[[1]](#footnote-1)

Exploring Open Innovation Dynamics: Service and Delivery Interplay in Circular Economy

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*Abstract*—The current business environment is witnessing significant changes due to changing customer preferences and an increasing desire for exclusive and experiential benchmarks. In light of these changes, it is crucial to analyze the convergence of open innovation (OI) in service and service delivery (SD) within the context of circular economy (CE) goals. The objective of this study is to examine the complex relationship between service innovation (SI) and service delivery innovation (SDI) while evaluating the preparedness of organizations to adopt CE practices. This research examines how innovative SD methods, viewed through the lens of service-dominant logic, can develop dynamic capabilities to effectively address changing customer requirements. This, in turn, leads to enhanced satisfaction and customer loyalty. Based on survey data from a sample of 435 responses, this research examines the moderating role of SDI and its interplay with SI, and the integrated effect of both, using regression, structural equation modeling, and the Hayes Process model. The findings emphasize the significant impact of SDI, demonstrating its ability to both moderate and enhance the relationship between SI and the generation of value for consumers. It examines the need to place SDI separate from SI. This undertaking strengthens the collaboration of service-dominant logic with dynamic capabilities approach and enables the incorporation of OI paradigms with the requirements of CE practices. The main goal of this research is to direct the service sector toward a future that places a strong emphasis on value creation and sustainability.

*Index Terms*—Service innovation, service delivery innovation, service-dominant (S-D) logic, dynamic capabilities, circular economy open innovation.

# INTRODUCTION

C

IRCULAR economy (CE) has gained significant attention in the worldwide discourse on sustainable development in recent years [1]. CE advocates for the adoption of systems that imitate natural ecosystems, aiming to minimize waste and maximize resource utilization [2], [3]. The concept is founded on principles that challenge linear value chains and offer a sustainable approach to resource utilization and value creation [4], [5]. CE requires a complete rethinking of product design and development, optimizing all production steps from raw material extraction to product consumption [6]. External and internal factors affect manufacturing enterprises' supply networks' CE integration [2].

According to the dynamic capabilities (DCs) approach, enterprises' adaptation to their internal and external contexts is crucial to coping with rapid environmental changes [7]. Firms’ DCs, including sensing, seizing, and reconfiguring, help organizations embrace CE practices and improve sustainability [8]. Research and development, consumer understanding, and market analytics help firms with strong DCs succeed [9], [10]. This research integrates the DCs view with the foundational framework of service-dominant (S-D) logic, which characterizes service ecosystems as intricate systems comprising players that pool resources linked by shared institutional arrangements [11], [12]. Both the frameworks are used to understand the creation of value. An S-D logic-informed perspective on service ecosystems can comprehensively reflect the intricate nature of CE [13], [14] by emphasizing the foundation of all economic and societal changes in institutional change processes [15].

Open innovation (OI) is considered a technological management strategy that values external sources and marketplaces [16]. Analyzing OI via the lens of S-D logic's core principles can improve the theoretical and practical components of the OI paradigm [17]. While OI research mostly concentrates on the external aspect of technology development, the internal aspect of technology exploitation has not received equal attention [18]. The S-D logic framework assigns great significance to customers, interactions between actors, and the processes of co-creating value. This approach can offer valuable perspectives, particularly when contemplating the use of technology. We theorize that this approach is in line with the principles of service, highlighting the significance of generating and providing value to enhance consumer experiences and influence economic environments.

The advancement of service provision, along with technological enhancements, has radically transformed the manner in which organizations engage with customers, resulting in tailored experiences that align with their individual preferences [19]. The advancements in the strategies used by industry leaders like Apple, Netflix, Airbnb, and others highlight the critical importance of service delivery (SD) in enhancing value generation and customer experiences. The delivery of services, which is of utmost importance for the experiences of consumers, emphasizes the vital link between businesses and the expectations of their customers [20]. The association refers to the point where the commitment to providing a service is fulfilled, establishing the basis for ongoing engagement with customers [21]. Though researchers have shown interest in service delivery innovation (SDI), it is studied as a component of service innovation (SI) [22], cloaking its unique effects.

Over the last three decades, OI based SI has emerged as a pivotal driver of organizational and economic growth [23], necessitating firms to continuously adapt to evolving CE practices in consumer preferences to enhance value within their delivery operations. [24], [25]. This paper examines the constructs SI and SDI from the OI lens. Open innovation is the foundation for large-scale technology and management practices throughout a sector, which is crucial to circular economy [26]. The concept is founded on the principles of users as innovators [27] and innovation communities [28] with technology playing a crucial role. Furthermore, the value creation is studied based on the conceptualization of DC created by linking OI based SI and SDI. The careful application of open innovation procedures can enhance a company's DCs [20]. Additionally, they improve the firm's ability to learn about new technical prospects and, in some situations, to use external resources to close capability gaps [17].

While SD is crucial for creating customer value, prior research has primarily treated SDI and SI as inseparable constructs, neglecting to explore their individual impacts on customer value creation. Consequently, the distinct effects of SDI, particularly its integration with SI, in generating customer value remain unexplored. Therefore, this study aims to elucidate the distinct contributions of SDI and examine how it interfaces with SI to enhance customer value. Specifically, we investigate the combined impact of SI and SDI on customer satisfaction (CS) and customer loyalty (CL), providing insight into the intricate processes of value generation within service ecosystems by addressing the following two questions:

RQ1: How does open innovation-based service innovation influence key outcomes such as customer value creation, satisfaction, and loyalty?

RQ2: What is the effect of the interplay of open innovation-based service delivery innovation and service innovation on customer value creation, leading to customer satisfaction and customer loyalty?

This research significantly contributes to both theory and practice. Initially, we enhance the breadth of the theory by distinguishing between the constructs of SDI and SI for value creation in the context of S-D logic and DCs within the framework of CE theory. SDI can have a moderating effect on other constructs and a moderated mediating effect. This can lead to new and enhanced services, which increases CVC, CS, and CL. The findings also inform practice by demonstrating the extent to which additional customer value may be achieved through differentiation using innovative methods of SD.

The remainder of the research is organized as follows: After describing the theoretical foundations, we develop hypotheses on the relationships between them and establish a conceptual model, which is then used to guide the investigation. Second, the methodology used in this study is explained in detail including the measures used. Third, the findings of the analysis are presented, followed by a discussion of the findings as well as their theoretical and managerial implications. Finally, we evaluate the limitations of the current research and ideas for future research.

# THEORETICAL FOUNDATIONS

This study's theoretical base rests on two influential theories: S-D logic and DCs theory. Both the approaches and constructs based on them are used to develop OI environment in CE.

