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Supply Chain Logistics Using the Internet of Things and Corporate Social Responsibility for a Sustainable Environment

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ABSTRACT

In the digitalization era, costs can be minimized and operations get fast for a sustainable environment. To compete in this modern era and manage operations, the supply chain shifted to smart technology to meet the goals of CSR for a sustainable environment. IoT has a great influence on the close-loop logistics operations in firms. This paper investigates the benefits of IoT in closed-loop logistics operations' effects on the goals of CSR for a sustainable environment and how the use of smart technology impacts the operations of CLSC to meet the goals of CSR for a sustainable environment. For data, we get the data of firms that are on close-loop logistics and firms that are using smart technology for their operations. regression for analysis in STATA. Results show that firms that are using smart technology for their operations are achieving more CSR goals for a sustainable environment. The Internet of Things will not instantly contribute to the accomplishment of CSR targets, despite the fact that it has a direct and positive influence on closed-loop supply chains (CLSC). The CSR goals are not directly relatowith the internet of things; nevertheless, the internet may be utilized as regulatory or assisting tools in order to achieve them. CLSC helps to change the sustainability measures in the environment. . Firms should shift to the closed loop supply chain to minimize the resources and better places for businesses to achieve CSR goals for a sustainable environment

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1. INTRODUCTION

Closed-loop supply chain is the process to ensure the recovery of endues product (Delpla, Kenné and Hof, no date) Throughout the evolution of sustainability, closed-loop supply chain

has a fundamental of supply networks. it leads many firms to sustainability(Fathollahi-Fard, Ahmadi and Al-e-Hashem, 2020; Salehi-Amiri *et al.*, 2021) development and establishing for a sustainable network CLSC has adopted by many firms blockchain technology and internet of things made it easy for the firms.(Hrouga, Sbihi and Chavallard, 2022) technologies like Internet of Things make data easier to gather and comprehend, especially in supply chain operations, which reduces the likelihood of supply chain issues.(Kazancoglu *et al.*, no date) Implementing new technologies can help to reduce the time .(de Vass, Shee and Miah, 2020; Prajapati, Chan, *et al.*, 2022)The Internet of Things (IoT) is a worldwide system of World wide web-connected devices that improves the Connectivity of the supply chain for better internal and external integration with both clients and suppliers. firms that are having high value to maintain that value and contribution in society for the long term in order to achieve these goals firms work on corporate social responsibility for the wellbeing of society(Liu, Yao and Chen, 2021) close-loop supply chain achieved the benefits of economy and environmental sustainability(Wang *et al.*, 2019) also the customer (Wang and Hazen, 2016) Profit maximization and social responsibility through product recycling through the closed-loop supply chain (CLSC). The manufacturer recycling the discarded goods ias utilized the reverse channel and the channel's non-profit maximizing goal through CSR practice generates a larger profit margin than the profit-maximizing objective. Recycling is an important aspect of the closed-loop supply chain, for maximum benefit, recycling must be limited. To ensure optimal channel performance (Panda, Modak and Cárdenas-Barrón, 2017). Sustainability in terms of the environment and corporate social responsibility (CSR) as social sustainability The manufacturers compete with one another on the dual-function acquisition price supplied to clients in the sustainable CLSC. To increase its market share, the shop engages in CSR in addition to the collecting process. (Hosseini-Motlagh, Ebrahimi and Zirakpourdehkordi, 2020)achieving the sustainability of the environment through the CLSC three methods can use remanufacturing, recycling and reusing of products. circular economy (CE) that is technologically enabled to improve resource efficiency. The most crucial aspect of this is tracing, tracking, and keeping information. Reduced extraction, extended product and material lifetimes, and waste prevention are all examples of CE techniques that can considerably lessen GHG emissions and harm to the environment. Reusing and recycling materials simultaneously cut costs and have a positive environmental impact. However, the circularity gap that is currently putting pressure on the environment and the global economy implies that CE is not yet progressing. (Mangers *et al.*, 2021) CLSC increase industrial system efficiency and sustainability. Coordination of information and material flows is essential for maximising the CE's enormous potential: To support techniques like predictive maintenance, refurbishing, or recycling, information regarding the amount and quality of products, as well as their material composition, needs to be collected and stored. Digital technologies allow for the "digital twin" concept, which allows for the preservation of data and materials in the cycle as well as the utilization of trash as a resource. Real-time information on an item's location, availability, and condition can be provided through digital solutions. They can also improve the traceability of materials, make it easier to acquire goods and services, and improve the efficiency and convenience of procedures Additionally, data analytics can be used to forecast product health and wear, minimize production downtime, plan maintenance, order replacement components, and optimize(Qu *et al.*, 2016) reverse logistics where end user products are taken from customer and then reuse it for again use and then attempts to manage EOL products are made through various decisions, such as recycling manufacturing and finally, disposing of some used products.(Govindan, Soleimani and Kannan, 2015a).internet of things tracking calls for a

