

# The Impact of Value Co-creation of Intellectual Capital on Student Sustainability Competencies with Sustainability Oriented Curriculum as Moderator

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## *Abstract*

*With the increased competition in higher education, the universities are looking for innovative ways to enhance the student sustainability competencies that could benefit the society. In this regard this research has proposed the value co-creation of intellectual capital for improving the student sustainability competencies. The independent variables of the study included human capital, structural capital and relational capital, and their individual impact was checked on the student sustainability competencies. The model also incorporated a moderator sustainability oriented curriculum, and its effect was checked on each relationship between each relationship. The research has validated the model through quantitative methodology. The students were the main respondent as it was intended to assess their competencies regarding the sustainability. A sample size of 384 students taken and a Five point Likert scale questionnaire was used to collect the data from the university students in Pakistan. For data analysis SEM-PLS was used. The empirical study validated the model and has also contributed to the literature and service dominant logic as the major theory for value co-creation in higher education sector. The study has also provided useful insights for the practitioners and future researchers. the practitioners can adapt the current learning activities for better sustainability competencies. The study provides opportunity for future researchers to expand the findings from the service providers' point of view i.e. the faculty and the university.*

**Keywords:** Value Co-Creation, Intellectual Capital, Human Capital, Structural Capital, Relational Capital, Higher Education.

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## **Introduction**

In the international educational arena, the growing developments in sustainability initiatives have made the issue highly relevant to the education sector (Pedro et al., 2020). Moreover, incorporating sustainability into the function and working model of Higher Education is the primary issue faced by Universities (Pedro et al., 2020). They need a more flexible atmosphere for students to increase their performance and efficiency in an environment where they can interact and co-create value to strengthen attributes, capabilities and to contribute more skills for the welfare of the community (Foroudi et al., 2019). This study highlights the role of co-creation in higher education and it summarizes and classifies prevailing research on co-creation and its impact in the field of university sustainability practices. Although co-creation started as a resource interaction strategy (Elsharnouby, 2015), this research incorporates the Value Co-creation strategy as means to achieve sustainability in Higher Education Institutes. The main driver of

value co-creation is intellectual capital in this study, which highlights the importance of operant resources in Higher education Institutes.

The Higher Education Institutes have an unquestionable duty and direct dedication to the development, retention of knowledge and new practices to turn them into value. Furthermore, they are also considered as the running engines of the society for meeting the needs and demands of society, solving urban problems, and helping organizations to sustain competitive differences that allow them to resolve the barriers involved (Rezende et al., 2017). Moreover, age, history, socio-economic status, possible career aspirations, ambitions, and desires of the students also vary and differ (Dollinger & Lodge, 2018). In addition, reduced government support, growth and globalization, increased competitiveness, and concerns regarding the importance of modern-age universities have contributed to a rising market orientation of universities (Dollinger et al., 2018). Therefore, the market is diversifying as the higher education sector intensifies and necessitates a proper strategy that may enhance the sustainability practices. In this regard this paper presents value co-creation as a viable option to enhance the competence in the higher education.

### **Problem Statement**

In Pakistan, it has been noted that HEIs are underperforming with respect to a standard curriculum, the motivation of students, and high expectations towards good quality of education and sustainability (Habib et al., 2021). Furthermore, in some cases, a lack of highly skilled and knowledgeable faculty, a lack of desire or dedication to the knowledge economy, as well as a limited budget for education, are common issues in higher education (Zahid et al., 2020). Due to the higher fee structure and poor financial assistance (or scholarships) for vulnerable students in the HEIs, a large number of talented students is either impaired or even deprived of higher education (Qureshi et al., 2012). In this context, the position and efforts of Higher Education Commission (HEC) Pakistan are quite commendable. The Commission has set up several accreditation councils to collaborate with relevant professional bodies to improve the quality of higher education, curriculum development, and research. Considering this transformative viewpoint, it is highly needed to redirect resources and the partnership between stakeholders engaged in HEI to change education based on sustainability practices (Leal Filho et al., 2019). Institutions must foster collaboration and discussion on sustainability issues in this current concept, reorienting them to current strategic models (Ferguson & Roofe, 2020). Furthermore, it is required that the higher education in Pakistan must direct more intangible resources towards enhancing the current performance and sustainable competence of the students. The poor recognition of students as skilled individuals needs to be elapsed and they must be taken as the co-creator of the services. Therefore, it is required that the co-creation efforts must be increased from both the service providers and users, in this regard the value co-creation of intellectual capital needs a proper model and implementation. The current study investigates the impact of value co-creation on the student sustainability competencies.

### **Aim of the Study**

The aim of this study is to investigate the impact of value co-creation of Intellectual capital on Student Sustainability Competencies with Sustainability oriented curriculum as moderator.

