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A Systems Perspective on Managing Eco-Logistics

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Abstract

The concept of Sustainability has recently picked up momentum in academic, industrial as well as regulatory communities. There is also a growing realization that achieving sustainability in the true sense is not the responsibility of only one entity but each entity has a unique role to play. With this approach, the present research tries to look at various factors that play a role in achieving ecological and economic sustainability simultaneously in logistics. Use of the term Eco-logistics is emphasized upon. An attempt has been made to apply system dynamics modeling to build a causal loop diagram to understand the present state of sustainability in logistics and how a balance can be achieved between the economic and ecological parameters. The study is qualitative and has been conducted in the Indian business setup. It emerged from the study that technology plays an important role, among other factors, in achieving the desired trade-off between the two pillars of sustainability, addressed in this study.

Keywords: Sustainability, Logistics, Eco-logistics, Technology, Qualitative

Introduction

Sustainability is increasingly gaining importance among business organizations, governments, and individuals, with efforts being taken in that direction. Yet, various studies which monitor the state of the environment across the globe do not show a positive picture. Despite increasing awareness and concern about sustainability, we frequently hear news of ice caps melting, ozone layer depletion, greenhouse effect, increasing pollution and other region-specific environmental issues affecting the health of human beings and destruction of natural flora and fauna (Dyllick & Muff, 2016). This implies that the system is falling short in fulfilling its responsibility towards environment. Achieving sustainability is not the responsibility of an individual or one business organization or the government alone, nor will it be right to expect so (Gladwin & Kennelly, 1995). Each entity has a unique role to play in achieving sustainability in true sense. Visible positive results can only be obtained when the system, comprising of the state, the commercial sector and the society, takes unified efforts towards improving the ecological footprint of various activities. The efforts taken at present are isolated and reactive

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in nature. Each entity in the system, especially in the developing nations, focuses on improving its own footprint by reducing or minimizing the damage that has already been done rather than getting to the root cause of that damage and eliminating it (Eltayeb et al., 2010). There is need of a collective proactive approach to curb environmental degradation and invest in building a better society; one that finds the source of the damage and works to eliminate that source.

Having said that each entity in the system has a unique role to play in achieving, protecting and preserving the environment, it is essential that this role must be well understood. Each actor must understand its part to achieve an overall improved ecological sustainability footprint. An important entity of this system is the commercial sector which draws resources from nature for its functioning. While business corporations are the biggest contributor to the degrading quality of the environment, they are also the pillars of a nation's economic and technological development. They possess the institutional as well as financial capability to bring about noticeable improvement in the quality of the environment and society in which they operate (Shrivastava, 1995). One of the biggest assets of these organizations is their technological know-how. Technology has been exploited to achieve economic benefits. However, it's use to achieve ecological sustainability is ubiquitous in both academic (Melville, 2010; Chen et. al 2008) as well as industrial sectors. The focus of this research is on understanding how business corporations can aim to be truly sustainable - what motivates them to think and act to achieve ecological sustainability of their operations and what inhibits them from taking necessary actions in that direction, without hampering their economic performance. Each activity, whether commercial or not, is associated with a unique sustainability footprint. Among various commercial activities, manufacturing and logistics are the ones resulting in large scale disruption of the environment. The effects of logistical operations are known and easily visible because logistics touches our lives closely in the form of public transportation and city logistics. Among the diverse functions that go on in a business, logistics is also an important cost head. Hence, logistics function has been chosen as the area of study for this research.

Extensive research in supply chain and logistics management has been done with the objective of achieving improved economic and environmental performance. However, most of these studies have been performed in isolation i.e. without considering the two pillars simultaneously. This subject needs more attention today – both in research and practice – because despite increasing awareness about preserving and taking care of mother nature, ecological degradation continues due to extensive commercial activities. Though some efforts in businesses have been directed to minimize the negative impact of business on environment and society, but they do not seem to be adequate in reversing the damage already done. While the very basic objective of commercial activities is making profit, businesses cannot ignore the negative effects of their operations on environment as they are dependent on environment/nature directly or indirectly for raw material.

