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Assessment of Economic and Environmental Sustainable Issues in the Mobile Communications Industry in Pakistan

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Abstract: Sustainability concerns related to both the economy and the environment within the mobile communications industry can impact not only the corporation itself but also have repercussions across various sectors. Significantly reducing energy consumption in Telecommunication Power Systems is crucial in telecommunications technologies. This reduction facilitates substantial economic resource savings and aligns with initiatives for achieving sustainable development. Despite the industry's importance, limited scientific attention has been given to economic and environmental sustainability issues. This study employs an integrated framework for corporate sustainable management, encompassing Pakistan's rural and urban areas. The investigation delves into the environmental and economic challenges within the mobile communication industry. Furthermore, an institutional theory focusing on mobile network providers and an economic and environmental management analysis are explored. This study holds significant implications for economists, practitioners, and policymakers involved in the mobile communication industry. The hope is that these findings will serve as a valuable starting point for subsequent practices and research in the realm of sustainability management for telecommunications services.

Key Words: Mobile Communications Industry, Mobile Network, Economic and Environmental Sustainable Issues, Greenhouse Gas Emission

Introduction

Economic and environmental concerns have risen to prominence on the global agenda with the escalating threat of climate change. Initiatives are underway to address these challenges at various levels, from the international to the individual (Pal, Tiwari, and Haldar [2021](#)). The Paris Agreement, a pact involving leaders from 175 nations, exemplifies this commitment by aiming to reduce greenhouse gas emissions (Borenius et al., [2021](#)). There is a noticeable increase in environmental awareness among individuals, contributing to the expanding population of environmentally conscious consumers (Khokhar et al., n.d.). In response to this shift, businesses are encouraged to minimize their environmental footprint and enhance their overall sustainability performance (Liu et al. [2021](#)). Within this context, Corporate Sustainable Management (CSM) addresses economic and environmental issues within the business sector. Companies can meet CSM by contributing simultaneously to the environment, economy, and society (Hou et al., [2022](#)). Given the relevance of environmental sustainability, there are a few ways to understand how organizations, such as environmental sustainability, seek to accomplish it. As a result, the study aims to broaden the scope of sustainability threats to learn how other industries, such as mobile communications, deal with them (Khokhar, Iqbal, et al. [2020](#)). The economic and environmental management system aims to promote the company's long-term growth while solving the problems of resource constraints and pollution caused by the company's specific manufacturing and service activities (Gunarathne et al., [2021](#)).

Companies can boost their revenue and secure a competitive edge by embracing positive approaches toward society and the environment through economic and environmental management systems (Bhatti

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et al., 2023). By adopting such methods, companies can derive long-term economic benefits that surpass their initial investment costs, regardless of the industry (Meihui, Khokhar, and Patra, 2023). Implementing economic and environmental management measures contributes to the company's cost efficiency and strengthens its competitive position, enhancing its long-term advantage in the market (Kwon et al., 2021). Moreover, companies can leverage economic and environmental management systems to engage effectively with diverse stakeholders. While previous studies have actively explored economic and environmental management systems, the research scope has been notably limited (HOU et al. 2021). Due to its closer association with pollution compared to other sectors, manufacturing has garnered more attention in the literature.

Consequently, this study focuses on electromagnetism in mobile communications (Irshad et al., 2019). A case study was conducted on four mobile network providers in Pakistan, namely TELENOR Pakistan, Pakistan Mobile Communication Limited (PMCL/Jazz), PTML (UFONE), and China Mobile Pakistan (CMPak/ZONG), to scrutinize the environmental management practices of mobile network operators. The findings reveal numerous economic and environmental challenges within the mobile communications industry, actively addressed by providers in rural and urban settings. These providers engage in proactive environmental management, overseeing, regulating, controlling, and standardizing the entire process.

Electronic Devices

The proliferation of technical equipment, particularly the frequent replacement of short-lived mobile phones, contributes significantly to this surge. Literature suggests that heavy metals like lead and cadmium in discarded mobile phones can generate toxic chemicals, posing a severe threat to human health, including the risk of hearing loss. E-waste from such disposals contributes to environmental degradation and raises social and economic health concerns, leading to resource depletion and financial losses (Hailiang et al., 2023). Consequently, the challenges associated with this issue can be categorized into three main dimensions: environmental, social, and economic (Khokhar et al., 2020). Since 2004, mobile network operators have directed their attention towards the responsible disposal of E-waste. These operators actively engage in the Mobile Recycle Pakistan initiative and Extended Producer Responsibility as outlined by the Ministry of Environment. In Pakistan, consumers frequently acquire phones and subscribe to mobile communication services through the agency of Mobile Network Operators (Yumei et al. 2021). Even though mobile network operators are not manufacturers of handsets, the mobile phone distribution scheme highlights that these operators bear a fundamental civic responsibility to collect unused mobile devices (Bhatti et al., 2023).

TELENOR Pakistan stands out among mobile network operators for its notable initiatives. In 2014, the company established the Happy Echo Phone Foundation, a charitable organization dedicated to employing the underprivileged, collecting, improving, and selling capable mobile phones as refurbished devices. This innovative approach generates revenue through the sale of used and refurbished phones. It provides a commendable solution for TELENOR Pakistan to address concerns related to hazardous heavy metal compounds and e-waste.