### **Research Objectives**

The study has the following objectives:

1. To investigate the impact of value co-creation in human capital on student sustainability competencies
2. To explore the impact of value co-creation in relational capital of student sustainability competencies

3. To investigate the impact of value co-creation in structural capital on student sustainability competencies.
4. To study the moderating effect of sustainability oriented curriculum between the human capital and student sustainability competencies.
5. To see the moderating effect of sustainability oriented curriculum between the relational capital and student sustainability competencies.
6. To explore the moderating effect of sustainability oriented curriculum between the structural capital and student sustainability competencies

## Literature Review

### Service Dominant Logic and HEI

Service Dominant Logic (SDL) as a marketing strategy which asserts that businesses (HE institutions), cannot provide isolated value instead give a proposition of value that the recipient (here student) who would subjectively perceive through value-in-use in an open network, i.e., value-in-context, affected by the socio-cultural context (Chandler & Vargo, 2011; Akaka et al., 2013; Díaz-Méndez et al., 2019). Recently, with the implementation of Service Ecosystem, Vargo and Lusch (2016) introduced a wider spectrum of SDL. By adding five Axioms, they have increased the scope of SD Logic for the future. Axiom 1 of the theory states that the fundamental pillar of the exchange is service. Axiom 2 states that multiple actors, including the beneficiary always help in value co-creation. Axiom 3 states that all social and economic actors are resource integrators. Axiom 4 focuses on the value is that is determined uniquely and phenomenological by the receiver. Axiom 5 stresses that co-creation of value is coordinated by actor-generated institutions and institutional arrangements (Vargo & Lusch, 2017).

SDL strategy focuses on interactions among different participants, beyond the bounds of the dyadic relationship between organization and customer, as well as the customer-centric orientation, towards a multilevel perspective where value is co-created jointly and cooperatively (Lusch & Vargo, 2014). Thus, higher education may be viewed as a networked system with an abundant resources that can be engaged with society to make progress in technology, institutional regulations, government educational programs/policies, alumni networks, and industrial ties, among other things (Díaz-Méndez et al., 2019). This notion is especially crucial in sharing systems, in which all participants collaborate to generate value (Lan et al., 2017). By its unique viewpoint on integrating resources deeper further into service system for actual and efficient creation of value, the inclusion of value co-creation into the HE service may well be broadened to society's sustainability (Aquilani et al., 2016).

### Value Co-creation in Higher Education

Value Co-creation (VCC) in the service context is defined as the joint value-creation between the service provider and the recipient and allows customers to design the service experience which best suits their needs and maximizes the benefits for both parties (Prahalad & Ramaswamy, 2004; Arnold, 2017). Through this, organizations and their customers can jointly define and resolve problems and can bring innovation while creating an experiential environment in which customers can engage in active communication and co-construct personalized experiences in an innovative way (Cossío-Silva et al., 2016; Prahalad & Ramaswamy, 2004; Foroudi et al., 2019). Members of the academic community are intrinsically skilled in co-creating value and establishing their inter-personal relationships and embracing a variety of roles (Strobacka et al., 2016). In strengthening the mechanism of co-creation in the university, its stakeholders have a vital position (Cossío-Silva et al., 2016).

Attempting to improve the ability of the universities to provide real value for society (Collins & Bethke 2017) has spawned plenty of management models and techniques in the higher education industry since the turn of the century (Smørvik & Vespstad, 2020). However, in this specific service environment, it is

difficult to comprehend what is meant by 'value' (Tight 1987; Tomlinson, 2018). The challenges that are transforming the strategic direction and organizational features of HEIs have blurred the idea of value in Higher Education (HE) (Pathak & Pathak 2010). These challenges include, for example, increasing external competitive pressures (Woodall et al., 2014) and the developing economic and social concerns brought on by globalization (Archer, 2002; Smørvik & Vespestad, 2020).

Nonetheless, most research efforts have focused on the requirements and expectations of a certain group of stakeholders, primarily students (Kalafatis & Ledden 2013; Elsharnouby 2015), who have already been designated as the key beneficiaries and clients of HEI services (Díaz-Méndez & Gummesson, 2012; Smørvik & Vespestad, 2020). The value of academic programs has been argued to be integrated into their contribution to students' personal and professional progress from this perspective (Elsharnouby, 2015; Smørvik & Vespestad, 2020). Given that value co-creation in HEI is based on active links between the university and students through effective communication relations, and that students participate actively in the system of producing value in order to gain knowledge and enhance transversal skills necessary for their later integration into the labour market (Perello-Marín, et al., 2018), this piece of research provides the co-creation method as a means to boost higher education sustainability development (Adom̄ent, et al., 2014).

### **Student Sustainability Competencies**

Competencies are becoming more widely recognized as important benchmarks for the designing of curricula and courses. Apparently are some distinctions between the notions of competencies, varying from minor terminological differences to more fundamental differences (Wiek et al. 2011; De Kraker et al. 2014). This research concentrate on moving forward with a convergent set of essential sustainability capabilities, backed up by a number of academics and researchers (Sterling & Thomas 2006; de Haan 2006; Barth et al. 2007; Frisk & Larson 2011; Wiek et al., 2011; Rieckmann 2012; Thomas & Day 2014; Steiner, 2013). These key competencies are (Wiek et al., 2011; Wiek et al., 2015) systems thinking competencies, future thinking competency, values thinking competence, strategic thinking competence, collaboration competence. Wiek et al. (2011) conducted an analysis of relevant literature on sustainability competencies in university education and identified five major competencies in sustainability education, they include: systems thinking competencies, anticipatory competencies, normative competencies, strategic competencies, and interpersonal competencies. These researchers imply an important sixth competency, specifically the meta-competence of effectively applying and integrating the five essential skills to solve sustainability concerns and promote sustainable development (Wiek et al., 2015).