distinct chain of locations where the product is actively scanned (using a barcode, QR code, smart label, or data logger), frequently only providing historical data gathered at the time of scanning. This is insufficient in the agri-food industry, where maintaining certain conditions (such as temperature, humidity, etc.) to stop product deterioration is necessary to ensure business continuity and lower supply chain risks. There are numerous papers that discuss "supply chain hazards" in the scientific literature, but there is still no universally accepted definition of the phrase. Adoption of IoT technology has a definite impact on increasing logistics efficiency, particularly in the agricultural sector where wastes, breaks in the cold chain, and tainted food have major negative effects on both the reputation of businesses and the health of consumers. Internet - of - things sensors in the agribusiness can gather information about the weather and the soil, allowing for the regulation of pesticide, pesticide, and water use to decrease waste, boost productivity, and ensure compliance with current health and safety laws. The ability to control delays or, even better, to prevent them results in appropriate cost savings, the safeguarding of priceless assets, and permits more efficient planning. (Capello, Toja and Trapani, 2016; 2020) An Iot technology system makes a wealth of data useful to better the efficiency of agricultural processes while also improving supply chain visibility, allowing for more assurance regarding the food's provenance, safety, and nutritional value. With a booming population, limited resources, and increased demand for social responsibility on the global market, IoT technology and data analytics can be used as an integrated tool to assist food producers.(Garrido-Hidalgo *et al.*, 2020) Industrial IoT technology will make it possible to fully and completely regulate every step of the supply chain, making it transparent to consumers and efficient in terms of wastage. (Magrini *et al.*, 2021) In order to address environmental, social, and economic issues, sustainable and green practises must be used. This strategy aims to build an organization and promote the adoption of the circular economy. The goal of a circular economy is to use an industry's resources, energy, and wastes to its benefit. In order to increase resource efficiency, the circular economy links supply and demand in supply chain businesses supply chain case scenario to satisfy industry 4.0 specifications and enabling the circular economy.(Manavalan and Jayakrishna, 2019a) internet of things in close-loop supply chain to meet the need of corporate social responsibility firms shifted to sustainable and green manufacturin

The process in which an individual or group wants to achieve their needs or wants without damaging the natural environment. Activities required in order to make progress towards development without compromising resources. To achieve success for the development and compete in the modern world required a change in process of thinking, and lifestyles.(Glavič and Lukman, 2007)

It is the widespread network of gadgets that can communicate with one another. And distribute data across a broader network, where the shared information can be used to derive value. Every device must employ embedded technology and have distinctive identities. Sensing, collecting, and transmitting data about oneself and one's surroundings to different hosts or devices.(Firouzi *et al.*, 2020)Internet of Things (IoT), one of the newest technological advancements in the ICT sector, outlined as a global network infrastructure that connects both physical and digital elements through maximising communication and data-capturing capabilities.(Côrte-Real, Ruivo and Oliveira, 2020)

It is defined as a supply chain system that combines design and deployment to maximize the useable value over the course of a product's life cycle while constantly recovering worth from a variety of returned goods.(Govindan, Soleimani and Kannan, 2015b) CLSC initiatives have the

potential to both raise enterprises' profitability and product uniqueness while also enhancing manufacturing operations' sustainability impact.(Talbot, Lefebvre and Lefebvre, 2007)

It is a business model which help company to grow with their stakeholders, society and fullfill the need for the sustainability of an environmnet. Increase the value of the company through social service work.(Côrte-Real, Ruivo and Oliveira, 2020)

1.1.OBJECTIVE

The purpose of the paper is to find that how IoT change and impact the CSR to maintain the sustainability of environment.