## S-D Logic

[11] argue that the concept of economic exchange is S-D and not goods-dominant (G-D). The S-D logic states that all economic exchanges rely on the provision of service, defined as the *“application of competencies for the benefit of another entity or the entity itself”* [11], [29]. The service ecosystem has been defined as a “self-contained, self-adjusting system of resource-integrating actors connected by shared institutional arrangements and mutual value creation through service exchange” [30]. This is in conjunction with the concept of CE, which emphasizes resource efficiency and sustainability by promoting the core principles of reduce, reuse, repair, and recycle [5]. Based on the service ecosystems perspective of the complex, dynamic, and involvement of multiple actors in value co-creation [31], [13] has proposed the “process framework of circular service ecosystem transitions.” OI advocates for enterprises to include stakeholders, such as suppliers and consumers, in the process and gain knowledge from their input [32]. The practice is supported by S-D logic [33]. The value is actor-specific, making each production contextual. Value is experiential, comprehensive, and shaped by the availability, integration, and use of different combinations of resources and exchanges and interactions with other actors and is always cocreated [30], [34]. The customer determines value based on “value in use” [35]. Firms do not generate or provide value and can only provide value propositions [30]. Simply put, this suggests that the integration and application of resources within a particular context determine and derive value [36]. Scholars have highlighted the dynamic process of value co-creation in the interactions between customers and firms by employing the S-D logic framework [35]. [37] emphasize the significance of absorptive and adaptive competencies in S-D logic. Adaptive competence refers to an organization's ability to adapt to changing situations. This aligns with the characteristics of seizing and reconfiguring in the deployment of DCs [38]. Absorptive competence refers to an organization's ability to understand significant trends and knowledge [39]. It involves the processes of sensing and shaping opportunities that are essential for DCs [38]. From the S-D logic lens, we explore the competitive circumstances to identify the resources for a firm that create value to provide an edge over the competition.

## Dynamic Capability View

According to [40], DCs assist a firm in adjusting to evolving circumstances and attaining its sustainability objectives. Researchers suggest that firms can overcome the challenge of transitioning from a linear economy-based approach to a circular economy (CE) business model by cultivating DCs [41]. The study conducted by [41] highlight the role of DCs in facilitating CE demonstrating how the act of sensing, seizing and reconfiguring activities can enhance its success. DCs play a crucial role in facilitating the implementation of CE rules, resulting in an accelerated transition to CE. This is supported by studies conducted by [42] de Angelis et al. (2023) and [43]. [44] examined the necessary DCs to implement pollution control, product care, and sustainable development strategies in the textile sector. In this study, we have considered the mobile telephony sector to study DCs through their SI and SDI processes leading to CVC, CS, and CL.

The theory of DCs was developed to improve the resource-based view (RBV) by encapsulating the evolutionary nature of resources and capabilities [45]. it is only through a distinctive arrangement of resources that a firm may attain sustainable competitive advantage [46]. The DCs associated with SI have been identified as critical drivers of sustained high performance [47]. According to [48], organizations must possess DCs to continuously innovate new services and implement service provision's underlying principles.

This research on the synthesis between innovation in services and innovation in SD contributes to establishing the combination as a DC. The combined constructive interaction working as an operant resource, as defined in the S-D logic, applies itself to the operand resources to deliver customer value. SDI enhances a service firm's ability to develop and improve innovative services. We propose that this DC influences a service firm's CVC.

Our contribution to DCs theory lies in our explicit emphasis on the interaction between SI and SDI as a crucial DC. Much recent work on DCs emphasizes the link between capabilities and S-D logic as shown in Table I below.

TABLE I: RESEARCH EXTRACTS ON THE COMBINED THEORIES OF S-D LOGIC AND DYNAMIC CAPABILITIES

|  |  |
| --- | --- |
| **Authors** | **Key Findings** |
| [11], [49] | Operant resources are generally unseen and intangible; they comprise fundamental competences or dynamic capabilities. This developing managerial paradigm sees the client as a source of operant resources for the firm, co-producing exchange value. |
| [50] | Classification of operant and operand resources into seven categories and suggested that all operant resources can be viewed as dynamic capabilities. |
| [12], [35], [51] | Emphasizes on the intricate and dynamic nature of social systems, which offer service, integrate resources, and co-create value. |
| [52] | Acknowledges the importance of operant resources such as knowledge and dynamic capacities since these improve the use of resources over time. |
| [30] | An increasing tendency in the literature on strategic management is the identification and elaboration of the micro-foundations that facilitate the comprehension of "higher-order," more macro-level structures. |
| [53] | Dynamic capabilities are configured to meet the actor's strategic direction, and the defining dichotomy is between reacting to changes in the service environment ("being market driven") and proactively changing the service ecosystem ("being market driving"). |
| [54] | Called for development of new resources and capabilities for value creation and innovative solutions in a context of perpetual change. |
| [38] | Recommended for research integrating dynamic capability and service-dominant logic views. |
| [55] | Defined dynamic capabilities as “operant resources, working upon other operand and operant resources that allow actors to systematically influence resource integration and institutions.” |
| [56] | Characterized the actors in S-D Logic in four categories depending on their contextual and dynamic facets. |

In line with the findings and drawing from these observations, we examine the proposed model.

# CONCEPTUAL FRAMEWORK AND HYPOTHESES DEVELOPMENT

## Service Innovation, Customer Value Creation and Customer Satisfaction

Researchers have argued that firms must innovate to cater to the changing trends, needs, and perceptions of their customers [57]. CVC is also the central idea behind SD logic [58], which states that the value-creation process starts when consumption of the service takes place by a customer [58], [59]. SD logic suggests a way of thinking about value in terms of the benefits for the beneficiary (e.g., the customer) and highlights that value creation occurs in the customer's realm, rather than solely within the firm [12], providing an alternative to the concept of circularity [14].

In today's challenging markets, CS is no longer adequate, and businesses must grasp service design to innovate successfully with SI being the “new ticket” [60]. The evaluation of the performance of the service against a perceived standard satisfies or dissatisfies a customer [61]. The theoretical underpinning of CS with respect to CVC has been studied and empirically confirmed [62] . In the customer’s assessment, value creation needs to take place to have CS. Since SI creates value, and greater value leaves customers more satisfied, we posit that:

*H1: Customer value creation mediates the relationship between service innovation and customer satisfaction, within the framework of circular economy.*

## Customer Value Creation, Customer Satisfaction and Customer Loyalty

Value can be enhanced by applying CE business strategies of “slowing resource loops” or “closing loops” comprising of extending product value or extending resource value respectively [4], thus enhancing the experience. In the CE, consumers actively close loops, resulting in more circular touch points between the company and consumers throughout multiple interactions and an extended customer experience [64]. This experience may also combine with the buying process due to which the product or service was used [65]. Characterizations based on outcomes regard service experience as an antecedent or result of other dimensions [66], such as CS, CL, and positive word-of-mouth [67].