Management of Electromagnetic Waves

Communication devices like base stations, relays, and mobile phones emit electromagnetic waves. The World Health Organization (WHO) has identified the increasing prominence of risks associated with electromagnetic waves, particularly in 2012 (Diouf et al., 2015). The impact of electromagnetic waves has been recognized as a significant factor. In response to concerns about the potential dangers of electromagnetic waves, TELENOR Pakistan, CMPAK/ZONG, and PMCL/JAZZ conducted tests on their communication devices, presenting the results in a sustainability report (Chien et al., 2021). The impact of electromagnetic waves has been recognized as a significant factor. In response to concerns about the potential dangers of electromagnetic waves, TELENOR Pakistan, CMPAK/ZONG, and PMCL/JAZZ conducted tests on their communication devices, presenting the results in a sustainability report (Kardinal Jusuf et al. 2023).

Environmental Communication

TELENOR Pakistan, Pakistan Mobile Communication Limited (PMCL/JAZZ), PTML (UFONE), and China Mobile Pakistan (CMPak/ZONG) have collectively undertaken environmental management initiatives in collaboration with stakeholders. Employees across these companies have actively participated in environmental education and forestry projects. TELENOR Pakistan and Pakistan Mobile Communication Limited (PMCL/Jazz) have achieved ISO 14002, an international environmental standard, and have implemented compulsory in-home education programs aligned with their environmental principles (Hou et al. 2021). PTML (UFONE) has contributed to relevant conferences to share expertise on environmental management, in line with the PTML (UFONE) Group's Green 2020 environmental targets (Iqbal et al. 2021). The three mobile network operators have played a crucial role in supporting companies with environmental management and education. UFONE has provided valuable assistance to corporate partners, offering green guidance on Carbon Management Systems and Energy Management Systems. TELENOR Pakistan has actively aided partner companies in obtaining ISO 14001 certification. Furthermore, these operators have facilitated partners obtaining necessary approvals (Khaskhelly et al. 2022).

China Mobile Pakistan (CMPak/Zong) is actively contributing to becoming an integral part of a developed country's economic and social stability. Mobile network operators are actively promoting carbon reduction and the adoption of the Internet of Things (IoT) (Hou et al., 2023). While the development of IoT services holds promise in addressing specific environmental issues, there is an anticipation that environmental challenges will escalate in the Mobile Communications Industry (MCI), including the continuous generation of greenhouse gas emissions from network devices and an increase in electronic waste (Yumei et al., 2020). Let's start by examining MCM's distinct environmental challenges through the lens of Corporate Sustainable Management (CSM), which is both integrated and holistic. The outcomes of this study, viewed through the perspective of CSM in the Mobile Communications Industry (MCI), aim to offer a comprehensive assessment of recurring environmental issues (Khokhar et al. 2022b). Based on this thorough examination, our objective is to present up-to-date guidance on environmental sustainability within the Internet of Things era. Section 2 will provide a concise discussion of Sustainable Management and Institutional Theory, followed by Section 3, which outlines the methodology employed in this article. Sections 4 and 5 will delve into the results, discussion, and conclusion (Khan et al., 2022).

Review of Literature

Sustainability in Business Management

In 1987, the World Commission on Environment and Development introduced the concept of sustainable development. This concept involves meeting present needs without compromising the ability of future generations to meet their own needs (Bhatti et al., 2023). Sustainable development seeks to enhance the utility or well-being of physical materials while ensuring resource exploitation that does not harm the global ecosystem (Ruggiero et al., 2021). Social justice and environmental integrity must be met for long-term sustainable economic responsibility (Pereira et al., 2022). Sustainable development has significantly influenced how businesses perceive environmental responsibilities. While companies' primary goal is to generate profit, the advent of sustainable development has expanded the scope of corporate responsibility beyond financial gains (Khokhar et al. 2022a). Corporate Sustainable Management (CSM) refers to strategic initiatives to ensure a company's long-term survival and growth by integrating environmental, economic, and social performance (Samo and Bhatti, 2020). The company's core profit-seeking activities involve long-term expansion, survival, increased profitability, and generating shareholder economic value. As part of CSM, social sustainability encompasses a commitment to social responsibility, including fostering social equality and establishing enduring relationships with various stakeholders such as employees, suppliers, communities, and governments (Xu et al. 2020). Corporate Sustainable Management (CSM) is accomplished by connecting and integrating three interdependent pillars: environmental, economic, and social. These pillars work collaboratively to achieve sustainable business practices. To elucidate the application of Circular Economy (CE) principles within an organization and create value through process, product, service, or business model innovation, it is essential to understand what CE is and why transitioning to a more circular mode of operation might be advantageous and relevant to an organization, both in the present and the future.