1.2.RESEARCH QUESTION

How IoT in CLSC effects the goals of CSR for environmental sustainability?

2. LITERATURE REVIEW

Companies have recently increased their efforts to produce goods and provide services in a sustainable manner, moving from pollution avoidance to integrated strategies that consider product lifecycles and broader consequences. Through a combination of technology and non-technological innovations that have the potential to produce significant environmental gains, eco-innovation aids in enabling this evolution. As the Internet has grown, there are now an exponentially greater number of options since many components can be connected to one another, automating procedures, interacting with one another, etc.; this phenomenon is known as the "Internet of Things (van der Laan, 2019)A higher degree of productivity, process standardization, an increase in the number of potential products or services, the development of wider communication networks, and many other advantages have been made possible by technology. Together with social developments, this has had a significant impact on the global economy over the ages, fundamentally changing how businesses conduct their operations(Salehi-Amiri *et al.*, 2021). The main factors influencing a company's productivity up until the industrial revolution were labour and capital. Since then, there has been a paradigm shift that now considers factors other than labour and capital to determine a firm's degree of productivity, as well as its business model and future prospects. (Tombido, Louw and van Eeden, 2020a)

(Talbot, Lefebvre and Lefebvre, 2007; 2020b) perform research on empirical data from a sample of 205 environmentally conscious SMEs working in the fabrication of metal goods and the production of electrical and electronic goods. The closed-loop supply is categorised using an organised research paradigm. tp show that the degree and location along the value chain of a product to which enterprises are able to execute CLSC environmental measures vary(Chaopaisarn, … and 2019, no date). The advantages of these efforts also appear to vary depending on the business model used. compares the Bullwhip Effect between serial and divergent supply chain networks with various structural variations using systems dynamics models. One trustworthy collector providing used goods appears to be more advantageous for a closed-loop supply chain than multiple collectors whose returns' quantities are unpredictable. It raises the level of environmental sustainability. (Tiwari and Khan, 2019)Investigating a measurement and accounting strategy based on action research in three seafood production enterprises in India. Through action research, eight sustainability indicators from the triple bottom-line model were taken into account while monitoring sampled tasks in five different locations. ANOVA, regression analysis, and descriptive statistics were used and finding reveals that sustainability has a close connection with the close loop supply chain(De Giovanni, 2022).