CL has been defined as “a deeply held commitment to rebuy or re-patronize a preferred product or service consistently in the future, thereby causing repetitive same-brand or same-brand-set purchasing, despite situational influences and marketing efforts having the potential to cause switching behavior” [68]. CL indicates the inclination of the customer to have a long-term affiliation with the service provider, which is the outcome of multiple transactions and longitudinal satisfaction [69]. Thus, the relationships that affect CS eventually also affect CL. Since a multitude of transactions affect CL, CS has a direct linkage with CVC and SI and shares a similar relationship with them. Therefore, it is posited that:

*H2: Customer satisfaction mediates the relationship between service innovation and customer loyalty, within the framework of circular economy.*

*H3: Customer value creation and customer satisfaction serially mediate the relationship between service innovation and customer loyalty, within the framework of circular economy.*

## Service Innovation and Service Delivery Innovation

[62] suggest that managers should accelerate the use of CE strategies to enhance the sustainable delivery of services to their customers. Customers' perspectives on the SD process are critical for successful service design and management [71]. Services are bringing differentiation and supporting it where products cannot [72], and SI is assisting enterprises to increase their performance and growth [73]. Environmental factors in product development, especially when services integrated into new product designs are sustainable, are important even when replacing the product, and available services can facilitate system innovation [74].

The proliferation of customers into different segments and their changes in preferences in what they shop, why they shop, and how they shop keep firms guessing on how to reduce cost while delivering enhanced value and improving ways to deliver their services [24]. With complexity increasing in service contexts and firm-consumer interfaces, multi-channel, multi-device, location-based, and context-aware services provide a mix and integrate the value provided in a variety of design contexts [75]. [76] put forward a multilevel service design based on seven service designs by [77] and proposed that an appropriate service interface can enhance the service experience. This service experience can be either “phenomenological” or “process-based,” or have characterizations of both as described by [78].

In the SI literature in the OI context, co-creation entails: (1) customer participation in the design of the new service offering [79], and (2) engagement among several service providers to combine the resources that compose the SD system for an enhanced service experience [76], [80]. The SD process is one of the elements that service design integrates to shape the customer's experience [80]. SI has been used as an umbrella term for all the elements included in service product development and processes used in service provisioning. We studied the literature to understand how various scholars have portrayed SDI in Table II below:

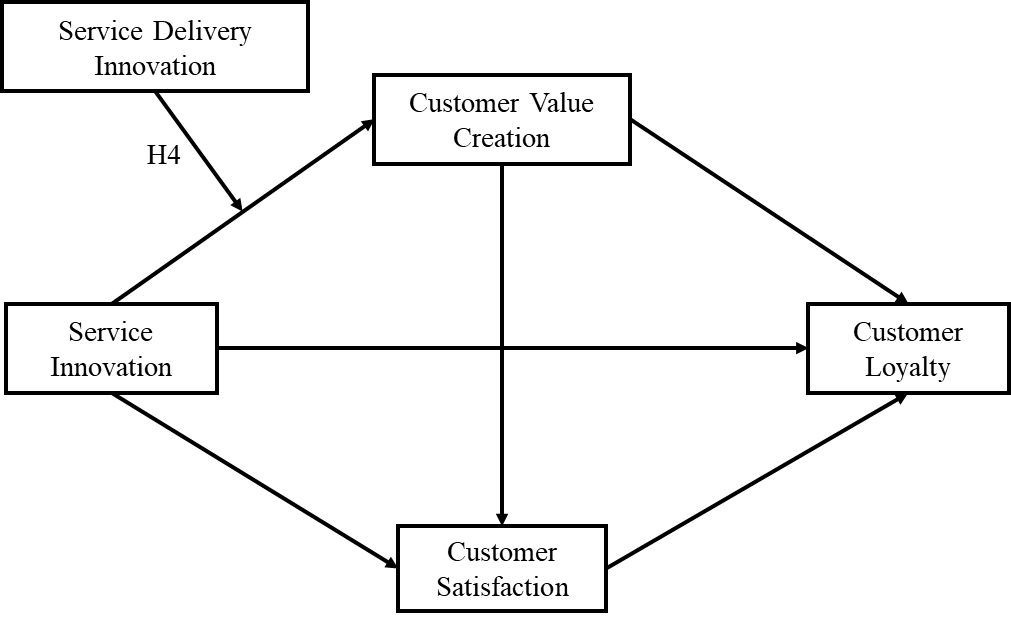
TABLE II: RESEARCH EXTRACTS COVERING SDI

|  |  |  |  |
| --- | --- | --- | --- |
| **Authors** | **SD separate from SI** | **SDI embedded in SI** | **Method of Study** |
| [81] |  | Considered as one of the dimensions under SI and mentioned as 'new service delivery system' | Qualitative |
| [82] |  | In experiential services, using a "journey perspective," innovation in SD is one of five design areas for holistic service innovation. | Qualitative |
| [24] | Firm performance is measured by studying SDI and its antecedents emphasizing scant research. |  | Quantitative |
| [83] |  | SI is conceptualized as an "elevated service offering" comprising multidimensional aspects, including a new service delivery system. | Qualitative |
| [84] | The prime variable studied with the help of a conceptual model is SDI within the firm. |  | Quantitative |
| [85] |  | In this meta-analysis, 'proficient operations and delivery systems' is considered as one of the antecedents and success factors of SI performance. | Qualitative |
| [86] |  | The study examined how SI enhances SD, treating improvements as process innovation through technology, rather than as innovation itself. | Quantitative |

While elements such as customer experience, business models, and efficiency are recognized as helping SI succeed, their relative importance is not well known [87]. Forwarding the argument, we propose that the effect of SDI also needs to be studied as a separate construct from SI. SD can result in service failure, whereas a well-executed delivery of service with a positive conclusion increases service quality and brand image ratings [88]. SI adds significant value to the services by introducing novel features, while SDI adds value to the services by introducing novel features into the delivery process of these services. We contend that the value SI increases with the amount of value the delivery process generates. Because value creation differs for each customer, if the delivery process is not determined to be coordinated with the consumer’s expectations, the value created may be reduced as a result. Additionally, the combination of SI and SDI acts as a capability that keeps reconfiguring itself to maximize value addition. The operant resources in use sense and seize opportunities to develop new services and new ways to deliver these services in the context of CE. Therefore, we hypothesize that:

*H4: Service delivery innovation* *moderates the mediated effect of customer value creation on the relationship between service innovation and customer satisfaction, within the framework of circular economy.*

Based on the relationships discussed in this section between the constructs and the hypotheses developed, the conceptual model (Figure 1) below is proposed.



