been focused on and questions the rationality of efficiency pursuit considering the fallacy of total optimization paradigm. The paper also gives suggestions for study in future.

### **What Supply Chain Management Theories Advocate**

Currently prevailing solutions in SCM can be summarized as minimizing stock, reducing lead time, adding value, integrating supply chains, systemizing and professionalizing. These concepts tend to be the exemplification of best practices achieved by innovative firms and they are commonly accepted and shared by practitioners in all stages of supply chains.

Unnecessary stock causes extra costs for warehousing facilities, personnel, finance and administration. It can also make loss by product obsolescence. Just-in-time delivery is a good example of solution to achieve the reduction of stock level. Reducing lead time is an important factor for a competitive edge in the current situation as consumer needs are well diversified and product life cycle is becoming shorter. As a result, diversifying the products is postponed further in the downstream of the supply chain, i.e., closest to the customer end of the supply chain. Thus, adding values on the product such as modifying, packaging and labelling is carried at the distribution phase rather than at the

manufacturing phase. These works are better coordinated by taking a wider command of supply chains horizontally and vertically, integrating decision-making processes along with the state-of-the-art ICT. Finally, higher levels of work in these processes are only achieved by professionals of various fields in logistics. This leads to the concentration of resources on the core competence on the side of manufacturers and distributors by outsourcing logistics to professional third-party service providers (Christopher, 1992; Bowersox *et al.*, 2000; Hines *et al.*, 2000; Schary and Skjoett-Larsen, 2001; Coyle *et al.*, 2003; Harrison and van Hoek, 2005; and Shinohara, 2006).

The main theme of these theories is the maximization of efficiency. By reducing stock, minimizing the time spent for goods to stay at the nodes and streamlining transportation, supply chains improve efficiency. This means that the objective of logistics is to maximize the efficiency of goods flow and increase goods movement.

However, one should note that few arguments have been made as to what is efficiency and whether extension of supply chains can really lead to an ultimate good. Without answering this initial question, the basic proposition of logistics and SCM will remain equivocal and the validity of its paradigm questionable.

In this field, practitioners and researchers have tended to follow the existing theories and discuss technicality in their application. Recent examples are seen in Chen's (2008) model for customer-focused objective-based performance evaluation of logistics service providers and Kunadhamraks and Hanaoka's (2008) evaluation of the logistics performance of intermodal transportation in Thailand. Gebauer and von Zedtwitz's (2007) analyses of the differences in orientations between Western European and Chinese service organizations focus on the methodology development to adapt European firms to the Chinese culture operating in the country. However, as the magnitude of the Asian economy is increasing and it has great influence on the future of global economy, a question should be raised as to whether the SCM theories should holistically take the specificity of Asian value system into account.

### **Rationality of Efficiency Pursuit**

In logistics, rationality is measured by efficiency. The right management is to increase inventory turnover and shortening the lead time. In order to realize it, on the basis of widely-shared logistics paradigms, people make decisions at every point of decoupling in supply chains. Optimization of supply chain is pursued in this manner.

What is the optimum supply chain? Optimum for whom? Decisions may be different whether the word is meant for manufacturers, their component suppliers or consumers. The best procurement for a firm is not necessarily the best supply for the vendor. The central concern for a firm is to contribute to its profitability by winning competitions. In this case, the optimum supply route may not be the channel through which a consumer obtains the commodity. If the supply chain optimization is meant for consumers, the profitability pursuits of the manufacturers and distributors tend to clash with the

well-being of the consumers. For the consumers, the optimum circumstance would be that the commodities are available at the lowest possible price anytime they want.

There is obviously a big gap between the two goals. The sellers try to find an equilibrium point where supply chains are streamlined well enough to maximize their profit and at the same time anchor the customers to the same product. Competition is something that has to be eliminated for the sake of their benefit. For the consumers, competitions among suppliers are always welcome. To get maximum satisfaction, they must be offered a large variety of similar goods with ample stock for immediate delivery at a competitive price.

Is there an equilibrium point in this sphere? Statically, the situation of tug of war between the buyers and sellers as above seems to settle on the point where both of them compromise. Actually, the pulling forces tend to act almost equally from both the directions in a balanced equilibrium. Therefore, there is a balanced power in the market for the moment. The question is how long it will last. As the factors are vulnerable, the state of balance at one time may cease to be balanced the next moment. The seemingly most efficient supply chain may become obsolete immediately after it has been regarded as optimum.