Sustainability competencies have also been included in the program descriptions of undergraduate degrees by various international agreements (Lambrsechts et al., 2013; Segalàs et al., 2009; Cortés et al., 2010). As a result, international organizations such as UNESCO (2005; 2017), UNECE (2009), and accreditation agencies (Engineering Council 2013) have recognized the importance of establishing core competencies in sustainable development. The United Nations Educational, Scientific, and Cultural Organization (UNESCO) recently highlighted a set of educational activities for each of the 17 Goals outlined in the 2030 Agenda for Sustainable Development (UNESCO 2017). UNECE also tasked a group of Education for sustainable development (ESD) specialists with developing a framework for student ESD competencies (UNECE, 2012).

Additional empirical study in higher education is needed on the construction and deployment of evaluation practices for sustainability competencies (Cebrián et al., 2019; Cebrián & Junyent 2015). More study is needed to implement innovative and transformative education and learning methods, as well as transformative institutional activities that contribute to long-term sustainability (Barth & Rieckmann, 2016; Sterling et al., 2017). As a consequence, studies should concentrate on operationalising sustainability capacities, considering diverse stages of competence, and analyzing and evaluating students' competency growth (Wiek et al., 2016).

### Sustainability Oriented Curriculum

The changing dynamics of sustainability innovation drives universities to re-structure and widen their courses to be more real-world oriented across all programs by forming partnerships with business and other organizations (Tasdemir & Gazo, 2020). HEIs are seen as critical to achieving the current SDGs. If they comprehend the importance and dynamism of the sustainability challenges, any university or department can contribute to these curricular development activities. At that point, deciding whether to integrate sustainability vertically or horizontally becomes crucial (Tasdemir & Gazo, 2020). A need for social situations in HE teaching grows as a result of the trans-disciplinary requirement, necessitating a redefinition of academic objectives and predicted learning outcomes, which include assessment. Not only theoretical knowledge and its practical application but also a comprehension of the context of a given (learning) scenario, as well as the acquisition of other competencies, such as critical thinking, are regarded as key learning outcomes in this discipline (Dobson & Tomkinson, 2012). The structure of the educational environment, as well as its tools for active participation, must be examined in order to move teaching methods toward trans-disciplinarily (Dlouhá et al., 2018). Teacher-student interactions, and the (learning) setting, play no part in the 'knowledge transmission' model, in which the student is seen as a passive receiver of existing knowledge established outside the educational environment (Zsóka et al., 2013; Dlouhá et al., 2018).

### Conceptual Framework

Based on the review of literature presented, value co-creation has rarely been used in higher education (e.g. Elsharnouby, 2016; Flesichman et al., 2015; Gros & López, 2016), and thus a comprehensive model was needed to better understand how co-creation occurs and adapts to the higher education context (Dollinger & Lodge, 2020). The suggested conceptual model focuses on value co-creation by taking student as the co-creators in HEIs (Díaz-Méndez et al., 2019).

This approach also supports the idea that sustainability is difficult to pinpoint to a single aspect because the diversity of the student population will influence what is most important to them. However, the current model considers that the operator's participation in value co-creation can develop new competencies for the university, which can ultimately lead to a sustainable university, based on the frameworks provided by Pedro et al. (2020), Rossi and Magni (2017) and Maxwell-Stuart et al. (2018). This research examines the impact of value co-creation of intellectual capital (human, relational and structural capital) in higher education, on students' sustainability competencies (Faham et al., 2017).

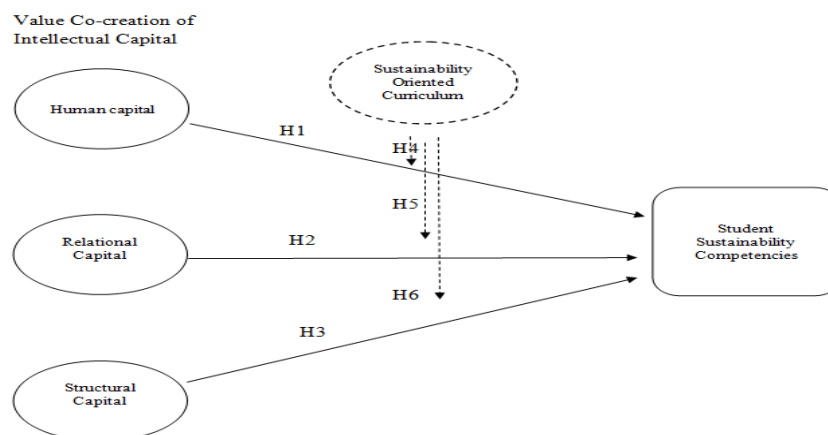


Fig. 1: Conceptual Model

Universities should build teaching and learning environments that promote co-creation and sustainability (Figueiró & Raufflet, 2015). This clarifies the role of sustainability-oriented education as a moderator in the existing paradigm, which may be defined by characteristics such as inter- and trans-disciplinary learning, participation, problem-solving, and the integration of formal and informal learning (Barth and Rieckmann, 2012; Figueiró & Raufflet, 2015).