**Fig. 1.** Conceptual model

# RESEARCH METHODOLOGY

In this quantitative study, primary data is collected using a survey design. The survey consisted of items based on constructs from established scales. The study uses different statistical tools to test, analyze, and report the findings. IBM SPSS is used to conduct EFA (Exploratory Factor Analysis) for factor rationalization. Then, we conduct CFA (Confirmatory Factory Analysis) using IBM AMOS to validate the model fit, estimate the various relationships, and examine construct, convergent, and discriminant validity and reliability. The Hayes process model [89] in SPSS is used to conduct moderation, mediation, and moderated mediation based on the relationships conceptualized in the model.

We invited participation in the survey from customers using a mobile connection from at least one Indian mobile network operator (MNO). The response was obtained by convenience sampling conducted online using the social media application 'WhatsApp' in English. The form was forwarded by multiple sources, preventing the calculation of a response rate. We observed that 1,223 respondents viewed the survey, of which 645 initiated it. However, only 435 completed the survey included in the final study (Table A.1).

## Telecommunications - Background

BCG forecasts that adopting the circular economy by the ICT industry may reduce world emissions by 15% by 2030. This represents more than a third of the carbon reductions needed to satisfy Paris Agreement sustainability commitments [90]. The GSMA's "Mobile Net Zero: State of the Industry on Climate Action 2022" report states that 50 operators, representing 63% of the industry by revenue and 44% by connections, will quickly cut emissions over the next decade [91]. Global e-waste is expected to reach 74.7 million tons by 2030, with most of it incinerated or buried in landfills [92]. According to Shield's, a telco solutions company, reused equipment has an 89% smaller carbon footprint than new hardware [93]. EY has reported that 90% of telecom operators find the circular economy important for their businesses [94]. EY has listed “poor management of the sustainability agenda” as one of the top ten challenges for telecommunications in 2023 [95]. As per ITU-TL.1020[[2]](#footnote-2), “circular economy is restorative and regenerative by design, and aims to keep products, components, and materials at their highest utility and value at all times while reducing waste streams. In his report titled, “CE in Indian Telecom Sector: Vision, Strategy and Action Plan,” Arun Agarwal, Dy. Director General, Department of Telecommunications, Ministry of Communications, India, has highlighted the need to sustainable telecom with circularity [96]. Furthermore, drafting the Vision 2030 for CE in Telecom, the report envisions a future that is regenerative, sustainable, and inclusive for the telecommunication sector (ITU-TL.1020) [96].

Consequently, the Indian telecom sector has been selected to study the relationships inside the conceptual model and comprehend customer perspectives on innovation and CE during service consumption. The measures considered for the constructs in the study are as below:

## Measures

**Service Innovation –**The construct SI, as originally proposed by [97], included 15 items divided into three sub-constructs of five items each: 1) new service concept innovation; 2) new service process innovation; and 3) new technological system innovation. In this research, out of the fifteen items, only twelve were taken, with five from the first sub-construct, three from the second sub-construct, and four from the third sub-construct. This was done to avoid replication of items with the SDI construct and to maintain relevance with the current study. Thus, the considered SI construct comprises twelve items. The items in the existing construct from [97] were modified to include the aspects of mobile services and CE. Words like sustainability, reusability, recyclability, waste reduction, durable, and environment-friendly were used to simplify CE for respondents. Input from the pre-tests of customers and telecom professionals was also used to modify the items. A pilot study of 25 customers was conducted on the survey questionnaire with modified variables, and its reliability was found to be within the permissible limit (Cronbach’s alpha > 0.7). The construct is assessed on a five-point Likert scale (anchored by “Strongly disagree” to “Strongly agree” at the endpoints).

**Service Delivery Innovation** – The SDI construct is based on the construct proposed by [24]. We modified the construct to include aspects of mobile services, the customer’s perspective, and SDI examples that relate to mobile services. CE was introduced in questions with words such as sustainability, reusability, recyclability, waste reduction, durable, and environment-friendly. SDI was measured using a Likert-type scale comprising a total of ten items (anchored by “Strongly disagree” to “Strongly agree” at the endpoints).

**Customer Value Creation, Satisfaction, and Loyalty** – The CVC construct adopts the conceptualization proposed by [83], is modified according to inputs from telecom professionals, and is tailored for mobile services. The construct comprises of three sub-components of functional, emotional, and social value. This construct was assessed as an aggregate measure on a five-point Likert scale (anchored by “Strongly disagree” to “Strongly agree” at the endpoints). The CS construct is based on the five items derived from the work of [97]. CS was measured using a Likert type scale (anchored by “Strongly Disagree” and “Strongly Agree” at the endpoints). The CL construct was derived from the work of [98] and [99]. A total of ten items were assessed under this construct using a Likert scale (anchored by “Strongly Disagree” and “Strongly Agree” at the endpoints).

## Sample Composition

The sample composition included 61% males and 39% females. The age groups comprised 42% between 18 and 24 years, 15% between 25 and 34 years, 10% between 35 and 44 years, 27% between 45 and 54 years, 5% between 55 and 64 years, and in the group of more than 64 years, it was just 1% of respondents. 68% were prepaid users and 32% were postpaid users, with 87.5% using prepaid in the 18–24 years and 25–34 years age groups combined. 58% of the respondents in the age group from 35 years onwards were using postpaid, and 42% were using prepaid. 44% of the sample used more than one mobile number or SIM in their phones, and 56% used only one.

## Validity and Reliability Analysis

We began the analysis with exploratory factor analysis (EFA). EFA was performed to assess if all the items in one latent construct had factor loadings greater than 0.5 [100]. Items that did not load together in EFA or had factor loadings of less than 0.5 were deleted. To determine the AVE, CR, and convergent and discriminant validity of the items, SPSS was employed. Convergent validity and discriminant validity were used to gauge the constructs' reliability. Factor loading and AVE correlations for latent variables (listed in Table III) serve as indicators of validity. There was sufficient convergent validity in each construct, with the average AVE over 0.5 [101]. For each latent construct, as indicated in Table III, the reliability of CR is greater than 0.7. The [102] test was used to determine the discriminant validity of a pair of constructs and their AVE. Since the AVE square root exceeded each correlation, the constructs were judged to be distinct (Table III).