Economic and Environmental Management Framework

To answer the report's rq2, we examined Pakistan mobile network operators' economic and environmental management systems using the isomorphic mechanism of institutional theory perspective. The findings revealed that MCI's institutional economics and pressure come from outside the company, and local and global trends affect companies (Nawaz, Profile, and Bhatti 2021). Because environmental laws and related legislation are strictly enforced, businesses are busy with them. For example, 195 countries pledged to reduce GHG emissions during the 21st Conference of the Parties to the UN Framework Convention on Climate Change. In December 2015, Pakistan committed to reducing GHG emissions by 37% by 2030, compared to expected GHG emissions in 2030, as part of the Paris Agreement (Siddiqui et al. 2023a). To achieve this goal, Pakistan corporations should work to reduce GHG emissions. Pakistan, meanwhile, has been using the Framework Act on Low Carbon Green Growth since 2010 to develop GHG and energy target management systems. The ETC, which came into force in 2015, provided an opportunity to review MCI's environmental issues, according to the environmental managers of three companies. Since 2005, the Pakistan Ministry of the Environment has required mobile device makers to comply with EPR (Siddiqui et al., 2023b). Finally, Pakistan mobile network operators' full acceptance of the economic and environmental management system is influenced by the regulatory framework based on local laws and international standards.

Mimetic/cognitive practice is defined as imitating the behavior of other organizations. MCI has relaxed environmental regulations compared to other industries. Given the growing global interest in climate change, they are not immune to environmental barriers. The mimetic method will be used for MMO economic and environmental management systems because of the high level of uncertainty in conducting economic and environmental management systems in this environment. Employees of MNOEM said meeting the next generation of service delivery and the response to climate change was challenging. Although the performance and coverage of the network device have improved, more relays and antennas are needed to provide reliable 5G mobile communication services. At the domestic level, environmental governance has been implemented through SKT, KT, and LGU +. Internal employees were trained on environmental concerns, and green workplaces were created. Replacing high-performance devices and next-generation services such as IoT has achieved economic and environmental growth in the business sector. They use a similar method for e-waste collection and e-billing and the provision of mobile membership cards. They provide navigation services that advise users on the most practical ways to reduce GHG emissions in the social sphere. Based on TELENOR PAK T-Map, the company's oldest and most widely used navigation tool, it seems to be. Worldwide ISO 14002 for Environmental Management was approved by TELENOR PAK in 2011, and PMCL (JAZZ) received the same certification in 2019. In 2013 and 2014, PTML (UFONE) received the Carbon Disclosure Project Sector Winners Award. And A Grade for Leadership in the same awards in 2016. Run one NAVI service. Cooperation between the two companies, according to one company's economic and environmental management system workers. Indicate the beginning of corporations that have a shared responsibility for climate change.

The standard approach is based on the principles that exist in the organization's operating environment. As stated in the CSM section, businesses should prioritize economic, social, and environmental sustainability. After attaining their economic development goals, businesses frequently attempt to meet social expectations, such as social duty and ecological responsibility. Customer legislators and civic organizations have more expectations and duties than corporations that play an essential role in society, like mobile network operators. Mobile network operators are not yet born of environmental pressure. Neither the last decade nor the traditional, global response to climate change is needed. Since Pakistan adopted "low-carbon green growth" as a national development goal in 2008, efforts to promote and control this approach have intensified. He launched his new Internet of Things services, and his expertise will improve his economic and environmental management system and social engagement.

To conclude, all the mechanisms that drive economic and environmental management system activity were identified and were all active simultaneously. Employing mimetic processes in economic and environmental management system activities makes the environment more unpredictable. Even though the standard method of ecological management in mobile network operators is subpar, it significantly impacts their economic and environmental management system.

Mobile Phones in the Field of Communication

Mobile communications service is essential for communication, data collecting, distribution, and business operations. People and society benefit from mobile communication, which functions as an internal nervous system. As a result, MCI is the foundation of a long-term culture and way of life. Conservation through smart grid and IoT services can reduce energy usage and costs (Albert et al., 2021). IoT services reduce GHG emissions, which can be reduced by continuously monitoring and modifying energy usage to improve efficiency.

On the other hand, environmental concerns within the MCI will skyrocket. As more devices connect to mobile communications, e-waste will rise, and IoT services will increase GHG emissions. The environmental duties of mobile network operators will be to deal with lost communications or mobile devices and reduce GHG emissions from network devices (Albert et al. 2021). Mobile communications and environmental sustainability are interconnected, and these connections can be used to minimize environmental damage. (Prohl et al., 2021) the first study on CSM for MCI provided an integrated approach to highlighting three factors, namely economic, ecological, socio-ecological, and socio-economic sustainability (Li et al. 2021) (JEL Code Q57 "Ecological Economics"). It is an excellent way to consider TBL connections in a complex business environment. This study will use a multi-pronged approach to investigate environmental issues in MCI and detect economic and environmental management systems in the state. The following is a suggestion for a research question.

Institutional Theory

The goal of organizational theory, despite its many variations, is to study organizational behavior and structural changes connected to the social environment. An organization is a term used to describe a company's social work and cultural influence (Contrafatto et al., 2014). Institution building establishes the social expectations of an organization's legal and acceptable activities as accepted ideas and ideals. Regulatory mechanisms: these three processes are the most common causes of isomorphism, and they significantly impact management decision-making (Sahabuddin, Alam, et al., 2023). External forces are a cause of the isomorphism of the organization, as are regulatory/robust processes. Government pressure from governmental countries and other organizations relies on government laws, constitutional restrictions, or political influence, as well as informal pressure from society and governments. Other organizations on which the company relies are Paul and the Maggio, 1983 Kim, Kim, and Lee (Sahabuddin, Tan, et al. 2023). The emission trading system, for example, has been used by businesses to meet government environmental requirements. The mathematical/scientific method, on the other hand, is used to mimic the organizations that have been successfully reviewed.