For example, just-in-time is a concept which originated in the lean management practice at Toyota (Womack *et al.*, 1991), but was named and manifested in the US. It advocates buyer-supplier cooperation to avoid unnecessary stock of goods which can be promoted by realigning stock location, stock management and transportation. It has been seen as a typical solution for large scale buyers such as automobile assemblers and mega retailers as the cooperation can generally be called for only by firms with power. The just-in-time proponent's core motive is to curb the liberty of suppliers in determining the quantity of production, inventory, stock places and supply routes in order to make them compliant with their needs as buyers. It is done through the building-up of friendly relationships with the vendors by coordinated cost reduction processes, guaranteed quantity of purchase, joint research and product development. Rationalization of supply chains is set forward through just-in-time method in this way towards 'optimization'.

However, this optimized situation tends to be vulnerable to contingency risk. Riken Corporation is a car component manufacturer based in Niigata, Japan. Due to their excellent quality, Riken's main products—the piston rings—are used in many types of engines that are supplied to all Japanese car manufacturers. The supply chain of the rings has been optimized so well that the stock was minimized and the production of certain rings was concentrated in its main factory in Kashiwazaki, Niigata, to pursue efficiency. However, Riken's manufacturing facilities at Kashiwazaki were severely damaged and the production was forced to stop for one week due to the Niigataken Chuetsu-oki Earthquake in July 2007. Although production resumed after a week, the stoppage of supplies of rings caused all the production lines of Toyota and Daihatsu to halt for several days. Other Japanese car manufacturers also suffered from partial stoppage of production. This incident

illustrates the difficulty of choice between just-in-time and the preparedness for a contingency risk.

As such, the optimization of supply chains contains some different implications. In a static condition, there is a point of equilibrium in logistics efficiency. However, if it is put in a dynamic state, the possibility to achieve the optimization becomes minimal as the environment gives numerous changes to the elements of supply chain.

Next, the discussion is for whom the optimization is intended. As shown in the aforementioned example of tug of war between vendors and consumers, business transactions are always the result of compromises. The word coined by Simon (1996) 'satisfice' is applicable in this situation. If each party to a transaction continued to seek an optimum condition, the transaction would never be closed. Therefore, people habituate themselves to stop seeking further improvement of things and satisfy themselves at a certain stage of decision-making process. A party with more power tends to steer the less powerful towards satisfaction halfway. It means that, in logistical decisions, optimum supply chain in general terms is something that cannot be achieved.

The last question is whether rationality can be established in SCM. The objective of supply chain optimization is the improvement of efficiency in a supply chain. Then, what decision is declared 'rational'? In the circumstances where more and more sophisticated SCM systems are developed in order to give a so-called rational decision for a solution, the decision still relies on human competence as the systems are programmed by humans.

When a judgment is to be made, how is necessary information obtained? Take for example, the solving of a location problem of a distribution center, where the management prefers a reduction in the number of centers for aggregation of stock and streamlining of the supply chain. The relevant department of the firm would conduct a survey for the best locations, comparing all the conditions of possible choices. After narrowing the list down to a small number of alternatives, the top management would be asked to make a decision. The information to collect at that time would include infrastructure such as port, road and railway, land prices, construction accuracy and costs, distribution route and costs, warehouse operation performance and its costs, etc. An apparently rational decision is made on the basis of these factors. However, people tend not to pay attention to the fact that all the information is constrained by certain assumptions and conditions, and if a change takes place in any of them, the outcome may be different. What can happen may be unexpectedly inadequate infrastructure, changes in legislation or administration, movement of competitors, cost increase, availability trouble, etc. The changes can actually occur at any moment, but from a practical viewpoint, it is not possible to continue investigations and analyze unlimitedly. Thus, they stop the work at a certain stage and make a decision. Even if there is a substantial change in the circumstances after the decision has been made, the project tends to be carried out without being altered. For a firm, withdrawal from what has been decided is so difficult that reconsidering the plan seldom takes place.

As such, people tend to assume that they follow the decisions made in line with the aforementioned paradigm of prima facie efficiency improvement, but in reality they act on the basis of a solution that is distant from the optimum. Simon's (1947) bounded rationality theory also applies accurately in SCM.

### **Fallacy of Total Optimization Paradigm**

In SCM, total optimization can never be achieved because of the limit of human ability to obtain information, to evaluate it and to undertake what has been decided, as Simon (1947) suggests. What we are aiming for in logistics is in fact a solution for a very short term, which is drawn from the bounded equilibrium on the basis of numerous assumptions.