In this research, an effort will be made to understand the dynamics of becoming a truly sustainable organization without compromising the economic sustainability of the firms. Logistics function is chosen because it is an important activity that determines the economic well-being –whether of a nation or of a particular industrial sector. The estimated logistical expenditure of various nations throws light on the importance of this sector in development. US and Europe have close to 10% share of logistics in their GDP; in Japan, this share is 11.4% while China and India had their logistical expenditure between 13%-15% of their GDPs (Sople, 2015). Logistics cost also varies from one industrial sector to the other; nevertheless, it forms an important cost head and indicator of economic performance of various firms. Some firms are in the logistics business where logistics is the core operational activity, rendered as a service to its customers. Other firms are highly dependent on logistics function for an improved performance in market. Logistics cost ranges from 5 to 35 percent of sales for various product-market configurations in different industries (Sople, 2015). These national and industry figures suggest that logistics function serves as a key source of development and competitive advantage.

The other reason for the choice of this sector is that it is a highly capital and technology-intensive function and some efforts have already been made towards making this function more eco-friendly; yet there is a long way to go. While academic literature is abundant with works on green supply chain management with logistics forming an important aspect of various studies; the industrial sector has fallen short in bringing about considerable ecological improvement of the logistics function. The result is polluted air, altered bio-diversity, land degradation, inadequate and inappropriate water supply and availability and other such issues which have a direct impact on the quality of life of the human beings. In this research, the objective will be to understand that despite awareness, why have the corporate sector not been able to improve the logistics function from ecological perspective. Third, since logistics is a common function across all industrial sectors, the results of this study are expected to be generic and applicable to all commercial activities which are directly or indirectly dependent on logistics for improved market performance.

Literature Review

Sustainability

The most widely accepted definition of sustainability is “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED 1987, p. 43). Human aspirations, at individual and societal levels, have caused large scale damage to the natural environment. At individual level, it is the short-sightedness (Midden et al., 2007) that makes a person pay more attention to fulfill his immediate material aspirations rather than to the environmental degradation to which he would be contributing on his path to achieve those aspirations. We fail to see that in the long run, immediate steps to quickly fulfill our present needs may cause a damaging effect on the environment. While the extent of damage due to such individual behaviour may not be big enough to become

apparent; but on a collective level, as a society, such behaviour becomes the cause of large scale ecological damage, which then starts becoming visible and becomes so big that it starts negatively affecting our quality of life, in the form of poor health (Dyllick & Muff, 2016; Chen et. al 2008).

Based on the definition of sustainability outlined above, it is worthwhile to note that many conceptualizations of sustainability have been proposed. However, the most common among various conceptualizations is the triple bottom line (3BL), which proposes three aspects of organizational performance – economic, environmental and social (Melville, 2010; Seuring & Müller, 2008). The present work is concentrated on the area of intersection between economic sustainability and environmental sustainability. Each organization has its own unique culture. It is this unique culture that determines what level of importance the organization gives to ecological concerns (as compared to economic concern) arising out of its operations and what is the level of efforts/ actions it takes to make the operations eco-friendlier without compromising with its economic performance in the longer run.

Corporations have the ability, both financial and institutional; to bring about visible change in improving the quality of the environment we live in (Shrivastava, 1995). Besides this, analysis of ecological sustainability combined with economic sustainability at this level is relatively weak in management literature. A firm, whose culture allows its decision makers to give equal weightage to economic as well as ecological sustainability of its operations can be appropriately termed as Ecologically Responsible Corporation (ERC). This is in line with the concept of Ecologically Sustainable Corporations (Shrivastava, 1995) which refers to firms that have an environmentally conscious culture (Varsei et. al, 2014; Linton et al., 2007; Kleindorfer et al., 2005) and have policies and practices aimed at achieving improvement in the quality of environment in which they operate. Such firms have an advantage over their competition in terms of better economic performance as well as improved goodwill and positive recognition in the eyes of all stakeholders (Koh et al., 2007; Gao & Zhang, 2006).

It is possible that decisions leading to a better environmental performance may bring down a firm's profit in the short-term. Therefore, a myopic firm will focus on short term benefits that are immediately visible rather than on long-term benefits as compared to a firm that is ecologically responsible. If ecological and economic aspects are considered as two sides of balance, then for a myopic firm the side with economic aspect will carry more weightage whereas an ecologically responsible firm will try to keep the balance straight assigning equal weightage to both the sides. However, whenever a decision is taken to bring about a large scale visible environmental improvement in its performance, due to investment in technology, training of people to create awareness and consciousness, building associated infrastructure, etc., the distribution of weight may seem biased with the economic aspect carrying less weightage, but this will only be a temporary situation. As the benefits due to investment start coming in, gradually the balance will go the ideal straight position. It can be seen that an ERC

keeps oscillating between the temporary stage, where ecological aspect seems to be given higher priority because of initial investment, and the ideal stage, where investment is fully recovered and benefits are realised and continue to accrue.