Methodology

This study used the environment management of four Pakistan mobile network operators as a case study. The advantage of a case study is that it allows you to conclude a case in a particular order. Pakistan MCI is technically better than global MCI, and service availability is comparable. Pakistan mobile network operators include TELENOR (Pak), PMCL (JAZZ), PTML (UFONE), and CMPAK (ZONG). They have continuously tried to promote economic and environmental management system governance as a corporate citizen. To put it another way, the case study of the economic and environmental management system of Pakistan mobile network operators is so important that it serves as a model for economic and environmental management system activities conducted by world-class telecommunications providers. As a result, the actions of Pakistan mobile network operators will reveal essential details about MCI's privileged position in the economic and environmental management system. We conducted several interviews to learn more about mobile network operators, and that is the initiative of the economic and environmental management system. On June 17, 2019, the discussion of TELENOR (PAK) was conducted; on July 13, 2019, the interviews of PMCL (JAZZ) were performed; on January 19, 2020, the discussion of PTML (UFONE) was conducted, and On December 25, 2020, the interview of (CMPAK/ZONG) was performed. PMCL (JAZZ) EEMS workers and the PTML (UFONE) CSR team were questioned, as shown in Figure 1, and four mobile networks of Pakistan (Anon n.d.-a), (Anon n.d.-b), (Anon n.d.-c), (Anon n.d.-d). All interviewees had at least seven years of experience. The list of discussions is shown in Table 1.



Table 1

List of interviews

ID	Mobile Network Operations	Authorized Tasks	Positions	Date Of Interview
A	PAK (TELENOR)	EEMS	Coordinator	June 17, 2019
B	PMCL (JAZZ)	EEMS	Head of suspicion	July 13, 2019
C	PTML (UFONE)	EEMS	Developer	Jan 19, 2020
D	CMPAK (ZONG)	EEMS	Company's Chairman	Dec 25, 2020

Figure 1

Pakistan mobile network providers

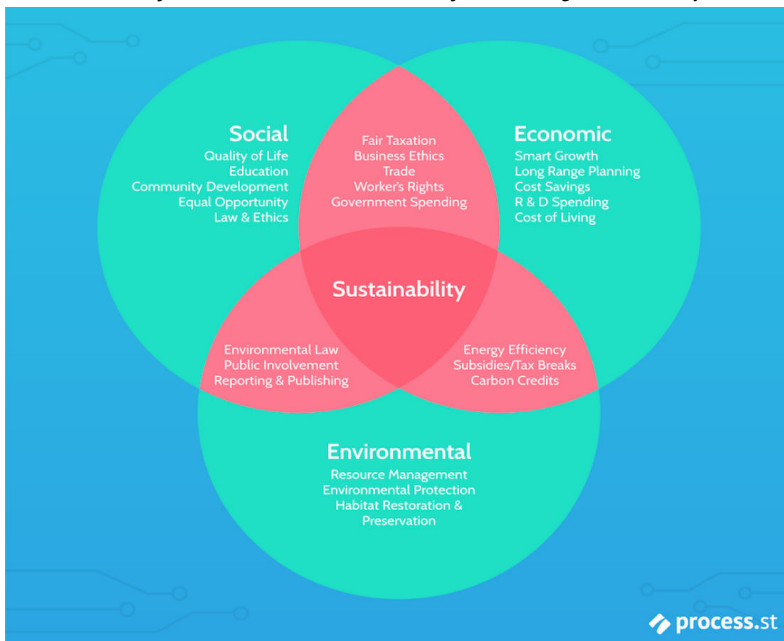


Each interview took about an hour to complete. A semi-structured method was used to combine structured questions with open discussion. We learned about each company's overall economic and environmental management system initiatives and policies and their approach to economic and environmental management systems in MCI. Secondary sources were used to compile the data. Mobile network operators' annual reports, business websites, and news articles published between 2012 and 2020 were used as sources. The data was analyzed using an integrated and complete CSM approach and institutional theory isomorphism.

On the other hand, isomorphism is used to investigate the economic and environmental management system of mobile network operators. As a result, both frameworks are suitable for solving research questions in studies, as shown in Figure 2. The environmental management case study of Pakistan mobile network operators is represented.

Figure 2

Framework of sustainable dimensions for solving research questions



The two parent companies are in the top five regarding economic and industrial performance in Pakistan and are actively involved in sustainable management. PCML (JAZZ), on the other hand, has grown from a state-owned to a large company with several subsidiaries engaged in developing Pakistan's telecommunication sectors. According to 2019 statistics, Pakistan has a population of about 200 million, as shown in table 2. The telecommunications market in South Asia is growing, with a range of mobile/wireless operators. PMCL (Jazz) had 35.98% of the mobile subscriber market in May 2019, followed by Telenor with 15 % to 30%. The Pakistan telecommunications market still has the potential to improve, with the average mobile network connection speed in the Asia Pacific area increasing between 2017 and 2019 and predicted to increase further from 2020 onwards. In May 20120, Pakistan had about 162 million mobile/wireless network subscribers.