TABLE III: CORRELATIONS, MEASURES OF RELIABILITY AND VALIDITY

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Variables** | **Mean** | **SD** | **AVE** | **CR** | **SI** | **SDI** | **CVC** | **CS** | **CL** |
| SI | 3.35 | 0.76 | 0.52 | 0.76 | **0.72** |  |  |  |  |
| SDI | 3.38 | 0.74 | 0.56 | 0.91 | 0.54 | **0.75** |  |  |  |
| CVC | 3.45 | 0.68 | 0.53 | 0.85 | 0.53 | 0.6 | **0.73** |  |  |
| CS | 3.52 | 0.77 | 0.56 | 0.86 | 0.53 | 0.57 | 0.55 | **0.75** |  |
| CL | 3.4 | 0.73 | 0.5 | 0.9 | 0.59 | 0.57 | 0.66 | 0.71 | **0.71** |

The square root of AVE is on the diagonal.

(SI – Service Innovation; SDI – Service Delivery Innovation; CVC – Customer Value Creation; CS – Customer Satisfaction; CL – Customer Loyalty)

After deleting the items that were discovered to be loaded under numerous factors, a CFA was undertaken to further demonstrate the validity of the construct. Table A.2 in Appendix A.2 shows the CFA results. AMOS version 23 was used to estimate the structural equation model. Table IV shows that the results of the model fit indices were satisfactory. For the model, [103] found that the CMIN/df is less than 5, and its p-value is significant. Both the TLI and the CFI must be more than or equal to 0.90. [104]. In terms of model fit, the RMSEA, SRMR, CFI, and TLI indices all meet or exceed the minimum standards [105]. Well-fitting models yield scores below 0.05 for the SRMR, which has a range of 0 to 1 [106].

TABLE IV: MODEL FIT INDICES AND DIRECT RELATIONSHIPS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **df** | **χ2** | **χ2/df** | **RMSEA** | **PCLOSE** | **SRMR** | **CFI** | **TLI** |
| 363 | 639.23 | 1.761 | 0.042 | 0.995 | 0.034 | 0.971 | 0.967 |
| Path | SI à CVC |  | SI à CL |  | SI à CS |  |  |
|  | 0.53\*\*\* |  | 0.66\*\*\* |  | 0.55\*\*\* |  |  |
| Path | CVC à CS |  | CVC à CL |  | CS à CL |  |  |
|  | 0.55\*\*\* |  | 0.66\*\*\* |  | 0.71\*\*\* |  |  |

\*\*\*Significant at the 0.01 level; \*\* Significant at the 0.05 level; \*Significant at the 0.1 level

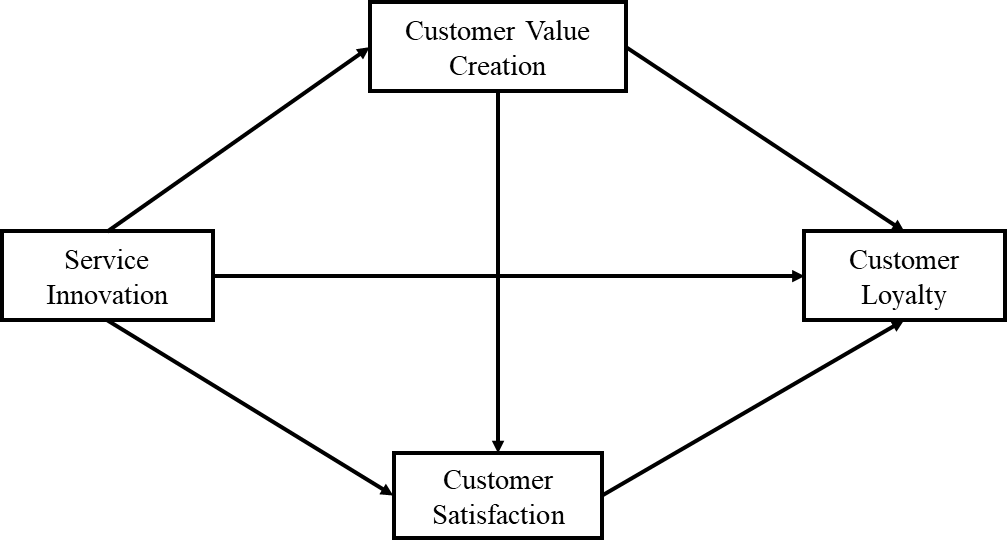
(SI – Service Innovation; SDI – Service Delivery Innovation; CVC – Customer Value Creation; CS – Customer Satisfaction; CL – Customer Loyalty)

Concerns regarding common technique bias arise when all variables are measured using the same method at the same time [107]. To prove that common technique bias is not an issue, a multi-pronged strategy was used. All participants were assured of their privacy and confidentiality, as well as the fact that there was no right or incorrect answer to the survey [108]. A second problem is that the poll was riddled with filler questions, which led to a mental dissociation of concepts [109]. Third, it was observed that the single component explained 45.8% of the variance in the dependent variable, which is satisfactory compared to the 50 percent rule of thumb following [110]. Fourth, we conducted the latent factor test by adding a latent factor to the structured equation model in AMOS [111]. We found that path coefficients and their significance continued to be steady even after the latent factor was added (model without common method factor: χ2/df = 2.898, CFI = 0.925, TLI = 0.918, RMSEA = 0.066, model with common method factor: χ2/df = 2.713, CFI = 0.933, TLI = 0.926, RMSEA = 0.063). Overall, this approach of using multiple methods should increase the level of confidence that the common method bias in the data is not consequential.”

# ANALYSIS AND RESULTS

## Mediation Model

The conceptual model was divided into 2 models for the sake of analysis: a mediation model (Model 1) and a moderated mediation model (Model 2). Figure 2.1 shows the model for mediation, and Figure 2.2 shows the model for moderated mediation. Model 1 is comprised of four constructs: SI, CVC, CS, and CL.



**Fig. 2.1.** Mediation and serial mediation – model 1

We conducted linear regression analysis on the direct relationships between the four constructs in the mediation model. All the relationships were found to be positive and significant (Table IV). The Hayes Process macro in SPSS was used to test the models [112]. We applied Hayes model 6 of sequential mediation and found that: (i) CVC mediates the relationship between SI and CL; (ii) CS mediates the relationship between SI and CL; and (iii) CVC and CS sequentially mediate the relationship between SI and CL (Table V).