## Hypotheses Development

### Value Co-creation and Intellectual capital

This study proposes universities a value-co-created model that seeks to provide a versatile context for the concept and application of intellectual capital assessment and management approaches for sustainability practices in HEIs. The system, therefore, suggests a phased framework for implementing a step-by-step transition within a university-based on the existing level of importance of VCC activities and sustainability. Secundo et al. (2017) further argued that the value of IC as a competitive asset, lies in the linkages behind them and the activities; all of this enables us to identify, measure, report and disclose organizational knowledge (Uden & Vecchio, 2018). It was recognized, even in the beginning that every aspect of IC (i.e. human, structural and relational) should not be taken in isolation (Edvinsson & Malone, 1997) and it makes sense to investigate their interrelations in HEIs. Therefore, a combined effect of components of IC should be examined on performance (Davey et al., 2017; Sultanova et al., 2017). A detailed examination of human, structural and relational capital components along with their VCC resource integration capabilities is discussed in the following section.

#### a) Relationship between Value Co-Creation of Human Capital and Student Sustainability Competencies

Human capital is the primary component of IC (Cabrita & Vaz, 2006), because human interaction is the basic source of intangible value in the knowledge age. Human capital comprises of staff of an organization and their attributes, such as knowledge, experience, skills, individual values, attitudes, abilities, commitment, behaviour, motivation, potential for innovation, creativity, know-how, expertise, capacity for teamwork, talent, adaptability of employees, openness of ambiguity, satisfaction, learning strength, skills, loyalty, formal training and education (OECD 2008; Bontis, 1999; Hussinki et al., 2019; Martín et al., 2011; Khalid, 2017).

The previous studies argue that the university human resource is inherently capable of VCC as they manage various interactions that are based on their performance and duties in the university (Adamson, 2009; de Fátima et al., 2021; Dollinger & Lodge, 2020). Gupta and Roos (2001) added that "core intellectual capital" which includes competence, attitude and intellectual agility is the strength of value creation synergies. This eventually increases the student competencies and they become more capable of creative and critical thinking, problem solving and decision making. Cebrián and Junyent (2015) highlighted the importance of value co-creation in increasing the sustainability competencies of students by improving teamwork, critical reasoning and innovative thinking. As students learn basic pattern of sustainability and develop skills and attitude towards the sustainability, they become active citizens that are aware and conscious of their actions towards sustainable development. Therefore this study proposes the following hypothesis:

H1: Value co-creation of Human capital has a positive impact on the student sustainability competencies.

#### b) Relationship between Value Co-Creation of Relational Capital and Student Sustainability Competencies

Education has never been an isolated service; it has always been a collaborative effort between the learner and the institution, and as such, it is built on relationships (Ramírez-Córcoles et al., 2012). These networks

and the other business networks increase the relational resources which can enhance the co-creation activities. As a result of the impact on other variables, the amount of Value Co-creation at university may increase (García-Peñalvo et al., 2013; Cavallone et al., 2021). Relational capital of University represents the comprehensive array of cultural, political and institutional connections that have been formed and retained between HEIs and their non-academic stakeholders (companies, NGOs, local government and general society), as well as other views of the organization in terms of its identity, attractiveness, trustworthiness and security, among others (Ramírez-Córcoles et al., 2012). It involves the tools related to the organizational external relations, such as its interactions with its clients, suppliers, partners and the community and the expertise embedded in those relationships (Bontis, 1998, Hussinki et al., 2019).

The involvement of students in developing and expanding relations with other universities and organizations improves their interpersonal and communication skills. The interaction with other developed institutes broadens the vision of students and helps in exploring the underlying issues of the society that needs to be resolved. Furthermore, the opportunity to learn from other sources outside the jurisdiction of university facilitates students to develop entrepreneurship skills. The students self efficacy and confidence helps them in taking voluntary steps for exploring the learning resources for self fulfilment, that could develop skills and attitude towards the sustainability (Ramírez-Córcoles et al., 2012). The following hypothesis has been presented in order to study the impact of relational capital on the student sustainability competencies:

H3: Value co-creation in structural capital has a positive impact on student sustainability competencies.

#### **c) Relationship between Value Co-Creation of Structural Capital and Student Sustainability Competencies**

Structural capital comprises of all non-human storages of organizational information (Bontis et al., 2000). Significantly diverse from human capital, structural capital can be described as the knowledge that stays in the organization even though workers go home or change their workplace (Hussinki et al., 2019). The development of ICT and infrastructure helps in the development of a better social network between teachers and students (Gronroos & Helle, 2010; Frow et al., 2015). On one hand, due to a better academic environment and web-based interactions, the teaching quality improves due to prompt and better feedback. Similarly on the other hand studies also show that such ICT infrastructures help in better communication among the students which strengthens the student networks (Pedro et al., 2019).