(Kim and Park, 2020) research on different hypothetical companies to find the results that is CSR effecting the company growth and sustainability of environment with the variable of consumer engagement. He used MANOVA analysis for his research study he found that A company's efforts to engage in corporate social responsibility (CSR) reduce the likelihood that disgruntled customers may take retaliatory action once a failed product is released and negatively effect on the sustainability. (Ben-Daya, Hassini and Bahroun, 2017) did an extensive literature review to find that how internet of things impact the processes of supply chain management in the industry. He found that Iot has a clar and consice impact on the process of close loop supply chain that enhance the sustainability of the environment. (Rejeb *et al.*, 2020) examines the literature on IoT's impact on SCM and logistics processes. To objectively and analytically uncover the growth in knowledge regarding IoT research as it relates to SCM and logistics, a comprehensive review and bibliometric analysis were performed. 807 papers from journals over 20 years were chosen. After then, the papers were dissected for their insights. CLSC's manufacturer engages in both new product development and remanufacturing by sourcing components from both new and recycled sources. However, varying rates of product recovery based on application The volume, quality, and timing of the returned product is extremely unknown, therefore choices like reuse, refurbishing, remanufacturing, recycling, and disposal are always subject to change. Because of the unknowns in the reverse flow, forward-flow planning is more challenging(De Giovanni, 2022). Due to the lack of established product life cycle data, it is important to conduct inspections and tests on returned items and their components. All the work done to disassemble and test a part only to find out it doesn't work is for naught(Prajapati, Pratap, *et al.*, 2022). Several points in the supply chain, including reverse logistics, have been proposed as potential applications for the Internet of Things. This network allows for the tracking and monitoring of anything. One of the most important parts of this kind of setup is radio-frequency identification (RFID) technology. (Manavalan and Jayakrishna, 2019b) works on a case study in an organisation involved in the supply chain was analysed to determine how to fulfil the objectives of industry 4.0 and enable circular economy. An investigation into the supply chain sector has been carried out, with the 6Rs serving as the primary point of interest. The goal of a circular economy is to reclaim value from an industry's resources, including its materials, energy, and waste. The supply and demand of industries along the supply chain are brought together by the circular economy, which results in increased resource efficiency.(Garrido-Hidalgo *et al.*, 2020)) present a framework known as the Circular Supply Chain (CSC) should be proposed for End-of-Life (EoL) management with the intention of meeting the information infrastructure needs of a particular use case involving the recovery of Electric Vehicle Battery (EVB) packs. provide a qualitative analysis of the information needs imposed by the CSC as well as an assessment of the Internet of Things' potential to fulfil those requirements. As a consequence of this, the implementation of a heterogeneous IoT network is advocated in order to achieve a digital CSC information infrastructure.(*Introduction to Management of Reverse Logistics and Closed Loop Supply Chain ... - Donald F. Blumberg - Google Books*, no date) Create a conceptual framework for sustainable manufacturing based on a methodical and in-depth analysis of the existing literature on artificial intelligence-driven big data analytics, real-time sensor networks, and product decision-making information systems. Things Connected to the Internet.

Hypothesis.
H1. Internet of things in CLSC positively impact the CSR.

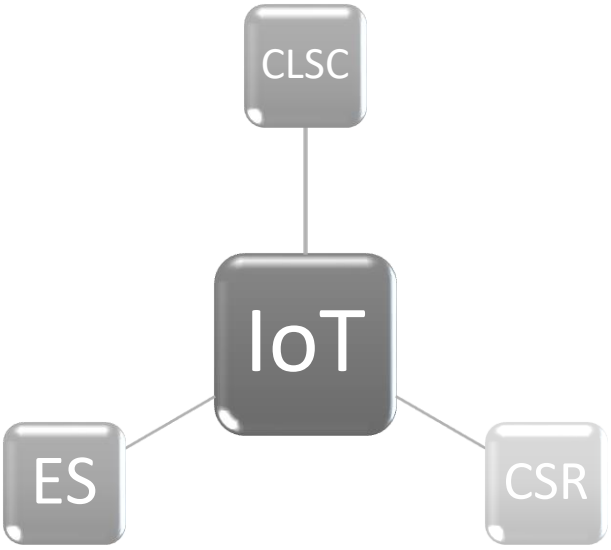
H2. Internet of things positively impact the Environmental Sustainability.

H3. CLS has influenced by IoT to reach its goals for sustainability.

3. METHODOLOGY

To address the research questions, we used a survey and structural equation modelling as a form of multivariate data analysis that would support concurrent examination of multiple relationships among both manifest and latent variables.

Conceptual Frame Work



First, we create the conceptual framework that is depicted up there. The variables that we use in the conceptual framework are IoT (internet of things), CLSC (close loop supply chain), ES (environmental sustainability), and CSR (corporate social responsibility) (corporate social responsibility). The Internet of things is the primary variable that we are working with. In this study, we will examine the effects of the internet of things on a variety of different factors, including the effects of the internet of things on the close loop supply chain, specifically how the internet of things (smart technology) affects the operation of the close loop supply chain, the effects of the internet of things on corporate social responsibility, specifically how the internet of things (smart technology) can either increase or decrease the level of csr in business environments, and the effects of the internet of things on environmental sustainability.