Sustainability in Supply Chain and Logistics Management

One way, how firms can achieve the ERC status is to integrate supply chain management and sustainability initiatives (Wolf, 2011; Seuring & Müller, 2008). Therefore, a sustainable supply chain is one that considers the 3BL aspects of sustainability in its every initiative. It becomes the responsibility of the focal firm (Wolf, 2011) to ensure that both the upstream and downstream parts of its supply chains follow sustainable practices (Seuring & Müller, 2008). An ecologically responsible firm will ensure that environmental sustainability initiatives are taken up throughout its entire supply chain. Such firms engage in Ecologically Sustainable Development (ESD) to balance discrepancies between economic and environmental performance of their supply chain.

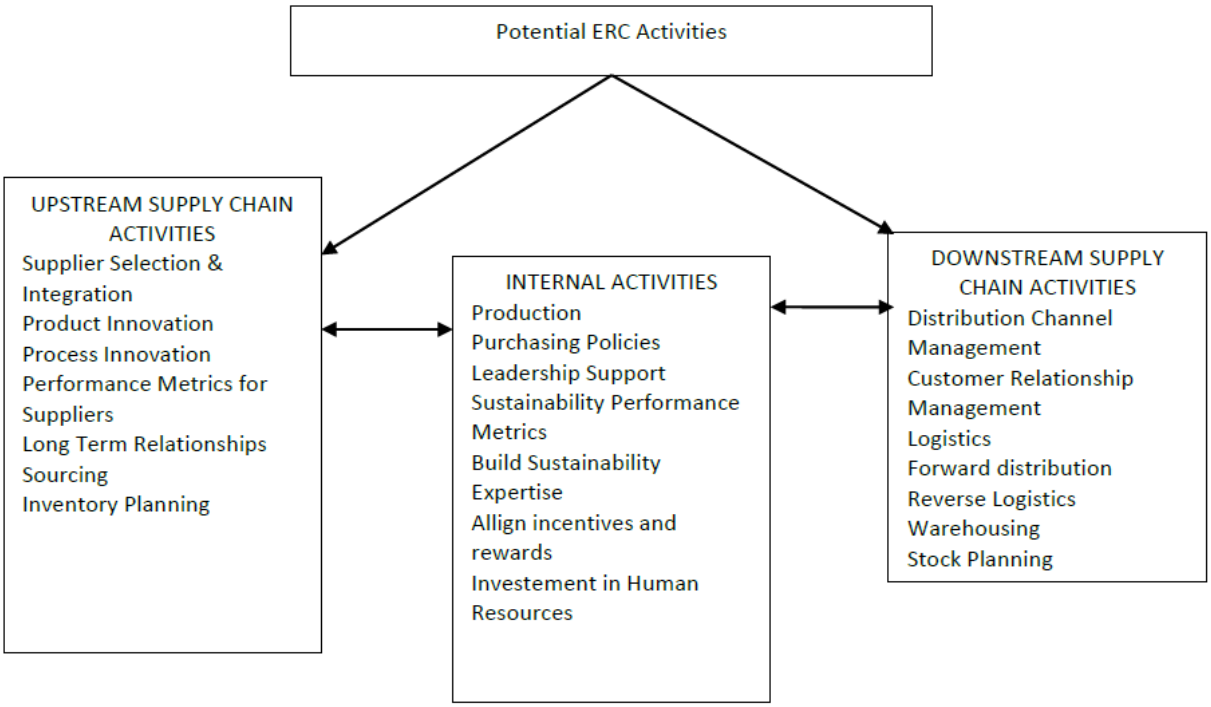

Figure 1: Ecologically responsible culture permeates the entire supply chain as well as the internal activities of an organization (Wolf, 2011; Seuring & Muller, 2008)

In this study efforts are directed towards understanding how environmental sustainability aspect can be integrated with the logistics function, an important function under the umbrella of supply chain management, and whose direct and indirect negative effects on the environment are easily visible and measurable. It is believed that a focus on the environmental aspect will lead to a firm's recognition as ecologically responsible as well as a socially

responsible corporation (Varsei et al., 2014; Linton et al., 2007; Koh et al., 2007; Kleindorfer et al., 2005) and will help in achieving economic sustainability as well.