According to Marr (2005), it is the substance enabling the organizations to advance. Mesa (2007), appreciates the logic of Marr's focus on value-creation of organizations and individuals. Ferenhof et al. (2015) says that SC is capital for creativity, process capital, technical capital and organizational capital. This shows that well-functioning organizational processes and technology, based on structural capital, are also expected to improve the pace at which services are provided to the students and society (Hussinki et al., 2019). The current COVID-19 pandemic also shows that the development of SC helps in smooth functioning of universities in uncertain situations. This further helps in enhancing the skills of students to cope up the uncertain situation with technological advancement and move towards innovative solutions for the betterment of the society. In this regard Morgan (2020) also asserts that better utilization of technological tools enhances students' remote working skills, which could help them in finding jobs that could reduce the carbon impact by less movement of employees. So the value co-creation in structural capital, by the students and university might help in enhancing the student sustainability skills. The following hypothesis has been presented in order to study the impact of structural capital on the student sustainability competencies:

H3: Value co-creation in structural capital has a positive impact on the student sustainability competencies

#### d) Value Co-creation and sustainability Competencies and Sustainability Oriented Curriculum (Moderator)

According to Bovill and Woolmer, (2019) researchers and practitioners have collaborated to develop curricula in a variety of ways. In some cases, students develop courses from the bottom up (Woolmer et al. 2016), and in others, students develop the curricula as the course unfolds (Cook-Sather et al. 2014). The integration of sustainability related courses was seen both vertically (through specific standalone sustainability related courses) as well as horizontally (through sustainability themes integrated with discipline related subject and courses across the entire curriculum) in previous studies (Wu et al., 2011; Barrella & Watson, 2016). Students can work with staff on curriculum development committees (Mihans et al. 2008). Shephard (2008), demonstrates that teaching and evaluating higher education relies primarily on cognitive skills and expertise knowledge instead of on the functional domain (values, behaviours and attitudes), while sustainability education may be supported by focusing on an effective domain. The knowledge building and career development of science members in sustainable development research allows universities to strengthen the sustainability skills of students (Barth & Rieckmann, 2012).

Despite the necessity for Sustainable Development to be included in curricula (Shriberg, 2004; Abdul-Wahab et al., 2003), as well as some attempts to integrate it into courses, institutions, and universities, progress has been gradual (Thomas, 2004; Boks and Diehl, 2006; Velazquez et al., 2005). There has been little research done to try to understand why SD has been incorporated into university curricula (Thomas, 2004; Velazquez et al., 2005; Quist et al., 2006; Sammalisto & Lindhqvist, 2008). Therefore, while keeping the importance of enhancing the co-creation effort towards improved sustainability competencies with better curricula this study incorporated the sustainability-oriented curriculum as a moderator between value co-creation and sustainability competencies. The following hypotheses have been presented in order to study the impact of sustainability oriented curriculum as moderator:

H4: Sustainability oriented curriculum has moderating effect between the human capital and student sustainability competencies.

H5: Sustainability oriented curriculum has moderating effect between the relational capital and student sustainability competencies.

H6: Sustainability oriented curriculum has moderating effect between the structural capital and student sustainability competencies.

### Methodology

This study aims to measure the impact of value co-creation impact on student sustainability competencies and moderating role sustainability-oriented curriculum. To achieve the objective of study data was collected from the final semester students at public and private sector universities in Pakistan. Gefen et al. (2011) suggest a minimum sample size 200 for a moderately complex model. Total 384 responses were obtained through floating the questionnaire on social media. So, the sample size for this study is 384, where respondents are from both genders, belonging to varied age groups and educational backgrounds. They were asked that they have idea of sustainable development or not. Moreover, their university is applying sustainable development plans or not. The data were collected in a non-contrived setting and respondents were supposed to fill out the questionnaire, following their own free will. This study develops a questionnaire evaluating many constructs based on a well-established instrument. Value co-creation construct is based on three dimensions of Human capital, Structural capital and Relational capital from the scale adapted from Pedro et al., (2019) Khalid, (2017), Córcoles et al., (2013) and Rossi and Magni, (2017). Student sustainability Competencies is another important construct which comprises of two dimensions namely Attitude and Skills from the scale adapted from the studies of Faham et al., (2017) and Erskine and Johnson, (2012), Sustainability Oriented Curriculum was measured with scale adapted from the studies of



Ceulemans and De Prins, (2010), Kurucz et al., (2014), Erskine and Johnson, (2012) and Lozano et al., (2013). Firstly, a questionnaire was distributed to 111 students for pre-testing purposes. The questionnaire was developed using a five-point Likert scale that ranged from 1 (Strongly disagree) to 5 (Strongly agree). The convenience sample approach was used to collect data from respondents. The convenience sampling helps in identifying and contacting the most conveniently available respondents for the study (Etikan, 2016). The questionnaire was uploaded on Google Docs, and all the respondents, identified through formal and informal contacts, were given the link to the questionnaire. The questionnaire was uploaded on Google Docs, and all the respondents, identified through formal and informal contacts, were given the link to the questionnaire. Using the G\*Power software<sup>1</sup>, a total of 384 respondent student's replies were obtained and selected for the study. As data was collected from the single source which may cause the issue of biasness, therefore to evaluate the biasness Hermon single factor test was applied which revealed that there is no issue of biasness.

### Data Analysis

The researcher distributed an online questionnaire to participants to collect data. Informed permission was obtained from each participant, and all ethical guidelines were followed to guarantee the validity of the data and maintain human rights. Participants may fill out the survey whenever it was convenient for them, and confidentiality was guaranteed. The questionnaire may be completed without restriction after receiving permission, and participants were free to stop at any point if they changed their minds. The study's importance was explained to them, and no risk was involved. The gathered information was input and coded in SPSS and then subjected to analysis using Smart PLS 3.0 (Hair et al., 2011; Ringle et al., 2015). Smart PLS 3.0 was used to calculate the structural equation modelling-variance based (SEM-VB) of the structural model (Ringle et al., 2015). A two-stage analytical method was developed following the use of descriptive statistics, which included evaluations of the assessment model and the structural models (Hair et al., 2016). In comparison to a one-step evaluation, the two-step method is more effective (Hair et al., 1998). The measurement model measures the construct, while the structural model measures the relationship between the constructs (Hair et al., 2016). The study uses Smart PLS 3.0 to analyze the structural and measurement model due to the method's ability to conduct a comprehensive evaluation (Barclay et al., 1995).