Table 2

Shows the characteristics of market share

	Telenor Pakistan	PMC(JAZZ)	PTML(UFONE)	CMPAK(ZONG)
	27.56%	35.78%	13.96%	22.4%
	27%	36.87%	12.79%	19.65%
	29%	36.99%	14.0%	20.98%
	28.2%	-	15.03%	18.97%
	27%	-	14.98%	18.82%
Market Share Characteristic of Month June	26.1%	-	17.2%	19.34%
	24.9%	-	18.98%	17.01%
	24.7%	-	18.68%	13.99%
	25%	-	19.17%	9.99%
	24.2%	-	22.03%	7.67%
	21.9%	-	20.67%	7.77%
	20.99%	-	21.85%	5.55%
	16.88%	-	22.09%	1.64%

Source: own research

PAK (TELENOR)

It is a leading mobile network operation. The company was founded in February 1985. They provide services mainly for mobile communication. It offers 2G and 3G services.

PMCL (JAZZ)

It is a leading primary fixed-line mobile network provider. The company was founded in November 1980. They provide services for mainly fixed line & mobile communication.

PTML (UFONE)

It is a leading mobile network operator. The company was founded in May 1983. They provide services mainly for mobile communication.

CMPAK (ZONG)

It is a leading mobile network operation with almost 60% of the market share. The company was founded in May 1983. They provide services for mainly all communications. It offers 3G and 4G services. The four mobile network operator's EEMS practices are summarized in Table 3.

Table 3

Mobile network operators' EEMS practices

	PAK(TELENOR)	PMCL(JAZZ)	PTML(UFONE)	CMPAK(ZONG)
Origin	In February 1985	In November 1980	In July 1995	In May 1983
Service Of Business	Service of mainly mobile communication	Services of mainly fixed line and mobile communication	Services of mainly mobile communications	Services of mainly all communications
Number of Subscriber	18,482,021	23,782,213	11,380,724	24,653,269



	PAK(TELENOR)	PMCL(JAZZ)	PTML(UFONE)	CMPAK(ZONG)
Revenue	16,308	34,634	22,324	21,548
Domestic Workers	3,789	18,765	7,934	20,657
First-Year Report of Eems	2007	2009	2012	2014

Source: own research

Results & Discussions

By examining the mobile network operators in Pakistan's rural and urban areas, this study addresses the environmental challenges emerging from MCI. Environmental concerns in MCI were classified using integrated CSM methodologies, and the findings will answer the study's query. Based on a holistic viewpoint, we also discussed MCI's environmental problems.

Consider Economic and Environmental Factors

Environmental and economic challenges were linked to financial gains while safeguarding the environment from greenhouse gases (JEL Code Q51 "Valuation of Environmental Effects"). MCI promotes eco-environment-friendly work by reducing greenhouse gas emissions. Two environmental and economic concerns exist: greenhouse gas issues from communication devices. MCI needs network equipment for mobile network operators as well as service delivery. In addition, mobile network operators' costs result from greenhouse gas emissions from network devices because they must purchase certified emissions reduction. MCI will emit CO₂ into global greenhouse gas emissions by 2021. As a result, mobile network operators may find it necessary to improve network performance in rural and urban areas of Pakistan. The regional differences in mobile network operation access and usage between urban and rural sites in Pakistan are shown in Table 4. The percentage of people with a working mobile phone when they were first approached (n = 4448/ 5583) was 97.8% in urban areas and 98.5% in rural areas. A simple-function telephone was used by 88.2% of respondents in both urban and rural areas, followed by a smartphone. For the study, the respondents provided the contact number of the child's father in each location (65% in urban areas vs. 34% in rural areas). Urban (99%) had significantly more daily access/use of a mobile phone than Rural (61.5%). Overall, 8% of rural and 10% of urban residents said they had network issues or trouble keeping their phones charged because of greenhouse gas emissions.

Table 4

Mobile network operation usage accessibility

Characteristics	Urban (N = 1609)	Rural (N = 1728)	Total N = 3337)	P value
Do you have access to a working phone	(N = 1,920)	(N = 1,957)		<0.001
Yes	1,857(96.7)	1,940 (99.1%)	3,797 (98)	
No	63 (3.3)	17 (0.9)	80 (2)	
Type of mobile phone				<0.001
Simple function phone	1,210 (75.2)	1,428 (82.6)	2,638 (79.1)	
Smartphone (Android /IOS/Symbian)	380 (23.6)	295 (17.1)	675 (20.2)	
Do not know	19 (1.2)	5 (0.3)	24 (0.7)	
Relationship with the contact person				<0.001
Father	822 (51.1)	995 (57.6)	1,817 (54.5)	
Mother	374 (23.2)	88 (5.1)	462 (13.8)	
Grandparent	122 (7.6)	87 (5)	209 (6.3)	
Uncle/Aunt	237 (14.7)	395 (22.8)	632 (18.9)	
Other	54 (3.4)	163 (9.4)	217 (6.5)	
Usage of mobile phone				<0.001
Daily	827 (51.4)	1,670 (96.6)	2,497 (74.8)	
Weekly	581 (36.1)	54 (3.1)	635 (19)	
Monthly	201 (12.5)	4 (0.2)	205 (6.1)	