Economy is a complex system and it changes every moment. If surrounding conditions change, a solution will also change. Therefore, the longer the time span, the more difficult it becomes to find an optimum and stable solution in SCM.

In this sense, logistics have so far been relying on equilibrium theories which can offer limited adaptability to environmental changes. Generalized theories in logistics and SCM are now subject to reconsideration.

First, stock minimization paradigm is to be examined. It is not easy to measure the risk of minimizing stock level. We cannot work out the amount of lost earnings that are caused by a certain product being out of stock because consumers do not usually express themselves when they go out of a shop to find what they want elsewhere. Then, just-in-case stockholding may be justified in some cases rather than always adhering to just-in-time operation. Stock level must be determined always within the range of bounded rationality.

Second, the reduction of lead time should be questioned. In order to attain reduction in lead time, simplification of administrative procedures and the postponement of product modification can be done in a justifiable manner in any environment. However, using express service by air to shorten the lead time rather than ocean freight will be subject to argumentation from the perspective of transport cost reduction and natural environment protection. The theory of the shorter the lead time, the better service and profitability we can assure should be reconsidered. Vendors' anxieties for the obsolescence of products that are market sensitive tend to force consumers to pay higher prices.

Third, value-adding logistics can be interpreted as mutation in the logistics evolution. Value-adding processes used to be an exclusive feature of manufacturing. However, logistics service providers have recently been increasingly involved in production on behalf of their manufacturing customers, such as labelling, packaging, coloring, modifying, inspecting and attaching accessories to the products in the warehouses or during transportation. Some of the production factories are wholly operated by logistics service providers. If more of these works are done by logistics service providers, it will affect the dynamics of SCM.

Fourth, a question should be asked as to who initiates integration of supply chains. At present, major promoters of the integration are large sized manufacturing or retailing firms. Their goal is to maximize profit by means of driving a larger part of supply chains to suit their own interest in procurement and product distribution. In the process are screening and consolidating suppliers, joint delivery, streamlining of distribution channels, etc. What is the ultimate consequence of this supply chain integration? Greater influence on the supply chains by a powerful firm leads to a vertical integration of friendly firms which means conglomeration. If the firm wants their suppliers to compete with each other for better quality and lower prices, its influence on the supply chains will become modest. Here, it should be recognized that a total management of supply chains can result in the initiator's obligation to the sustainability of the suppliers by guaranteeing the purchase of their products. This means that the supply chain integration does not necessarily ensure the optimum status of procurement.

Fifth, dependence on ICT for decision making should be questioned. Nowadays, SCM systems generate a lot of business opportunities. By introducing sophisticated ICT, people assume that they can make rational decisions and optimize supply chains more easily. However, that expectation often turns into a disappointment. The difficult part is the investment cost for ICT and the returns on it. The solution that may be given through ICT is also bound by the data put in and the analytical ability of the persons who use the results.

Sixth, professionalization of logistics by outsourcing is also subject to reconsideration. Logistics has been evolving towards scale enlargement, sophistication and diversification. In these processes, knowledge for managing supply chains has been built higher. Manufacturers and retailers' desire to concentrate their resources on the core competence has accelerated outsourcing of logistics operation to the service providers. From the front line operations to logistics management planning, outsourcing has been progressing in scope and degree. Under the concept of Third-Party-Logistics (3PL), logistics service providers are trying to be involved more in the management of every aspect of their customers' supply chains. This leads to the increase in the information asymmetry (Stiglitz, 1997) between the logistics service provider and their customers. For manufacturers and retailers, it can be a great risk to lose control in supply chains and eventually in the market competition. In the context of the above, professionalization of logistics and optimization of supply chains are not necessarily synchronized with each other.

We have examined the main elements of logistics paradigm that are widely believed to be shared both in the Western and the Asian business fields and recognized that the paradigm is based on a certain stereotype, i.e., adherence to efficiency. However, there are many ways towards efficient supply chains. Efficiency is measured differently in different time spans. What is efficient for one year may not be efficient for 10 years. Therefore, SCM theories need to take its dynamic features into account.

## **Towards a New Logistics Paradigm**

It is concluded that the current paradigm in SCM is not universal. The factors of efficient SCM which have been deemed accurate and rational, are in fact vulnerable and subject to evolution in the changing environment. Let us now consider what kind of evolution in the paradigm is underway.