### Assessment of Measurement Model

The measurement model was tested for validity and reliability using convergent and discriminant validity. The degree of consistency, accuracy, and dependability of the findings produced by the items considered mostly in model for measurement is known as reliability. After conducting a reliability test, the results showed that Cronbach's alpha of 0.818 of Human capital, .836 for Structural Capital, 0.829 for Relational Capital, 0.886 for Sustainability Oriented Curriculum and the Student Sustainability Competencies was observed to be 0.920. Since the data range in between 0.7 and 1, it denotes that they are reliable. High loadings were found for the variables, which demonstrate the factor reliability. High factor loading is indicated by values larger than 0.70 (Kannan & Tan, 2005). All the study's items have higher factor loadings, as seen in Table 3. Convergent validity was measured in the study using the average variance extracted (AVE). The value for each AVE was greater than 0.5, indicating that the measurement items are acceptable. The suggested value of AVE is higher than 0.5. As seen in Table 3, the AVE therefore satisfies the requirements for convergent validity. Additionally, it was discovered that the composite reliability for every variable was above 0.5, demonstrating the reliability of the measurement items.

Table 1: Loadings, Median, Standard deviations, Cronbach's alpha, AVE, CR

Constructs	Constructs	Item	Loadings	Cronbach's alpha	AVE	CR
Value Cocreation	Human Capital	HC1	0.489	0.818	0.518	0.863
		HC2	0.695			
		HC3	0.735			
		HC4	0.803			
		HC5	0.830			
		HC6	0.712			
	Structural Capital	SC1	0.777	0.836	0.629	<b>0.874</b>
		SC2	0.768			
		SC3	0.832			
		SC4	0.855			
		SC5	0.846			
		SC6	0.809			
		SC7	0.646			
	Relational Capital	RC1	0.699	0.829	0.542	0.876
		RC2	0.611			
		RC3	0.725			
		RC4	0.799			
		RC5	0.832			
RC6		0.732				
Sustainability Oriented Curriculum	Horizontal Integration	CHI1	0.776	0.886	0.525	0.908
		CHI2	0.815			
		CHI3	0.812			
		CHI4	0.816			
		CHI5	0.713			
	Vertical Integration	CVI1	0.863	0.847	0.689	0.898
		CVI2	0.866			
		CVI3	0.877			
		CVI4	0.700			
Student Sustainability Competencies	Attitude	SCA1	0.629	0.836	0.611	0.874
		SCA2	0.744			
		SCA3	0.793			
		SCA4	0.792			
		SCA5	0.736			
	Skills	SCS1	0.767	0.881	0.568	0.918
		SCS2	0.909			
		SCS3	0.892			
		SCS4	0.861			

NOTE: HC=Human Capital, SC= Structural Capital, RC= Relational Capital, CHI= Sustainability Oriented Curriculum (Horizontal Integration), CVI= Sustainability Oriented Curriculum (Vertical Integration), Student Sustainability Competencies=SSC, Attitude (SCA), Skills (SCS)

Cross-loadings and HTMT correlation ratios were used to examine discriminant validity. As shown in Table 4, for determining the discriminant validity of indicators cross-loadings are the first stage. The study meets the requirement for outer loadings to above cross loadings, hence proving discriminant validity.