TABLE V: INDIRECT EFFECTS IN MODEL 1

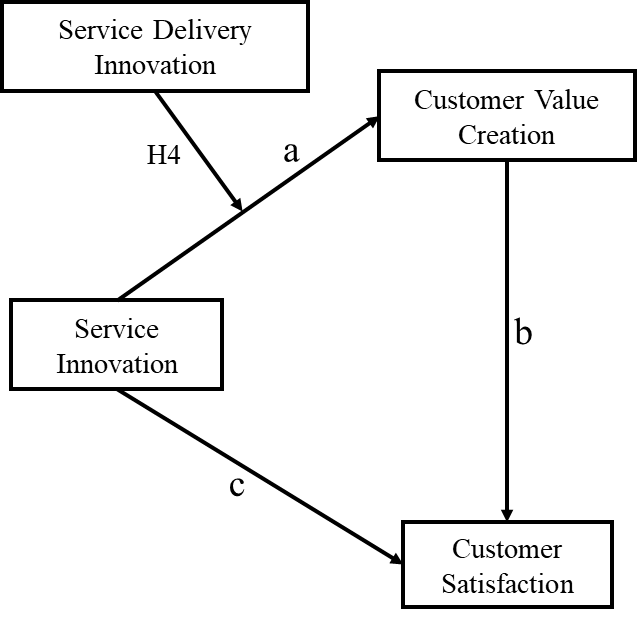
|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Mediation** | **Effect** | **BootSE** | **BootLLCI** | **BootULCI** | **Support** |
| SI 🡪 CVC 🡪 CL | 0.1694 | 0.0351 | 0.1048 | 0.2436 | H1 supported |
| SI 🡪 CS 🡪 CL | 0.1416 | 0.0310 | 0.085 | 0.2067 | H2 supported |
| SI 🡪 CVC 🡪 CS 🡪 CL | 0.0859 | 0.0202 | 0.0505 | 0.1285 | H3 supported |

(SI – Service Innovation; CVC – Customer Value Creation; CS – Customer Satisfaction; CL – Customer Loyalty)

## Moderated Mediation Model

The moderated mediation model consists of four constructs: SI, SDI, CVC, and CS. The Hayes process (model 7) in SPSS was used to carry out the test [113] of moderated mediation, in which SDI moderates the relationship between SI and CVC, and CVC mediates the relationship between SI and CS (Figure 2.2).

With this model, we are testing that the effect of SI on CS is mediated by CVC and that this mediation is moderated by SDI, where SDI is moderating the path ‘a’ between SI and the mediator CVC. The first regression results are given in Table VI, in which the mediating variable CVC has been regressed onto SI and SDI. The Int\_1 is the interaction term (SI \* SDI) and is found to be significant at *p-value = 0.0454*, which denotes moderation.

****

**Fig. 2.2.** Moderation and moderated mediation - model 2

The slope of 0.2948 (Table VI) for SI is the slope for SI's effect on CVC for cases falling at the mean on SDI. The slope for SDI here is reflecting the effect of SDI on CVC for cases that would be falling at the mean on SI. The slope for SI is positive and statistically significant. The slope for SDI is positive and statistically significant. The moderator (Int\_1) has a positive slope at 0.568 and is statistically significant (p-value = 0.0454*).* It means the effect of SI on CVC, as shown by the slope of the relationship, varies across SDI levels. The process macro runs a series of regression analyses.

TABLE VI: MODERATION EFFECT IN MODEL 2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Coeff** | **se** | **t** | **p-value** | **LLCI** | **ULCI** |
| SI🡪CVC | 0.2948 | 0.0434 | 6.795 | 0.000 | 0.2096 | 0.3801 |
| SDI🡪CVC | 0.4534 | 0.0441 | 10.2817 | 0.000 | 0.3667 | 0.5401 |
| Int\_1 | 0.568 | 0.0283 | 2.0068 | 0.0454 | 0.0012 | 0.1125 |

(SI – Service Innovation; SDI – Service Delivery Innovation; CVC – Customer Value Creation)

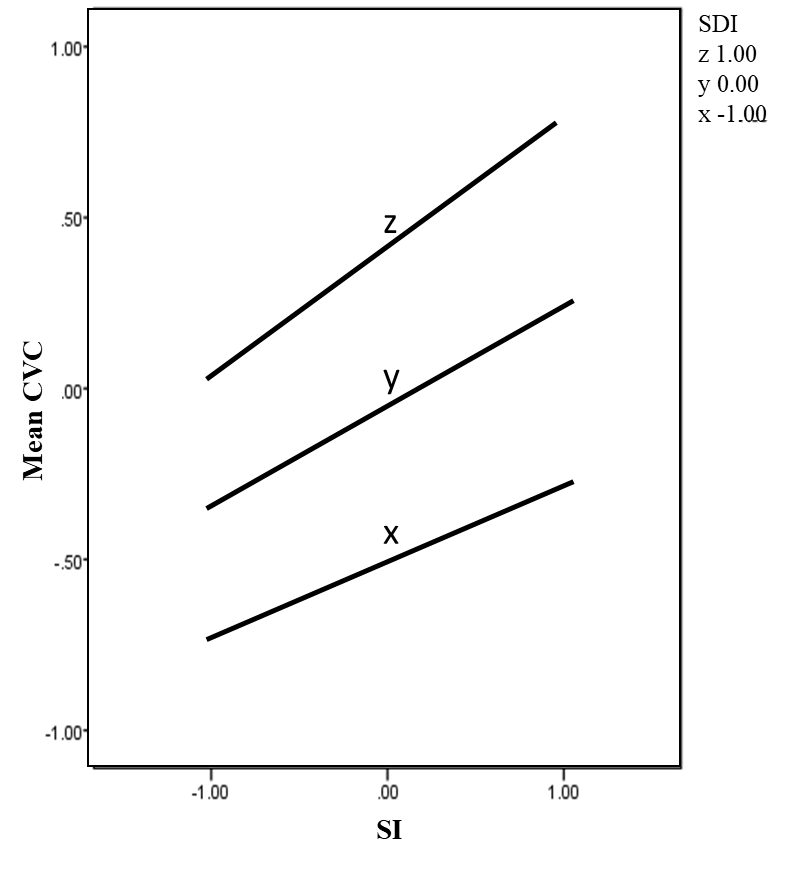
The interaction term was statistically significant in the regression model, and as the interaction, is probed further by computing conditional effects and then testing them for statistical significance. These are referred to as slopes, and these are the slopes for the effect of SI on CVC at one standard deviation below the mean on SDI, at the mean, and one standard deviation above the mean on SDI.