3.1.Data Collection

Empirical research is based on data collection. The sample for this study is based on random sampling through email with the logistics firms that are using smart technologies with the system. . A Likert-type scale (five-points) was used to collect the data, where 0 means “strongly agree”; 1 means “agree”; 2 means “neutral”; 3 means “disagree” and 4 means “strongly disagree”. Initially, the link for the online questionnaire was emailed to 150 companies. we

received 120 valid and completed questionnaires. Questionnaire does not contain any demographic questions.

4. RESULTS

4.1.Statistical Analysis.

Table 1 Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Internet Of Things	120	1.333	1.374	0	4
Sustainability	120	1.425	1.275	0	4
CLSC	120	1.3	1.294	0	4
CSR	120	1.383	1.182	0	4
Sustainability& CSR	120	1.4	1.331	0	4
CLSC & IoT	120	1.325	1.189	0	4

Table represents the descriptive statis of the data. It shown that we have 120 observations that we take from different logistic companies that use the smart technology for the procedures. We have five measures of likert scale that represent the answers and data of the questionnaires. We did mean and standard daviations for the validity of the data.

Table 2 Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) internetofthings	1.000					
(2) sustainability	0.672	1.000				
(3) CLSC	0.813	0.590	1.000			
(4) CSR	0.609	0.700	0.583	1.000		
(5)Sustainability &CSR	0.777	0.592	0.769	0.665	1.000	
(6) CLSC &IoT	0.689	0.745	0.690	0.741	0.629	1.000

Correlation between variables internet of things is highly correlate with the sustainability that is 0.672 and correlation of variables sustainability with other variables are not highly corelate except corporate social responsibility that means the relationship between sustainability and close loop supply chain is highly positive. Corporate social responsibility is not highly correlated with other variables because the values between variables indicates the negative correlation between variables sustainability and Close lop suppy chain is highly correlate with the internet of things and that is 0.777 and its highly significant and other than that corporate

social responsibility and close loop supply chain are highly correlate with each other.the overall results of the correlation matrix are significant and positive.

Table 3 Factor Analysis

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	4.122	3.816	0.986	0.986
Factor2	0.306	0.277	0.073	1.060
Factor3	0.029	0.060	0.007	1.066
Factor4	-0.031	0.083	-0.007	1.059
Factor5	-0.114	0.018	-0.027	1.032
Factor6	-0.132	.	-0.032	1.000

LR test: independent vs. saturated: chi2(15) = 573.33 Prob>chi2 = 0.0000

In addition, we performed a factor analysis on our model. It is shown in the table that the factor pone eigenvalue is 4.122, which is greater than 1, which indicates that we are able to keep this value for our model. Additionally, the value for factor 2 is 0.306, which is less than one, and the factors 3, 4, 5, and 6 each have eigen values that are less than 1. When we compare the eigen values of the second columns, we can see that factors two through six do not differ greatly from one another. However, the difference between factor one and factor two must be greater than three in order for it to be considered significant for our model. In the proportion column, it is very easy to observe that factor one accounts for 98 percent of the overall variation. And the first factor accounts for 98% of the overall variation shown in the table.

Table 4 Factor loadings (pattern matrix) and unique variances

Variable	Factor1	Factor2	Factor3	Uniqueness
Internet of things	0.868	-0.205	-0.055	0.201
sustainability	0.791	0.238	-0.048	0.316
CLSC	0.843	-0.257	-0.037	0.223
CSR	0.792	0.244	0.091	0.304
Sustainability &CSR	0.833	-0.196	0.106	0.257
CLSC &IoT	0.843	0.209	-0.052	0.243

With the Internet of Things having an impact of almost 86% on Factor 1, and other variables having a positive effect on Factor 1, such as Sustainability having a value of (0.791),

which is equal to 79% that is highly positive, CLSC (close loop supply chain) having a value that is (0.843), which is equal to 84% that is significantly positive on Factor 1, and CSR (corporate social responsibility), which is also significantly positive, then we have a merge of two variables assume as one. That have a very favorable impact on factor 1 and its implications. Within the first factor, every value is in the positive range. While in Factor 2, the variables Internet of Things, CLSC, and Sustainability and CSR have values that are negative, and while there is some positive value for Sustainability, CSR, and CLSC& IoT, it is very low. During the process of moving toward Factor 3, the values of the variables concerning the Internet of Things, sustainability, and CLSC as well as CLSC and IoT have been steadily decreasing in comparison to Factors 1 and 2. Therefore, when taken collectively, all three components describe the variety that exists among the data of the variables. Uniqueness in the variables in the model is not much unique. In our model, the uniqueness values shows that our variables are fit for the model.