This implies that firms that leverage upon the efficiencies and performance of their logistics function for a positive economic performance will achieve better results if they aim to shift from just logistics to eco-logistics (Kleindorfer et al., 2005; Koh et al. 2007). Eco-logistics follows various principles and practices of Green Supply Chain Management, viz. waste reduction, reduced emissions, reverse logistics, life cycle assessment for product design and development, clean process technology etc. and those of Supply Chain Sustainability Integration (SCSI), viz. coordination, collaboration and integration with supply chain partners through the use of enabling technologies like IT and IS, etc. The focal firms must take the onus of creating an eco-logistics network and ensure that all logistical partners meet the minimum criteria to classify as green to remain in the network (Seuring & Müller, 2008). Such measures lead to various practices that, translate into better economic as well as ecological performance, of the entire logistics network and hence, of individual firms too. For example, excess inventory in the supply chain is not just blocked money but it is also a proof of the environmental short-sightedness of the supply chain members. From eco-logistics perspective it means that time and money has been spent on moving and storing the inventory that is of no use to anybody and it has been achieved by extracting raw material that could have been useful for future generations. The extraction of raw material and some degree of processing must have consumed various other resources apart from time and money and would have left a negative impact on the environment, which could have been avoided if there were serious eco-supply chain and eco-logistics initiatives put in practice.

This research proposes the use of the term Eco-logistics instead of Green logistics to better portray the simultaneous orientation of the logistics function towards *Economic* as well as *Ecological* performance. The motivation behind the proposition of this term is that the prime objective of any business is economic performance. It is natural for businesses to evaluate any environmental initiative from the cost perspective. One reason why environmental initiatives by the corporate sector have not resulted into great improvement in the quality of the environment is the high cost they incur in implementing these initiatives versus the benefit they derive from them. Therefore, it will be unjustified to expect the corporate sector to be proactive on the environmental sustainability aspect without considering the economic sustainability. The term Eco-logistics highlights a more practical orientation of businesses towards environmental issues – the notion of a trade-off between the economic and the environmental/ecological performance criteria. The trade-off implies that an ecologically responsible firm ideally gives equal weightage to economic as well as ecological performance of the logistics function. While the logistics function tries to achieve this state of equal weightage, it passes through an intermittent stage where ecological ideology seems to overweigh the economic performance. But eventually both economic as well as ecological ideologies become embedded in the routine operations.

This notion of trade-offs is backed in literature too (Psaraftis, 2016: page xii), where the author gives a definition of Green Transportation Logistics which is modified only slightly to define Eco-logistics as below:

Eco-logistics is an attempt to attain acceptable environmental performance in the logistics activities, while at the same time respecting traditional economic performance criteria.

Research Gap

- Analysis of HOW ecological sustainability can be combined with economic sustainability at corporation/organization level is relatively weak in management literature (Gunasekaran et al., 2014)
- Short-sightedness at the corporate level regarding environmental performance has not been addressed.
- System Dynamics Modelling has been used less frequently as compared to other Management Science methods for addressing sustainability issues in supply chains. This gap shall be discussed in detail in the coming section on research methodology.

Research Objectives

1. To understand the present state of Eco-logistics among the various industrial sectors
2. To identify enablers and inhibitors of technological interventions, for a shift to Eco-logistics

Research Questions

- What are the enablers or inhibitors of technological interventions in achieving the Eco-logistics status?
- Does an amalgamation of logistics management, environmental sustainability and technological interventions lead to a better environmental performance of the logistics function without having any adverse effect on the economic performance of a firm?

Research Methodology

System Dynamics Modelling

The methodology used in this research is System Dynamics Modeling (SDM). It was developed by Prof. Jay W. Forrester in 1961. He defined System Dynamics Modeling as:

'…the investigation of the information-feedback characteristics of [managed] systems and the use of models for the design of improved organizational form and guiding policy.'

Evident from this definition is the fact that SDM involves developing models of the system we are trying to study. Such studies are motivated by the undesirable behavior of the system under consideration (Forrester, 1994). Despite the fact that there is awareness about continually declining state of our environment and various entities like the state, business firms, NGOs and media and individuals take some measures to minimize the damage done to the environment, our environment is not what we expect it to be – clean and fresh air, less noise, better visibility,

clean and safe drinking water, ample water for irrigation, no ozone layer depletion, no melting of ice caps, no further alteration of bio-diversity, preservation of natural flora and fauna, no temperature extremes during various seasons of the year, etc.