TABLE VII: CONDITIONAL EFFECTS OF THE FOCAL PREDICTOR AT VALUES OF THE MODERATOR

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **SDI** | **Effect** | **se** | **t** | **p-value** | **LLCI** | **ULCI** |
| -1.000 | 0.2380 | 0.0519 | 4.5832 | 0.000 | 0.1359 | 0.3401 |
| 0.000 | 0.2948 | 0.0434 | 6.7950 | 0.000 | 0.2096 | 0.3801 |
| 1.000 | 0.3517 | 0.0517 | 6.8037 | 0.000 | 0.2501 | 0.4532 |

(SDI – Service Delivery Innovation)

SDI was mean-centered (Table VII) at 0, and the 1.000 is equal to the standard deviation of the SDI variable on both the positive and negative sides. The slope at one standard deviation unit below the mean on SDI is 0.2380 and statistically significant. The conditional slope at one standard deviation above the mean on the centered SDI variable is 0.3517 and is statistically significant. The same is depicted graphically, where the effect is clearly visible (Figure 3). The slope becomes less pronounced from low SDI to higher SDI. The slope that the line x is reflecting is one standard deviation below the mean on SDI; the line y reflects the mean on SDI; and the line z reflects the slope at one standard deviation above the mean on SDI. Figure 3 clearly shows line z has the most pronounced slope, line y has the next most pronounced slope, and line x has the weakest slope, and all are statistically significant according to the conditional effects test.



**Fig. 3.** Conditional effects – moderation

The indirect effect of the SI variable on CS through the mediating variable CVC varies across levels of SDI. This is also one standard deviation below the mean, at the mean of SDI, and one standard deviation above the mean on SDI. The conditional indirect effects are computed as the product of path ‘a’ at a given level of SDI and path ‘b.’

As zero falls outside of the lower and upper bounds, we deem the conditional indirect effect statistically significant. In all three conditions (Table VII) of the confidence intervals, the conditional indirect effects are statistically significant. The results obtained have a single index of moderated mediation, which combines the results from above and provides an overall test of moderated mediation. The bootstrap confidence interval shows that moderated mediation index is statistically significant. The zero falls outside the lower and upper bounds (Table VIII), indicating moderated mediation.

TABLE VIII: INDEX OF MODERATED MEDIATION

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Index** | **BootSE** | **BootLLCI** | **BootULCI** | **Hypothesis** |
| SDI | 0.215 | 0.0119 | 0.0004 | 0.0474 | H4 supported |

(SDI – Service Delivery Innovation)

# DISCUSSION

The primary objective of this study was to thoroughly examine the distinct effects of SDI as an independent factor from SI in relation to their influence on enhancing CS and fostering CL. This investigation entailed examining the intricate interrelationships among SI, CVC, CS, and CL, within the broader frameworks of OI and CE. OI serves as the initial step towards implementing technology and management on a large scale throughout an entire industry, which is especially important for promoting CE [26]. We focused on the telecommunications sector, specifically targeting mobile service consumers, in order to meet the CE goals, set by the industry. It was essential to measure and understand these interactions within this specific framework because the sector has a significant impact in delivering services that adhere to CE regulations.

The empirical findings of our inquiry validate all four hypotheses, establishing the positive and statistically significant direct relationships between the constructs (refer to Table IV). SI is recognized as a vital component that is closely associated with CVC, CS, and CL, which answers the primary question of our research. The profound importance of SI can be attributed to its impact on many phases of the customer life cycle within the ongoing firm-customer interaction. CVC plays a crucial function in facilitating the relationship between SI and CS. The relationship between SI and CS remains statistically significant both prior to and following mediation. However, the mediation effect through CVC significantly enhances this association. The direct influence of SI on CS is readily evident, underscoring its capacity to augment CL. However, the process of creating value varies for each consumer, based on their specific needs, perceived value, and duration of engagement with the product or service. While SI may offer added reassurance to a current consumer, it plays a crucial part in establishing contentment for a new customer. This emphasizes the significance of generating value by being responsive, dependable, and incorporating adaptive characteristics that accommodate evolving tastes.

Furthermore, our data demonstrates a robust and favorable association between CS and CL, affirming the prevailing scholarly notion that consistent consumer satisfaction fosters enduring loyalty. Furthermore, CS acts as a mediator between SI and CL, a concept that has been previously supported by other academics and further validated by our own research [114]. The relationship between SI and CL is mediated by both CVC and CS sequentially. This is consistent with the studies conducted furthering theory on the relationships between the four constructs. This underscores the collaborative impact of value generation in fostering customer contentment and allegiance, aligning with the focus on sustainable value cultivation in the CE paradigm.

The unique aspect of our work is in the thorough analysis of SDI as distinct from SI. It is found that SDI, as an independent entity, affects the SI-CVC relationship, illustrating the intricate interplay of various innovation frameworks in determining consumer value. The existence of SDI has a regulating impact on the mediating influence of CVC in the connection between SI and CS. This indicates that SDI has the capability to either augment or diminish the value offered by SI, responding to the second research question. The combination of SI and SDI can thus form a basis for the development of DCs to build competitive advantage by delivering value. According to [17], DCs pertain to the strategic choices made by a firm within a particular business context, whereas OI facilitates the processes of sensing, seizing, and reconfiguring. This underscores the necessity of incorporating inventive approaches into the processes of delivering services, emphasizing the importance of integrating novel concepts and techniques into service provision in alignment with the principles of OI.

## Theoretical implications

According to [115], the ability and inclination of a firm to execute an organizational transformation are contingent upon its DCs. Consequently, DCs play a vital role in attaining CE [116]. This study emphasizes the significance of clearly distinguishing SI and SDI as distinct concepts, while also considering their integration within the broader framework of CE and OI. OI enhances collaboration and knowledge sharing, influencing both SI and SDI by integrating external innovations into SD processes, hence enhancing customer experiences. In this study, we examine how the two separate capabilities (SI and SDI) collaborate to build “combinative capabilities” [117] and produce value greater than the sum of the parts. The capabilities can reconfigure the resources in an ongoing manner to maneuver and accommodate market change [118]. Our findings demonstrated the advantage of applying both constructs together for the first time.