Encountered issues that cause hindrances in mobile use				
Network access	13 (0.8)	85 (4.9)	98 (2.9)	<0.001
Keeping phone battery charged	34 (2.1)	52 (3)	86 (2.6)	0.01
Phone can receive messages in local language text	1,591 (98.9)	1,538 (89)	3,129 (93.8)	<0.001
Purpose of using mobile phone				<0.001
Talking on a mobile phone	1,146 (71.2)	1,196 (69.2)	2,342 (70.2)	
Texting	26 (1.6)	88 (5.1)	114 (3.4)	
Both	437 (27.2)	444 (25.7)	881 (26.4)	
Self-ability to reply				
SMS	859 (53.4)	995 (57.6)	1,854 (55.6)	0.02
Automated calls	1,579 (98.1)	1,507 (87.2)	3,086 (92.5)	<0.001
Someone else in the household can reply				
SMS	1,500 (93.2)	1,425 (82.5)	2,925 (87.7)	<0.001
Automated calls	1,588 (98.7)	1,588 (91.9)	3,176 (95.2)	<0.001
Someone you trust to reply on your behalf				
SMS	1,550 (96.3)	1,409 (81.5)	2,959 (88.7)	<0.001
Automated calls	1,598 (99.3)	1,633 (94.5)	3,231 (96.8)	<0.001
Preferred language for SMS				<0.001
Roman Urdu (Urdu written in English)	931 (57.9)	541 (31.3)	1,472 (44.1)	
Sindhi	47 (2.9)	1,142 (66.1)	1,189 (35.6)	
Urdu	613 (38.1)	34 (2.0)	647 (19.4)	
Roman Sindhi (Sindhi written in English)	18 (1.1)	11 (0.6)	29 (0.9)	
Preferred language for call				<0.001
Sindhi	93 (5.8)	1,634 (94.6)	1,727 (51.8)	
Urdu	1,516 (94.2)	94 (5.4)	1,610 (48.2)	
Have some time preference to receive SMS.				<0.001
Anytime	1,192 (74.1)	810 (46.9)	2,002 (60)	
Evening (6 pm to 10 pm)	247 (15.4)	591 (34.2)	838 (25.1)	
Afternoon (12 pm to 6 pm)	108 (6.7)	238 (13.8)	346 (10.4)	
Night (10 pm onwards)	51 (3.2)	31 (1.8)	82 (2.5)	
Morning (5 am – 12 pm)	11 (0.7)	58 (3.4)	69 (2.1)	
Have some time preference to receive Automated calls.				<0.001
Anytime	1,187 (73.8)	809 (46.8)	1996 (59.8)	
Evening (6 pm to 10 pm)	247 (15.4)	592 (34.3)	839 (25.1)	
Afternoon (12 pm to 6 pm)	107 (6.7)	235 (13.6)	342 (10.2)	
Night (10 pm onwards)	55 (3.4)	35 (2)	90 (2.7)	
Morning (5 am – 12 pm)	13 (0.8)	57 (3.3)	70 (2.1)	
Want to receive information from the health facility inquiring about your health through				
SMS	1,526 (94.8)	1,681 (97.3)	3,207 (96.1)	<0.001
Automated calls	1,597 (99.3)	1,722 (99.7)	3,319 (99.5)	0.01
Do you prefer texting or talking on the phone?				
Talking	1,146 (71.2)	1,196 (69.2)	2,342 (70.2)	<0.001
Texting	26 (1.6)	88 (5.1)	114 (3.4)	
Both	437 (27.2)	444 (25.7)	881 (26.4)	
Would you like to receive an SMS from the health facility inquiring about your health?				
Yes	1,526 (94.8)	1,681 (97.3)	3,207 (96.1)	<0.001
No	83 (5.2)	44 (2.5)	127 (3.8)	
I am not sure.		3 (0.2)	3 (0.1)	
What are the possible barriers to getting your child immunized for routine immunization?				
Forgets child's due date and lack of information on RI	20 (1.2)	1,280 (74.1)	1,300 (39)	<0.001



Vaccines-related adverse effects	743(46.2)	33 (1.9)	776 (23.2)	
Forgets child's due date for RI	548(34.1)	139 (8)	687 (20.6)	
Lack of information on RI	125 (7.8)	111 (6.4)	236 (7.1)	
Forgets child's due date & vaccine-related adverse effects	126 (7.8)	34 (2)	160 (4.8)	
Others	47 (2.9)	131 (7.6)	178 (5.3)	
Would you like to receive a phone call from the health facility inquiring about your health?				
Yes	1,597 (99.3)	1,722 (99.7)	3,319 (99.5)	0.012
No	12 (0.7)	3 (0.2)	15 (0.4)	
I am not sure.		3 (0.2)	3 (0.1)	

Source: own research

According to employees from economic and environmental management interviewers A, B, C, and D, the business has worked hard to build an economically friendly network infrastructure. To cut down on the number of network devices, they changed the network architecture to an integrated device and replaced low-performance machines with high-performance machines. Table 5 shows the types of environmental MCI's. In data mobile network operations in rural and urban areas of Pakistan, too much power generates too much heat, and too much energy is required to keep devices cool.