System Dynamics is a suitable tool for both qualitative and quantitative study (Coyle, 1996). SDM starts with development of a model of the system. This model is termed the *influence diagram*. The development of an influence diagram of the system to be studied and analyzed is an iterative process. The researcher or the system dynamics practitioner starts with identifying the various variables which define the system and the interconnections among them. The data for this can be collected through any source - secondary like company documents, web sites, etc. or primary like questionnaire, interviews, etc. The initial idea is to get a basic picture of the system. As the qualitative analysis of the data starts, this initial influence diagram will go through much iteration involving addition and deletion of variables, change of interconnections between variables, depicting the dynamics of the system, before a final diagram is achieved. This first part of data collection and building of an influence diagram constitutes the qualitative aspect of SDM. The second part of SDM is quantitative data analysis. Once the influence diagram is finalized, it can be analyzed through simulation to understand how changes in the values of variables will change the behavior of the system. Various software are available which aid in drawing the influence diagram and its quantitative analysis. For this research, Vensim has been used to develop the causal loop diagram. The outcome of the second part is to help the managers in the system develop policies and take appropriate decisions to achieve the desired goal. This research uses qualitative case study methodology to find answers to research questions 1, 2 and 3a. Data will be collected primarily through semi-structured interviews of logistics and supply chain experts across various industrial sectors. Secondary sources like websites, company documents and literature review will also be used, to build the final influence diagram. The research question 3b will be answered through quantitative analysis of the influence diagram. Quantitative analysis will help in understanding how various enablers and inhibitors of technological interventions in the logistics function interact among each other leading to an improved environmental performance, without having any negative impact on a firm's profits.

The SDM fits well for conducting this study also because of the following reasons:

1. SDM is the most suitable analytical tool when a complex phenomenon involving numerous factors acting simultaneously, has to be studied. This research brings together three different areas – logistics management, technological interventions and environmental sustainability. Environmental sustainability and role of IT and technology in the environmental sustainability, both are distinctive in scope, complexity and urgency (Melville, 2010). When these are studied from logistics perspective, the complexity will further increase due to a number of factors acting together (in a positive or negative way) to achieve environmentally sustainable performance.

2. The basic premise for the use of Systems Approach is that a system that is composed of many parts will act differently when all parts act simultaneously than when only one is acting. This is also the reason why we find that many times our systems including natural systems do not act the way we wish them to. Since we are looking at the logistics function, there will be many actors involved – suppliers, transporters - apart from the focal firm. Due to this reason and due to the reasoning given in point 1 above, SDM emerges to be the most appropriate tool for this study.

The literature supports the use of Systems Approach, especially SDM, in Sustainable Supply Chain Management (SCM) (Varsei et. al, 2014; Angerhofer & Angelides, 2000; Goncalves et al. 2005). A study by Tako & Robinson (2012) on the use of Discrete Event Simulation (DES) and System Dynamics Modelling (SDM) in Supply Chain Management revealed that DES has been used more frequently to model and analyze various SCM issues. Literature survey also points towards incorporating mixed methodologies to study sustainability in supply chains (Chen et. al 2017).

To conduct this study, 10 semi-structured interviews were conducted, each of an average duration of 45 minutes. The respondents were supply chain and logistics heads or held director level positions in their respective firms with an average overall experience of 23 years. 9 respondents were interviewed face-to-face and 1 respondent was interviewed through online voice chat. All the interviews were recorded. The audio recordings were converted to written transcripts. These written transcripts were then shared with the respective interviewee for validation of the data reproduced in the transcript and the promise of anonymity. Out of 10 respondents, 8 were working in MNCs while 2 respondents belonged to SMEs. Out of the 10 firms approached, 2 were 3PL service providers and rest 8 belonged to various other sectors where logistics formed an important cost head.

Research Findings

It emerged from the study that there is a discrepancy between the present state of logistics and the desired state of eco-logistics. This discrepancy can be reduced through collective efforts by various actors identified in the system. These actors include the business organizations, transporters and the government. A causal loop diagram was developed to display the interconnections between various enablers and inhibitors of investment in technology leading to eco-logistics.

The present state of logistics is characterized by an absence of environmental consciousness. Though the firms possess environmental awareness i.e. they acknowledge the degrading state of the environment and the business's contribution to this state, yet they do not take sufficient measures which can translate into visible positive improvement in the quality of the environment. This is primarily because the economic performance and service levels are still the most important KPIs. Since cost-efficiency is till the factor of prime importance, any

investment decision to improve ecological performance is guided by overall profitability of the function. In the absence of any financial support from the government, decisions to improve ecological performance of logistics are usually seen as a cost head. Support from the regulatory authorities is also needed in the form of policies that can encourage collaboration among various industrial players to share the investment for a better ecological performance. At present, policies which can put pressure on the commercial sector to measure the environmental performance of logistics and take measures to improve upon it, are very ambiguous. Any initiatives to improve the ecological performance are also hindered by the unorganized transportation sector. The transporters and the truck owners belong to the unorganized sector and it becomes difficult to get their support to implement any technology that can lead to better environmental performance of logistics.