Table 5 Multivariate Regression

Internet of things	Coef.	St. Err.	T	P>t	[95%Conf.	Interval]
sustainability	0.227	0.079	2.850	0.005	0.069	0.384
CLSC	0.448	0.085	5.240	0.000	0.279	0.617
CSR	-0.077	0.089	-0.870	0.388	-0.254	0.100
Sustainability & CSR	0.312	0.083	3.780	0.000	0.148	0.476
CLSC & IoT	0.093	0.099	0.950	0.345	-0.102	0.289

R-square= 0.8725, f= 157.3857, p= 0.0000

Our final analysis is multivariate regression analysis. In which we see the effect of each variables with the significance of p values, t values and on the basis of the coefficient in the first column the coefficient that is +1, -1and between 0. That represents that the size and direction of the variables with predictors and responsive variables. In the above table it is show that the variables of sustainability that is almost 22% of the total size of the predictors variable with same goes to other variables that is CLSC having coefficient value of almost 44% total direction to the predictor variable that is our dependent variable Internet of Things. Then we have CSR having coefficient that falls in negative. Then we have combination of two variables that is sustainability and CSR and CLSC and internet of things. In our model there very less standard error that the high terror that we observe is 0.089 that is very low. So, moving toward next column that is t table but our main focus is o P values that show the significance of our model and will indicates the results. P values that is highly significant when it is less than 0.005. in the model that the p value of sustainability is significance at 95% confidence interval and have a positive impact with

internet of things. The two more variables that are significant that are CLSC and sustainability and CSR having positive relation with internet of things.

5. FINDINGS

According to the findings, there is a significant and positive impact that the internet of things has on the environmental sustainability. With the use of the internet of things and smart technologies, a closed loop supply chain may be able to accomplish significant goals related to corporate social responsibility. However, the CSR goals are not directly concerned with the internet of things; however, the internet of things may be used as regulating or aiding tools to meet the CSR goals. The close loop supply chain incorporates the importance of accomplishing sustainable goals with the assistance of internet of things (smart technology), which ultimately leads to the achievement of corporate social goals. As a means of putting our hypothesis to the test, we have determined that our initial hypothesis is. The Internet of Things has a favourable impact on the CSR at CLSC. It is now generally agreed that the internet of things will have a direct and beneficial impact on closed-loop supply chains but will not immediately contribute to CSR target achievement. Therefore, a portion of our theory is supported. Then, our second hypothesis, which states that the Internet of Things will positively impact the Environmental Sustainability, was totally accepted in the regression model findings, which demonstrates that the Internet of Things has a good relationship between the environment and technology. According to the findings of our investigation, our third and final hypothesis, which states that CLSC has been affected by IoT to attain its goals for sustainability, was also shown to be correct. After the hypotheses have been tested, we move on to the research questions that we formulated before beginning the study, such as how the internet of things would affect the CSR goals related to closed-loop supply chains and environmental sustainability. After research results demonstrate that internet of things in closed loop supply chains has a direct link with sustainability, but internet of things does not directly affect CSR, we can say that internet of things has a connection with sustainability. The Internet of Things has a direct impact on the environment within CLSC, but it does not have any impact on CSR.