Table 5

Types of environmental in MCI's

Different types of issues	
Environmental & Economic	Environmental and economic considerations GHG emissions are generated by network equipment. Invest in innovative technology and Internet of Things (IoT) services. Bills and membership cards should be issued. Encourage the use of green offices.
Environmental	Managing network equipment's electromagnetic radiation and e-waste disposal
Social & Environmental	Social greenhouse gas emission
Environmental Communication	Green consulting for partners, environmental education, and EM governance

Source: own research

Modern Technology

Investing in new economic-friendly technologies and developing new services like the Internet of Things is key to MCI's environmental and economic sustainability issues. Internet modern services are a new sector in the competitive MCI market that could be a critical factor in generating economic benefits for mobile network operators. Furthermore, better services based on information communication technology are expected to provide environmental benefits in the modern era, such as increased energy efficiency or reduced greenhouse emissions. As a result, mobile network operators have prioritized green technology and related service development in their CSM.

For example, services for starting new businesses and improving Low Power Wide Area's environment resolved the issues. Technology is also being developed for the NB or IoT of narrowband IoT Services of TELENOR Pakistan, Pakistan Mobile Communication Limited (PMCL/Jazz), and PTML (UFONE); technologies have been adopted by all four companies, allowing them to cover long distances with less power. PAK (TELENOR) provides a lighting energy management system that monitors power consumption and converts light intensity in real time to save energy. Using a renewable energy management system, PMCL (JAZZ) has effectively handled geothermal energy. PTML (UFONE) offers remote management solutions for intelligent pipe networks that monitor and prevent water and gas emissions, while PMCL (JAZZ) has aggressively pushed energy diversification. Furthermore, PAK (TELENOR) and PTML (UFONE) have collaborated with home appliance interior designers and apartment construction firms to create a

complete smart home solution. PTML (UFONE) home Internet of Things services can measure the energy stored in a home through solar panels.

Case study

Regarding billing and membership cards for mobile communication services, mobile network operators face environmental and economic difficulties. The primary source of revenue for mobile network operators is the transferable communication service fee, which is paid monthly on all customer lines. Paper bills are a waste of resources, are hazardous to the environment, and cost a lot of money for mobile network carriers. Between 2012 and 2016, mobile network operators spent Over 35 billion on paper bills. The four organizations encourage customers to migrate to electronic or mobile bills and mobile membership cards to save time and money. Around 18 million TELENOR customers used electronic or mobile bright bills in 2017. PMCL (JAZZ), PTML (UFONE) & (CMPAK/ZONG) rates have been steadily rising since 2012. The money saved through the program. Electronic billing will be donated to organizations that help children with terminal illnesses. In 2017, PTML (UFONE) reduced the number of paper receipts issued to 3.75 million, thus saving the environment. Mobile membership card conversion rates have increased with the increase in cell phone usage, reducing the cost and resources required to create a physical membership card. According to TELENOR PAK, A4 sheets of paper or oxygen are produced from 42 pine trees in a year, and the market share value data is described in Table 6.

Table 6

Market share value of mobile network operators

Supplier	Market share switching (%)	Market share base stations (%)	Market share mobile terminals worldwide (%)	Rank on total GSM market
Ericsson	48	37	25	1
Nokia	14	22	24	2
Siemens	21	2	9	3
Motorola	1	13	20	4
Alcatel	10	10	6	5
Lucent	2	4	4	6
Matra	2	3	2	7
Italtel	0	5	2	8
Nortel	1	0	3	9
Philips	0	2	6	10
Orbitel	0	2	2	11
Other	1	0	13	3

Source: own research

Ranking of Pakistan Business Sector

PMCL (JAZZ), on the other hand, has grown from a state-owned to a large company with several subsidiaries involved in developing the Pakistan telecommunications sector. In 2016, PMCL (JAZZ) was ranked 12th in Pakistan's business sector. In 2016, its mobile communications services varied from 2G to 4G. It has been in business since 1980 as the first mobile phone service provider. Following its privatization, the company became part of the TELENOR Group, which has had phenomenal growth. Since 1981, KT has been the primary fixed-line operator in the United States. PMCL (JAZZ) offers 3G and 4G services, with a market share of about 26% in 2016. TELENOR PAK, PMCL (JAZZ), PTML (UFONE) & (CMPAK/ZONG) Group fell victim to the late arrival in the Pakistan mobile communications industry. 1996 Telecom bought PTML (UFONE) & (CMPAK/ZONG) and its subsidiary LGPP ower.com to become a third-party carrier. As of 2016, the company provides 2G and 4G services and has a market share of about 20%.