The Causal Loop Diagram (CLD) shown in figure 2 depicts the interplay among various factors that can influence the decision of businesses to invest for a better ecological performance of logistics. There are 3 exogenous variables in the system as depicted by the CLD. These are the Environmental Condition, State Owned Infrastructure & Processes, Balanced Manufacturing Hubs and the Degree of Organization in the Transportation Sector. Exogenous variables imply that these are not under direct control of the business managers. Exogenous variables are represented in boxes. Other variables are endogenous variables and the business managers can influence the values of these variables to achieve their objective. Some of the endogenous variables are known as auxiliary variables, which influence the managerial decisions but do not necessarily depict system performance. Regulatory pressure, Industry & Government Collaboration, Regulatory Support, Stock Visibility, Modal Shift, Better Volume Utilization and Intra and Inter Industry Collaboration are auxiliary variables. Actual State of logistics, Desired State, discrepancy between actual and desired states, investment in technology for eco-logistics and improvement in environmental parameters are the endogenous variables that depict the system performance – economic and ecological.
Three loops have been identified in the CLD:

Negative feedback or goal-seeking loop 1:
Actual State of Logistics –Discrepancy between actual and desired states – investment in technology for eco-logistics – improvement in environmental parameters – actual state of logistics. This loop emphasizes upon the need to continuously invest in technology to improve the ecological performance of logistics. The investment in technology leads to improved environmental performance, which further improves the actual state of logistics. In turn, this reduces the discrepancy between the desired investment and the actual investment. As long as there remains a discrepancy between the actual and the desired states, the system will keep on taking corrective actions. The decision to invest in technology is further influenced by variables like regulatory support, state owned infrastructure and processes, stock visibility, better volume utilization and intra and inter industry collaboration.