5.1. DISCUSSIONS

(Nahr, Nozari and Sadeghi, 2021) finds that internet of things With the Internet of Things playing such a pivotal part in ensuring the long-term viability of industrial systems, their findings provides a theoretical contribution in the literature. Their results that says that internet of things has a positive impact on the close loop supply chain as our results indicate the same results. (de Giovanni, 2022)findings shows that Although reverse omnichannel solutions seldom improve performance, the blockchain enables a more efficient CLSC system. Evaluating the merits of switching from a passive to an active return strategy is essential. An active return strategy can improve the CLSC network by creating valuable incentives for collectors and maximizing the advantages of the blockchain. Contrarily, consumer incentives may have negative repercussions on distributed ledger technology. While there are some business performance boosts that may be achieved through a variety of incentive combinations, the CLSC system's operational and service capabilities can only be strengthened through incentives provided to collectors. (Singh and Dehraj, 2022) findings reveal that close loop of the supply chain are crucial to the management of the whole process, from the extraction of raw materials to the final delivery to the customer. Transparency issues, order delays, and duplicate data entry are just a few of the difficulties plaguing this type of logistic management. This dispersed technology has the potential to reduce

these.(Prajapati, Jauhar, *et al.*, 2022) integration of physical and digital supply networks. The expenses of sourcing inputs, transporting them subject to a carbon emission tax, warehousing, processing, and producing outputs, refurbishing, recycling, and virtualizing. Among these include maintaining infrastructure for blockchain and Internet of Things applications directly impact the sustainability of the environment. (Zarbakhshnia *et al.*, 2019)findings are likely to be with our findings that shows that changes in the process of CLSC helps to maintain the sustainability of the environment.(Prajapati) finds that building a resilient infrastructure for the e-commerce sector's closed-loop supply chain with various tiers of electronic items is an important step toward achieving the circular economy. In a reversal of the normal process flow, items that have been returned by customers are collected from their locations and brought to an inspection facility for review. So findings that the literature shows and our findings are head to contribute to the literature.

6. CONCLUSION

It is concluded that The Internet of Things will not instantly contribute to the accomplishment of CSR targets, despite the fact that it has a direct and positive influence on closed-loop supply chains (CLSC). The CSR goals are not directly related with the internet of things; nevertheless, the internet may be utilized as regulatory or assisting tools in order to achieve them. CLSC helps to change the sustainability measures in the environment. The closed loop supply chain, also known as CLSC, is an essential component in the management of the whole process, beginning with the procurement of raw materials and ending with the delivery of the product to the end user. The operational and service capabilities of the CLSC system can only be strengthened through the provision of incentives to collectors. While there are some business performance boosts that may be achieved through a variety of incentive combinations.

6.1.LIMITATIONS AND RECOMMENDATION

The research has some obvious drawbacks. This research is not without its limits, which are outlined in the following paragraphs to pique readers' interests in the subject matter and encourage more study in the same field. The investigation of the internet of things as the one and only digital technology with the potential to enhance both the CLSC and sustainability is the primary subject of this research. Other technologies that are part of Industry 4.0 may very well have an impact that is distinct from the findings (Rosa *et al.*, 2019). The application of internet of things technology with the goal of improving both the forward and reverse flows of the chain has the potential to have a significant and beneficial influence on the efficiency of the CLSC. In addition, the implementation of Internet of Things (IoT) technologies is absolutely necessary in order to gather data from the ecosystem as a whole and record it on the blockchain. It is important to note that we have shaped the research based on the assumption that the CLSC impacts sustainability in accordance to CSR. This presumption is inextricably tied to the use of blockchain technology, which stores information in the CLSC and enables one to track and enrich it through reverse logistics. The CLSC and sustainability may be assumed to have an inverse connection in any future advances in the same region, which may be a topic of discussion. while evaluating their relationship using a variety of digital tools, or when placing it in a context that is not the same as the one they normally do. Furthermore, future research should also investigate some barriers that are linked to the adoption of smart technology as internet of things. These barriers include structural constraints that are attributable to system rigidity, as

well as cultural obstacles that are linked to well established modus operandi. This research should be carried out in the future (Son *et al.*, 2021). It would be interesting to gather a big sample of data and analyse the conclusions of this research using dynamic analysis. This could be done. In conclusion, additional information can be extrapolated with the help of other methodologies, such as the use of structural equation modelling (SEM) to determine the set of CLSC actions that have the greatest influence on business performance or regression models that drive companies to switch from one type of incentive to another.

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