Greenhouse Gas Emissions and Improved Energy Efficiency

All mobile network operators have attempted to develop green workplaces to conserve resources and money. For example, TELENOR PAK, PMCL (JAZZ), PTML (UFONE) & (CMPAK/ZONG) have developed an



outdoor air system to reduce the amount of energy required for cooling. They have all tried to minimize the use of paper, install water-saving faucets, recycle rainwater, and replace all lighting with LEDs to reduce greenhouse gas emissions from office buildings. Furthermore, by using renewable energy sources such as solar and geothermal energy, PMCL (JAZZ), PTML (UFONE) & (CMPAK/ZONG) have reduced greenhouse gas emissions and improved energy efficiency. PTML (UFONE) has built self-generating systems at its facilities in Pakistan. PMCL (JAZZ) has used geothermal energy for thermal cooling and hot water supply. It is converting to electric vehicles for its business automobiles to save on fossil fuel costs and consumption. Environmental and social issues in rural and urban areas are related to the sustainability of the mobile network communication industry.

Organizations Efforts to Reduce Greenhouse Gas Emission

Mobile network operators have broadened the indirect greenhouse gas reduction area by researching to reduce greenhouse gases and proposing environmental solutions. Using mobile network operators' ICT services to reduce gas emissions from routine activities is called social greenhouse gas management. These four mobile network operators have created navigation services to reduce these gas emissions. TELENOR PAK provides T-Map navigation as one of its offerings. In 2016, PMCL (JAZZ), PTML (UFONE) & (CMPAK/ZONG) collaborated to develop its services in rural and urban areas of Pakistan. These navigation systems help reduce fossil fuel and greenhouse gas emissions by using real-time traffic information and giving the shortest time and distance direction. We looked at various issues related to electronic waste. Disposal and emission of an electromagnetic wave through economic and environmental management system-based network devices and devices of mobile network operators. The results of the practitioners are as follows: to begin with, environmental concerns must be addressed. Managements are used instead of an integrated approach to CSM. Second, although mobile network operators' economic and environmental management systems have evolved from initial regulatory compliance to voluntary engagement as corporate citizens, they do not need to be fully operational. However, according to the greenhouse gas emissions trading scheme and the applicable enforcement rules Act, getting credit for environmental measures is problematic.

Conclusion

This research examined the economic and environmental management system of Pakistan's mobile network communication industry, using an isomorphic framework of institutional theory, and looked at environmental issues in MCI from a CSM perspective that was integrated and complete. The environmental issues raised by MCI were presented as both economic and ecological concerns. Pakistan mobile network operators were at the forefront of economic and environmental management system practice based on rural and urban area data. Regulatory and mathematical processes were the main drivers of its economic and environmental management system. The percentage of abandoned use of recovered mobile devices is lower than sales. Firstly, users are concerned about their personal information being exposed on their mobile phones. Phone numbers, texts, photographs, and financial information are sensitive data stored on mobile phones. Second, older mobile phones, such as cadmium and lead, have a lower risk of perceived hazardous substances in the human body. Third, some unique features exist for users who want to get their phones back. Consumers will sell their old cell phones instead of participating in the mobile phone trash collection service because they can save more money and develop green workplaces and outdoor air systems to reduce the energy required for cooling. In this study, to solve these problems, it is necessary to improve the identification of issues related to mobile phones and to encourage consumers to retrieve old mobile phones.

Limitations and Future Recommendations

MCI E-west now covers most of the network and mobile devices, but in the future, it will encompass smart speakers, smart appliances, and wearable devices. At this time, it is unknown what he will do after leaving the post. As a result, addressing the social changes caused by the advancement of technology requires professional and realistic environmental regulations and more comprehensive environmental policies that reflect the sector's characteristics. Mobile network operators began as a response to the introduction of economic and environmental management system regulations in rural and urban areas, but over time, the

routines became more active. It can be seen as a sense of social responsibility of the company. Even if they tried to implement a more aggressive economic and environmental management system, one of the economic and environmental management system managers said they would comply because the investment would not be adequately compensated. As a result, rewarding mobile network operators for their environmental and social contributions to the carbon emissions trading system can aid in attaining sustainable green growth.

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Appendix

Table A1

Word list with their total count

Word List	Total Count	Word List	Total Count	Word List	Total Count
Growth	78	Support	45	Digit	25
Ocean	55	Industry	77	Custom	89
Solut	63	Women	55	Technology	86
Port	67	Economic	95	Africa	66
Boost	94	Startup	65	Sustain	51
Opportune	74	Growth	27	Innov	34
Develop	88	People	25	Transport	55
Logist	83	Custom	47	Logist	62
Create	61	Africa	59	Startup	42
Digit	75	Power	84	Economy	87
Barrier	93	Carbon	62	Work	32
India	27	Custom	19	Growth	40
Support	72	Innov	45	Sustain	28
Employee	66	Food	68	Port	25
Impact	69	Commit	41	Boost	27
Emiss	90	Logist	88	Environ	17
Grow	33	Fuel	70	People	18
Country	64	Partner	64	Efficiency	15
Carbon	78	Opportune	78	Country	13
Sustain	22	Solute	34	Innov	24
Future	16	Europ	99	Africa	29
Mexico	18	Crew	43	India	33
Commun	74	Transport	33	Barrier	14
Enable	60	Africa	32	Create	78
Emiss	55	Develop	31	Fuel	45
Technology	77	Power	48	Women	76



Word List	Total Count	Word List	Total Count	Word List	Total Count
Work	88	Growth	43	Industry	13
Digit	34	Support	28	Solut	12
Power	26	Enable	87	Ocean	17
People	72	Custom	18	Commit	18