Table 2: Cross-loadings

	CHI	CVI	HM	RC	SC	SCA	SCC	SCS	SOC
CHI1	0.776	0.467	0.399	0.524	0.643	0.450	0.576	0.618	0.711
CHI1	0.776	0.467	0.399	0.524	0.643	0.450	0.576	0.618	0.711
CHI2	0.815	0.461	0.461	0.480	0.616	0.463	0.538	0.561	0.730
CHI2	0.815	0.461	0.461	0.480	0.616	0.463	0.538	0.561	0.730
CHI3	0.812	0.413	0.376	0.462	0.481	0.370	0.478	0.431	0.698
CHI3	0.812	0.413	0.376	0.462	0.481	0.370	0.478	0.431	0.698
CHI4	0.816	0.473	0.425	0.417	0.400	0.277	0.518	0.386	0.728
CHI4	0.816	0.473	0.425	0.417	0.400	0.277	0.518	0.386	0.728
CHI5	0.713	0.608	0.318	0.320	0.397	0.285	0.422	0.373	0.733
CHI5	0.713	0.608	0.318	0.320	0.397	0.285	0.422	0.373	0.733
CVI1	0.592	0.863	0.406	0.386	0.489	0.368	0.472	0.440	0.796
CVI1	0.592	0.863	0.406	0.386	0.489	0.368	0.472	0.440	0.796
CVI2	0.509	0.866	0.361	0.267	0.404	0.351	0.464	0.317	0.745
CVI2	0.509	0.866	0.361	0.267	0.404	0.351	0.464	0.317	0.745
CVI3	0.534	0.877	0.407	0.422	0.428	0.371	0.545	0.339	0.766
CVI3	0.534	0.877	0.407	0.422	0.428	0.371	0.545	0.339	0.766
CVI4	0.395	0.700	0.388	0.397	0.439	0.419	0.455	0.310	0.598
CVI4	0.395	0.700	0.388	0.397	0.439	0.419	0.455	0.310	0.598
HC1	0.070	0.165	0.489	0.108	0.129	0.179	0.140	0.034	0.125
HC2	0.274	0.262	0.695	0.288	0.306	0.286	0.334	0.222	0.299
HC3	0.309	0.271	0.735	0.311	0.344	0.300	0.354	0.268	0.325
HC4	0.418	0.387	0.803	0.377	0.416	0.391	0.477	0.300	0.450
HC5	0.461	0.376	0.830	0.408	0.523	0.503	0.527	0.360	0.470
HC6	0.446	0.458	0.712	0.381	0.450	0.404	0.610	0.340	0.501
RC1	0.432	0.246	0.337	0.699	0.405	0.348	0.532	0.322	0.388
RC2	0.405	0.330	0.381	0.611	0.302	0.225	0.509	0.272	0.413
RC3	0.428	0.372	0.392	0.725	0.342	0.298	0.399	0.269	0.448
RC4	0.410	0.357	0.285	0.799	0.389	0.332	0.368	0.309	0.430
RC5	0.435	0.326	0.330	0.832	0.431	0.425	0.408	0.287	0.430
RC6	0.373	0.331	0.349	0.732	0.429	0.440	0.409	0.268	0.395
SC1	0.567	0.470	0.569	0.476	0.500	0.470	0.777	0.356	0.581
SC2	0.535	0.424	0.461	0.462	0.411	0.384	0.768	0.295	0.539
SC3	0.486	0.435	0.526	0.459	0.482	0.496	0.832	0.305	0.515
SC4	0.568	0.530	0.502	0.493	0.554	0.514	0.855	0.408	0.613
SC5	0.488	0.536	0.500	0.403	0.501	0.456	0.846	0.376	0.569
SC6	0.491	0.409	0.416	0.506	0.486	0.407	0.809	0.401	0.506
SC7	0.435	0.420	0.419	0.488	0.383	0.318	0.646	0.315	0.479
SCA1	0.282	0.385	0.391	0.453	0.497	0.629	0.342	0.177	0.367
SCA1	0.282	0.385	0.391	0.453	0.497	0.629	0.342	0.177	0.367

SCA2	0.394	0.361	0.424	0.433	0.653	0.744	0.448	0.331	0.424
SCA2	0.394	0.361	0.424	0.433	0.653	0.744	0.448	0.331	0.424
SCA3	0.327	0.288	0.330	0.395	0.646	0.793	0.397	0.287	0.346
SCA3	0.327	0.288	0.330	0.395	0.646	0.793	0.397	0.287	0.346
SCA4	0.352	0.294	0.337	0.239	0.636	0.792	0.424	0.282	0.365
SCA4	0.352	0.294	0.337	0.239	0.636	0.792	0.424	0.282	0.365
SCA5	0.373	0.354	0.408	0.278	0.648	0.736	0.433	0.355	0.408
SCA5	0.373	0.354	0.408	0.278	0.648	0.736	0.433	0.355	0.408
SCS1	0.362	0.279	0.196	0.250	0.584	0.223	0.210	0.767	0.363
SCS1	0.362	0.279	0.196	0.250	0.584	0.223	0.210	0.767	0.363
SCS2	0.499	0.327	0.294	0.300	0.703	0.269	0.351	0.909	0.469
SCS2	0.499	0.327	0.294	0.300	0.703	0.269	0.351	0.909	0.469
SCS3	0.526	0.356	0.344	0.326	0.738	0.341	0.386	0.892	0.499
SCS3	0.526	0.356	0.344	0.326	0.738	0.341	0.386	0.892	0.499
SCS4	0.643	0.474	0.466	0.440	0.808	0.480	0.535	0.861	0.633
SCS4	0.643	0.474	0.466	0.440	0.808	0.480	0.535	0.861	0.633

**NOTE:** HC=Human Capital, SC= Structural Capital, RC= Relational Capital, CHI= Sustainability Oriented Curriculum (Horizontal Integration), CVI= Sustainability Oriented Curriculum (Vertical Integration), Student Sustainability Competencies=SSC , Attitude (SCA), Skills (SCS)

Discriminant validity of variables was tested using the HTMT correlation ratio. This method evaluates the correlation between the variables to evaluate the HTMT of the correlations. HTMT is a useful criterion since it achieves the lowest specificity rates of any simulation condition. Results from the HTMT that are close to 1 indicate that the test lack discriminant validity. HTMT uses a predetermined threshold as a comparison point. A higher HTMT value indicates that discriminant validity is lacking. The HTMT threshold that is suggested is 0.85. As indicated in Table 5, all the HTMT (Heterotrait-Monotrait) correlation ratio test values indicate that discriminant validity has really been demonstrated, i.e., less than 0.85.