First is the correlation between comparative advantages and transportation. Since the Industrial Revolution, people have relied on the Ricardian Comparative Advantage Theory solely in terms of production costs. World trade has grown steadily in size and scope together with the development of new raw materials, components and final products, innovation of technology and the growth of capacity and quality improvement in transportation. Trade growth has always been a good cause of narrowing economic disparity. Transportation has been assisting it. However, transportation is different from mere infrastructure and is not subject to market competition mechanisms. The quantity and quality of transportation services provided are determined in the market and various surrounding factors have an influence on it. The price of services fluctuates according to supply and demand. If transportation costs fluctuate drastically, as we see in the bulk shipping and tanker markets, the whole supply chain of a product will have to be re-examined and stocks and production sites may well be relocated to suit the new transportation cost structure. The current situation of fluctuated availability of maritime transportation service which is influenced by shipbuilding capacity and fuel costs, works as a motive to shorten the overall transportation mileage. For more than two centuries, people have taken the improvement of transportation efficiency for granted. However, the economies of scale in transportation are now facing a severe challenge in global issues such as geopolitical risks, disruption of market by speculative money, etc. This will affect the paradigm within the framework of the comparative advantage theory.

Second, the above implication is amplified by current environmental concerns. We encounter a situation where long-distance transportation is more disadvantageous to business because of the cost burden on the longer transportation for CO<sub>2</sub> emission from ships, aircrafts and trucks. In future, local production to local consumption is likely to be promoted again with greater political emphasis. More and more restrictions on the operation of transport and its hardware will be imposed to preserve the natural environment. In these circumstances, freedom of the seas (Grotius, 1609) paradigm will be re-examined. Shipping and fishing have used the ocean without restriction or payment of any fees for usage in principle. However, the dramatic improvement of life standard in populated countries like China and India which multiplies the flow of goods across borders make it inevitable to consider restricting and charging the use of the ocean in the near future. A key question will be, how SCM should encompass measures to tackle this problem.

Third is the change in the logistics service market structure. The service providers have reconciled themselves with the situation that their service fees have always been the

first to be cut and the last to be raised in the dynamics of an economy. As a result, the shortage of investment in all sorts of resources due to financial inadequacy has caused more accidents, poor working conditions and lack of innovation which becomes a vicious circle. However, in view of the recent widening of the scope of services, logisticians provide value adding operations as mentioned earlier. Logistics service providers may have more power in the market by controlling major elements in supply chains, i.e., human resources and information. This may lead to a change in the current paradigm which says that the availability of low-cost logistics service is always ensured.

The fourth aspect is the difference between short-term and long-term solutions. So far, the SCM paradigm is constructed on the foundation of short-term equilibrium pursuit. In reality, we see a lot of deviation from the rational supply chains if we take into consideration a longer timespan. Efficient supply chains for one year may not be efficient for five years because changes take place all the time in natural, social and economic conditions. The longer the timespan, the more difficult it becomes to seek optimality in the complexity of global logistics. Therefore, people tend to rely only on short-term solutions because the extrinsic factors are more visible in a shorter timespan. While arguing about the optimality of supply chains, it should always be asked how long the effectiveness of stock location and level, the creditworthiness of the suppliers, logistics service providers and transporters will last. The current logistics and SCM theories have not been able to answer these questions, as the variables are uncountable and we all live in the world of complexity. The degree of this uncertainty is likely to become higher as Asians with greater population play more important roles in the worldwide supply chains for all sorts of commodities.

Then, can we not apply the value system that Asians have cultivated for a long time in their history to better manage the supply chains? Here, we take typical Asian paradigm of modesty, diligence and long-term orientation. The Confucian teachings which East Asian people rely on for their behavioral standard, place benevolence at the center of value system. Benevolence is a tender and mother-like virtue (Nitobe, 1905). It is realized by accumulating trust, harmony and maintaining humbleness (Confucius, 1999; and Serikawa, 2007). Hofstede's (1994) focus on the long-term orientation of Asians also gives us hints.

The important point for SCM is that the supply chain will work effectively without alteration for a long time. Existing equilibrium approach for supply chain optimization is, in this sense, not exactly applicable for this purpose. The necessary factor for sustainable success in a supply chain is to be able to maintain longstanding trust and harmony among the stakeholders of the chain. In general, people trust each other and maintain harmony when they do not count profit or loss at every stage of transaction, but leave it to the possible reciprocity for a longer term. This is observed typically in the case between family members and friends. If people can eliminate short-term profit making and try to nurture a paradigm to foster a sense of co-existence, they can avoid excessive fluctuations of markets and construct supply chains that are a right fit for the global environment.