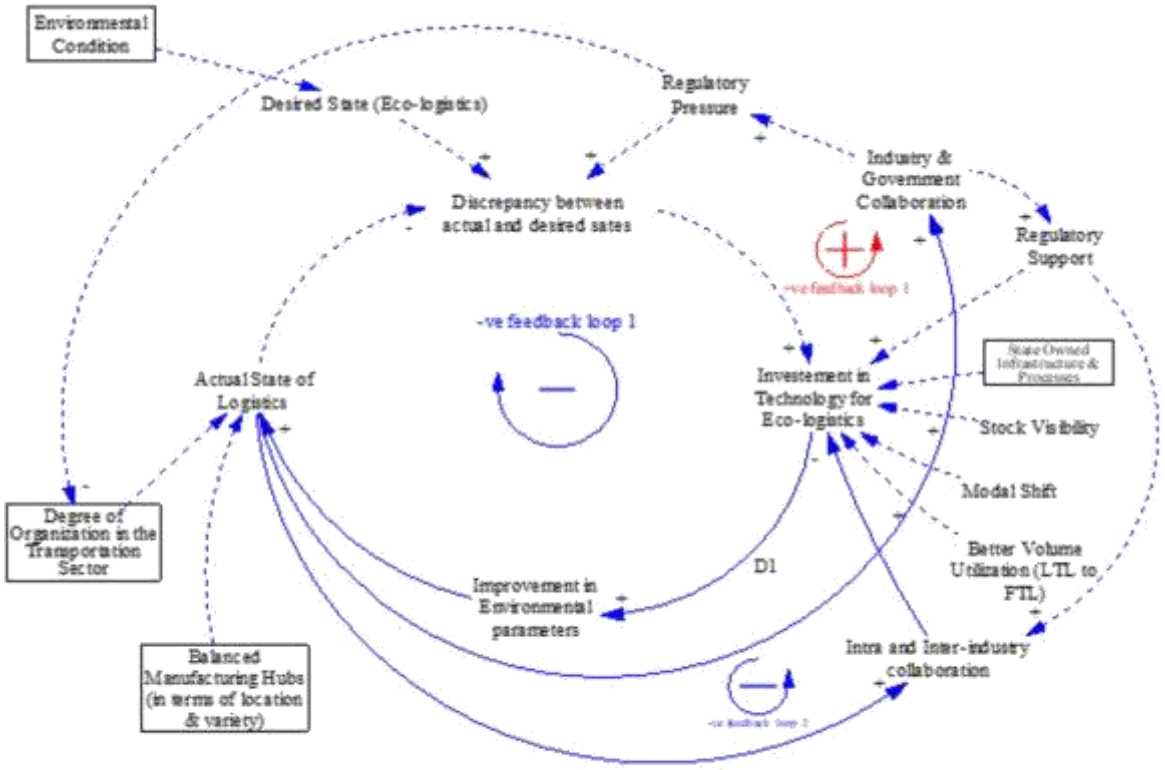

Figure 2: Causal Loop Diagram: Interplay of enablers and inhibitors leading to Eco-logistics

Negative feedback or goal-seeking loop 2:
Intra and Inter-industry collaboration–investment in technology for eco-logistics–Improvement in environmental parameters–actual state of logistics–intra and inter-industry collaboration

This loop emphasizes upon the need for collaboration between various players in the industry. If the various players, including the transporters, collaborate to share the investment to improve ecological performance of logistics, then per head investment will reduce resulting in the reduction of cost incurred by a single player. This also puts the onus of better ecological performance on all the partners in collaboration, rather than on just one. If the collaboration results in better ecological performance, then the collaborators will be motivated to keep the partnership alive for a longer time.

Positive feedback or growth producing loop 1
Industry & govt. collaboration–regulatory pressure–discrepancy between actual and desired states–investment in technology for eco-logistics–improvement in environmental parameters–actual state of logistics–industry & govt. collaboration

This loop emphasizes on the need for collaboration between the industry and the government. The regulatory and commercial sector must get together and collaborate to formulate suitable policies and successfully implement those for a better ecological performance of logistics. Investing in such collaboration will lead to building of required regulatory pressure which will push the organizations to invest in technology for eco-logistics. The collaboration leads to increased regulatory support, which shall motivate the commercial sector to invest in technology. This will result in an improvement in environmental performance of logistics and hence, the current state of logistics. This improved performance will enhance the current state of logistics and the actors will be motivated to further invest in keeping the collaboration active.

The Role of Technology in Eco-logistics

All the respondents in the study mentioned extensive use of technology to achieve better ecological performance of logistics. However, all of them also emphasizes that just a promise of better ecological performance of logistics is not sufficient to push them in favour of a particular technological intervention. The technology must also offer some economic or service level benefits along with the promise of an improved ecological footprint of logistics. Adoption of technology comes with its own set of challenges and the biggest one is diffusion and institutionalization of these throughout the entire organization (Melville, 2010; Midden et al. 2007).

Conclusion and Future Research

This paper is an attempt to present a systems perspective to look at challenges in achieving a desired balance between ecological and economic performance of logistics. The outcome is an influence diagram or a causal loop diagram which depicts how various influencing factors are connected and act together to lead to a particular level of system performance with reference to eco-logistics. The below table categorizes these influencers as enablers and inhibitors.

Future researches on the subject can aim to extrapolate the CLD presented in this paper into a measurable one leading to simulation of system performance. The validity of the model can also be put to test through case analysis. This will help in further justifying the claim if the results of this paper can be generalized.

It is necessary that our policies and actions must be directed to effectively eliminate the inhibitors and enhance the enablers. This will result in collective efforts to improve the quality of the environment in which we live and the businesses operate. There is need that both the industry and the government join hands. It is high time that proactive steps are taken to identify the source of environmental degradation and eliminate that root cause. Reactive steps are also necessary as a beginning point for various organizations. But only collective and proactive measures can bring about considerable improvement in the state of the planet without hampering the economic performance of the commercial sector.

Parameter	Enablers	Inhibitors
Regulatory Pressure	□	□
Regulatory Support	□	□
State Owned Infrastructure & Processes	□	□
Promise of only environment friendly performance		□
Added economic and service benefits	□	
Unorganised Transportation Sector		□
Collaboration	□	

References

Angerhofer B. J. and Angelides M. C. (2000). System dynamics modeling in Supply Chain Management: Research review. *Proceedings of the 2000 Winter Simulation Conference*.

Beamon B. M. (1999). Designing the green supply chain. *Logistics Information Management*, 12 (4), 332-342.