SI is found to have a positive and significant relationship with CVC, CS, and CL. The analysis reveals that, while SI is crucial, SDI moderates its relationship with CVC such that more value is created when more innovation is imbued in the SD process. The operand related to SDI needs to consider the environment of SD, which can be unique for each customer. According to the survey undertaken, the operand can be the phone (device or hardware) of the customer to which the service is being delivered. [30] emphasized that resource integration possibilities are unlimited. A new service that gets developed must factor in the delivery of the service to different customers. Hence, the operant resources need to work on the operand resources (a phone in this case), considering all the user interface challenges the user might experience while using the device. This resembles DCs working with other resources and capabilities to create value by sensing and seizing opportunities and redeploying and reconfiguring a firm’s resource base. This also adds to the theory by integrating the DCs into the S-D logic.

Through this integration, we acknowledge that value creation is not solely dependent on the possession of distinctive resources, but also on the ongoing dynamic reconfiguration and integration of these resources in collaboration with multiple actors. The DC framework facilitates the agility and responsiveness necessary to adjust to changing circumstances, whereas S-D logic offers a more comprehensive comprehension of value co-creation through intricate and dynamic interactions.

## Managerial implications

The investigation into the relationship between SI and SDI, along with the importance of CVC, provides valuable guidance for telecommunications industry managers who want to improve CS and strengthen CL. The telecommunications service industry is operating in a hypercompetitive environment, which has led to the commoditization of voice and data services, making it a bigger concern for CE. As a result of the substantial expansion resulting from rapid technological advancements, the telecom industry faces an urgent concern regarding sustainability. As the telecommunications business approaches commoditization, maintaining CL remains uncertain and fragile [119], [120]. The establishment of this infrastructure often necessitates the acquisition of new equipment, which places a burden on the global supply of raw materials and necessitates increased power consumption due to the densification of networks [121].

The integrated perspective of S-D logic and DC view suggests that organizations should prioritize the development of DCs that enable the co-creation of value by integrating resources with a variety of stakeholders. This method not only improves CS, CL and CVC, but also guarantees that the organization remains adaptable and responsive to market fluctuations. Recognizing the temporary nature of CL, telecommunications companies often carry out CS surveys to obtain crucial insights into changing consumer preferences and expectations. These insights are crucial for R&D, marketing, and customer service efforts, enabling managers to proactively meet changing client expectations. In addition to immediate operational improvements, the industry's trajectory requires the implementation of CE concepts and OI methodologies. Telecom managers may reduce waste, extend product lifecycle, and provide environmentally friendly services using CE principles like recycle, reuse, repair, and remanufacture, aligning it with UN sustainable development goals and ITU’s Connect-2030 Agenda (ITU-T L.1031[[3]](#footnote-3)) [96]. The managers must prioritize customer-centric, value-creating innovations that follow CE and OI principles.

## Limitations and future research

No study is without limitations, and we are cognizant of some of our own. The survey was designed to capture the views of mobile service users. Kolkata, India's third-largest city, received 60% of the responses, with the balance coming from other cities. The study's limitations include only an urban, educated, English-speaking population.  Additionally, there might be other facets of the mobile service MNO company that add value to customers but haven't been fully or even partially covered by SI. A future study can focus on the Indian rural telephony market. Comparing rival organizations' innovations from the standpoint of OI and CE leading to CVC adds another dimension. Further research on secondary data on customer porting from one firm to another is possible, as well as comparing different state models and MNOs to see which has lost and gained the most customers and why. The current study did not differentiate between retail and corporate customers, which can be used as a differentiator in future studies.

# CONCLUSION

## This study, for the first time, uses two innovation constructs, SDI and SI, to understand their impacts, individually and in conjunction, on the created value to generate CS and CL. From a broader standpoint, it becomes increasingly evident that SI and SDI are crucial elements of the overarching notion of OI. OI principles not only facilitate these features but also play a pivotal role in directing enterprises towards embracing CE principles. Shifting external factors and industry competition compel enterprises to have the capability to address evolving customer preferences. The integration of CE concepts into SI and SD amplifies the influence of these principles and showcases a commitment to generating sustainable value. Hence, establishing a conducive environment for OI not only fosters uniqueness but also facilitates the adoption of CE techniques, ultimately driving the generation of customer value, satisfaction, and loyalty in a dynamic market.

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**Appendix: Tables**

TABLE A.1: SAMPLE COMPOSITION FOR STUDY

(N=435)

|  |  |  |
| --- | --- | --- |
| **Age** | 18-24 | 50% |
| 25-34 | 13% |
| 35-44 | 9% |
| 45-54 | 22% |
| 55-64 | 4% |
| Above 64 | 1% |
| **Gender** | Male | 62% |
| Female | 38% |
| **Education Level** | < 12th grade | 2% |
| 12th grade pass | 26% |
| Graduate | 26% |
| Post graduate | 42% |
| Other | 3% |
| **Occupation** | Student | 49% |
| Private service | 19% |
| Government service | 5% |
| Business | 9% |
| Professional | 11% |
| Homemaker | 4% |
| Other | 2% |
| **Mobile Service** | Prepaid | 70% |
| Postpaid | 30% |

TABLE A.2: FACTORS FROM CFA

|  |  |  |
| --- | --- | --- |
| **Construct** | **Item** | **Estimate** |
| Service Innovation | SI3 | 0.629 |
| SI10 | 0.685 |
| SI11 | 0.713 |
| Customer Value Creation | CVC11 | 0.76 |
| CVC12 | 0.831 |
| CVC13 | 0.728 |
| CVC14 | 0.761 |
| CVC15 | 0.811 |
| Service Delivery Innovation | SDI3 | 0.837 |
| SDI4 | 0.833 |
| SDI5 | 0.81 |
| SDI6 | 0.754 |
| SDI7 | 0.807 |
| SDI8 | 0.688 |
| SDI9 | 0.704 |
| SDI10 | 0.744 |
| Customer Satisfaction | CS1 | 0.855 |
| CS2 | 0.833 |
| CS3 | 0.861 |
| CS4 | 0.88 |
| CS5 | 0.787 |
| Customer Loyalty | CL2 | 0.762 |
| CL3 | 0.826 |
| CL4 | 0.826 |
| CL5 | 0.723 |
| CL6 | 0.805 |
| CL7 | 0.81 |
| CL8 | 0.809 |
| CL9 | 0.737 |
| CL10 | 0.805 |

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A person smiling for the camera

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   . [↑](#footnote-ref-1)
2. ITU-TL.1020: Guide for operators and suppliers on approaches to migrate towards circular ICT goods and networks. [↑](#footnote-ref-2)
3. ITU-T L.1031: Guideline for achieving the e-waste targets of the Connect 2030 Agenda [↑](#footnote-ref-3)