The international division of labor based on the comparative advantage will thus be subject to constraint by means of restraining transportation of goods across continents to a certain degree. Increasing volume of world trade definitely contributes to equalizing wealth and enhancing the welfare of people. However, our generation is more than ever under strong pressure to consider the sustainability of the globe and its inhabitability by containing the emission of greenhouse gases. Logistic paradigms have encouraged people to pursue optimum supply chains at lowest costs with the shortest lead time. The result is they have to handle greater volumes of goods at one time based on the economies of scale and use a transportation mode of higher speed. All these are promoted by more powerful firms in the supply chain.

Logistic service providers and component suppliers have long been subordinates in the market mechanism in which a more powerful firm in the supply chain, such as the assembler of automobile, has been taking advantage of a dominating position. Thus, everything proactively done in the supply chain has been to maximize the profitability of the powerful firm. Minimizing stock level means forcing component suppliers to deliver the goods just-in-time to the assembler's factory without delay on a short notice. Consequently, those suppliers are obliged to have enough stock of components at the nearby warehouse at their cost. Otherwise, a heavy penalty is levied on them by the assembler in the event of a delay, causing stoppage of the production line. Lead time shortening in transportation may actually prove stressful for the drivers of the trucks who are supposed to deliver cargo/goods in tighter and shorter timelines. It may mean lesser sleep and relaxation time for the truck drivers. The implementation of sophisticated ICT for warehouse management and distribution costs are more, but the investment may not be recouped by logistic service fees. Value-added services in the process of distribution are not necessarily linked with additional income for the service provider. As such, currently prevailing paradigms of SCM lack the idea of mutual co-existence and co-prosperity with a loss of trust and harmony. Optimization of supply chain is not optimum for those other than a particular firm.

In order to break this standstill of inequality among stakeholders in supply chains, the invisible hand in the market mechanism is not dependable for solution as shown in history. Rather, our last resort will be to appeal to one's emotions, i.e., the emotion to be mindful of those who are suffering and in distress (Nitobe, 1905). Even by constraining profit, one should mind the well-being of others. By limiting the optimization of supply chain, one should mind the sustainability of the global environment. The art to enable the global supply chains to benefit human beings in a true sense will be found in the vast inheritance of the Asian traditional philosophy.

## **Conclusion**

We have discussed SCM paradigms which are epitomized by efficiency. Logistics have always focused on the efficiency of goods flow. The objective of the management is often

expressed by optimization of supply chains. The discussions presented in this paper, however, have revealed that it is not able to define or demonstrate its validity.

If the meaning of efficiency varies according to time span, decisions taken by firms in SCM will turn out to be far from being rational. Management theories in this field of study have neglected this dynamic aspect of logistics. As supply chains are being extended further across borders, the uncertainty of surrounding conditions increases on a dynamic basis. Then, what kind of a paradigm should govern SCMs in future?

Two key factors are now obvious. One is the equality of the distribution of wealth in which the law of the jungle is adjusted towards harmony among the participants of supply chains. A vast population of Asians, who come and work in European and American markets require equitable system of wealth distribution. Therefore, more populace-centric SCM theories will need to be structured.

The other is global environment orientation in which the wasteful consumption of energy and resources only satisfies the more powerful participants. The Asian population's growing influence on global warming will no longer allow logistic managers to keep scrambling for competitive advantages based on the extension of supply chains.

We have come to a conclusion that the currently prevailing paradigms of SCM are not suitable to solve these problems as long as they are based on the rationality paradigm which takes for granted that pursuing efficiency will lead to the optimum state of supply chains. Instead, a value system based on ethical foundation may well be promoted in one way or another. The traditional Asian values of benevolence, modesty and humbleness which are still embedded in the mind of the modern generation of the region will have a lasting impact on the growing Asian-centric supply chains.

This paper is intended to demonstrate the dynamic feature of vulnerability of the current paradigm in logistics and SCM and to present the necessity to establish a new paradigm away from short-term efficiency. Indications were made that the law of division of labor and mercantilism will be subject to a certain degree of limitation for application to the global supply chains.

The suggestions made here are still on the explorative level. It is hoped that the points raised here will serve as a basis for future discussions from both empirical and conceptual aspects towards environmental and social sustainability. ❧

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