Bowersox D. J., Closs D. J. and Cooper M. B. (2011). Supply Chain Logistics Management. *Tata McGraw-Hill*, Second Edition, Eighth Reprint

de Brito M. P., Carbone V. and Blanquart C. M. (2008). Towards a sustainable fashion retail supply chain in Europe: Organisation and performance. *International Journal of Production Economics*, doi: 10.1016/j.ijpe.2007.06.012

Chen A. J. W., Boudreau M. C. and Watson R. T. (2008). Information Systems and Ecological Sustainability. *Journal of Systems and Information Technology,* 10(3), 186-201.

Chen L., Zhao X., Tang O., Price L., Zhang S. and Zhu W. (2017). Supply chain collaboration for sustainability: A Literature review and future research Agenda. International Journal of Production Engineering, 194, 73-87.

Chien M. K. and Shih L. H. (2007). An empirical study of the implementation of green supply chain management practices in the electrical and electronic industry and their relation to organizational performance. *International Journal of Environmental Science and Technology*, 4(3), 383-394.

Coyle R. G. (1996). System dynamics modeling: A practical approach. *Chapman & Hall/CRC*

Dyllick T. and Muff K. (2016). Clarifying the meaning of sustainable business: Introducing a typology from business-as-usual to true business sustainability. Organization & Environment, 29(2), 156-174.

Eltayeb T. K., Zailani S. and Ramayah T. (2010). Green supply chain initiatives among certified companies in Malaysia and environmental sustainability: Investigating the outcomes. *Resources, Conservation and Recycling,* 55 (5), 495-506.

Forrester J. W. (1994). System dynamics, systems thinking, and soft OR", *System Dynamics Review,* 10(2).

Gao S. S. and Zhang J. J. (2006). Stakeholder engagement, social auditing and corporate sustainability. *Business Process Management Journal*, 12(6), 722-740.

Gladwin T. N. and Kennelly J. J. (1995). Shifting paradigms for sustainable development: Implications for management theory and research. *Academy of Management Review*, 20, 874-707.

Goncalves P., Hines J., Sterman J. (2005). The impact of endogenous demand on push-pull production systems. *System Dynamics Review*, 21(3), 187-216.

Gunasekaran A., Irani Z. and Papadopoulos T. (2014). Modelling and analysis of sustainable operations management: Certain investigations for research and applications", *Journal of the Operational Research Society,* 2014(65), 806-823.

Kleindorfer P. R., Singhal K., Wassenhove L. N. V. (2005). Sustainable operations management. *Production and Operations Management,* 14(4), 482-492.

Koh S. C. L., Birkin F., Lewis L., Cashman A. (2007). Current issues of sustainable production, eco-supply chains and eco-logistics for sustainable development. *International Journal of Global Environmental Issues,* 7(1), 88-101.

Lin C. Y. (2007). Factors affecting innovation in logistics technologies for logistics service providers in China. *Journal of Technology Management in China,* 2(1), 22-37.

Linton J. D., Klassen R., Jayaraman V. (2007). Sustainable supply chains: An Introduction. *Journal of Operations Management,* 25 (6), 1075-1082.

Melville N. P. (2010). Information Systems Innovation for Environmental Sustainability. *MIS Quarterly*, 34(1), 1-21.

Midden C. J. H., Kaiser F. G., McCalley L. T. (2007). Technology's four roles in understanding individuals' conservation of natural resources. Journal of Social Issues, 63 (1), 155-174.

Psaraftis H. N. (2016). Green transportation logistics: The quest for win-win solutions. *Springer*, International Series in Operations Research and Management Science, Vol. 226.

Seuring S., Müller M. (2008). From a literature review to a conceptual framework for sustainable supply chain management. *Journal of Cleaner Production,* 16, 1699-1710.

Shrivastava P. (1995). The role of corporations in achieving ecological sustainability. *The Academy of Management Review,* 20 (4), 936-960.

Sople V. V. (2010). Logistics Management. *Pearson*, Second Edition, Third Impression.

Tako A. A., Robinson S. (2012). The application of discrete event simulation and system dynamics in the logistics and supply chain context. *Decision Support Systems,* 52 (4), 802-815.

Varsei M., Soosay C., Fahimnia B., Sarkis J. (2014). Framing sustainability performance of supply chains with multidimensional indicators. *Supply Chain Management: An International Journal*, 19 (3), pp. 242-257.

Wolf J. (2011). Sustainable supply chain management integration: A qualitative analysis of the german manufacturing industry. *Journal of Business Ethics,* 102 (2011), 221-235.

World Commission on Environment and Development. (1987). Our Common Future. *New York: Oxford University Press.*