Table 3: HTMT

	CHI	CVI	HM	RC	SCA	SCC	SCS
CHI							
CVI	0.723						
HM	0.554	0.534					
RC	0.674	0.537	0.539				
SC	0.756	0.630	0.602	0.626			
SCA	0.572	0.562	0.596	0.589			
SCC	0.739	0.670	0.656	0.695	0.650		
SCS	0.686	0.483	0.403	0.450	0.451	0.483	

**NOTE:** HC=Human Capital, SC= Structural Capital, RC= Relational Capital, CHI= Sustainability Oriented Curriculum (Horizontal Integration), CVI= Sustainability Oriented Curriculum (Vertical Integration), Student Sustainability Competencies=SSC, Attitude (SCA), Skills (SCS)

**Assessment of Structural Model**

The structural models are evaluated using beta ( $\beta$ ), t-values and  $R^2$  with 5,000 resamples using the bootstrapping technique (Hair et al., 2016);emphasized the significance of overall effect size  $f^2$ ,Because the p-value simply confirms the presence of an impact and does not provide information on its size, The effect size is also determined by  $f^2$ .Both p-value (statistical significance) and effect size (substantive significance) impact size are significant in reporting and interpreting results. Applying the Cohen 1998 recommendations of low, medium, and high effect sizes, respectively, of 0.02, 0.15, and 0.35.Table 6 shows the existence of substantial significance.

**Results**

The model's hypotheses were evaluated with "partial least squares" (PLS), and the outcomes were examined with the path model, as shown in Figures 1 and 3. The R-square result of model show that model is 52% significant or overall change in model due to all IVs is 52% and model is considered a good fit. The results show a significant link between Human Capital and Student Sustainability Competencies ( $\beta=0.161$ ,  $t=3.235$ ,  $p=0.001$ ), which supports H1, as the hypothesis proposed a positive relationship.

The link studied between Structural Capital and Student Sustainability Competencies was observed to be significant, i.e.,  $\beta=0.136$ ,  $t=2.238$ ,  $p=0.023$ ; this finding supports H2.According to H3, Relational Capital has a positive association with Student Sustainability Competencies, i.e.,  $\beta=0.140$ ,  $t=3.335$ ,  $p=0.001$ . The association between Human Capital and Student Sustainability Competencies moderated by Sustainability Oriented Curriculum were found to be significantly negative i.e.,  $\beta=-0.123$ ,  $t=2.834$ ,  $p=0.000$ ; this finding supports H5 (see Figure 1).

The association between Relational Capital and Student Sustainability Competencies moderated by Sustainability Oriented Curriculum was observed to be significantly strengthen the relationship, i.e.,  $\beta=0.074$ ,  $t=1.826$ ,  $p=0.013$ ; this outcome supports H6 (see Figure 2). The final proposed hypothesis that Structural Capital and Student Sustainability Competencies moderated by Sustainability Oriented Curriculum was significantly positive, and the outcomes do support H7 ( $\beta=0.339$ ,  $t=1.980$ ,  $p=0.040$ ) (See Figure 3).

Table 4: Hypotheses Testing

	Hypotheses	Path coefficients	$F^2$	T-value	p-value	UL	LL	Hypothesis testing	VIF
H1	HM-SC	0.161	0.029	3.235	0.001	0.159	0.159	Supported	1.702
H2	RC-SC	0.140	0.021	3.336	0.001	0.023	0.023	Supported	1.690
H3	SCC-SC	0.136	0.015	2.238	0.023	0.038	0.014	Supported	2.429
H4	SOC*HM-SC	0.123		2.834	0.000	-0.188	-0.073	Supported	
H5	SOC*RC-SC	0.074		1.826	0.013	-0.155	-0.025	Supported	
H6	SOC*SCC-SC	0.059		1.980	0.040	0.007	0.170	Supported	

**NOTE:** HC=Human Capital, SC= Structural Capital, RC= Relational Capital, CHI= Sustainability Oriented Curriculum (Horizontal Integration), CVI= Sustainability Oriented Curriculum (Vertical Integration), Student Sustainability Competencies=SSC , Attitude (SCA), Skills (SCS)

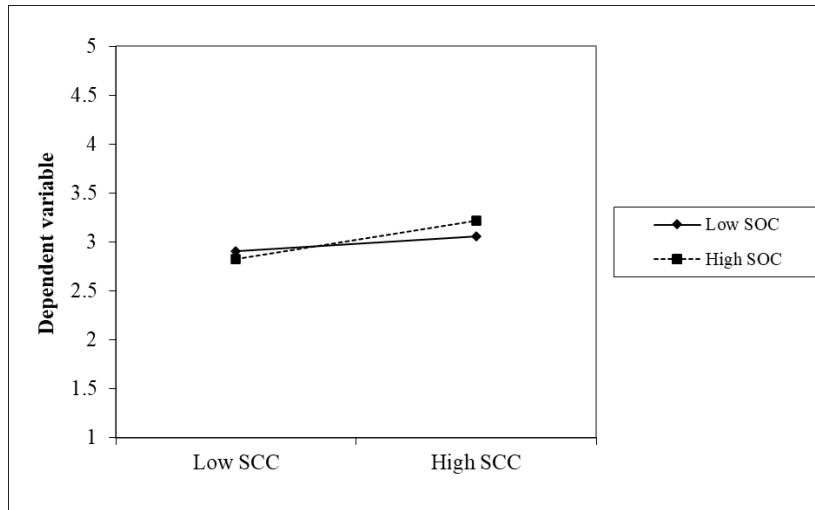


Figure 2: HM\*SOC

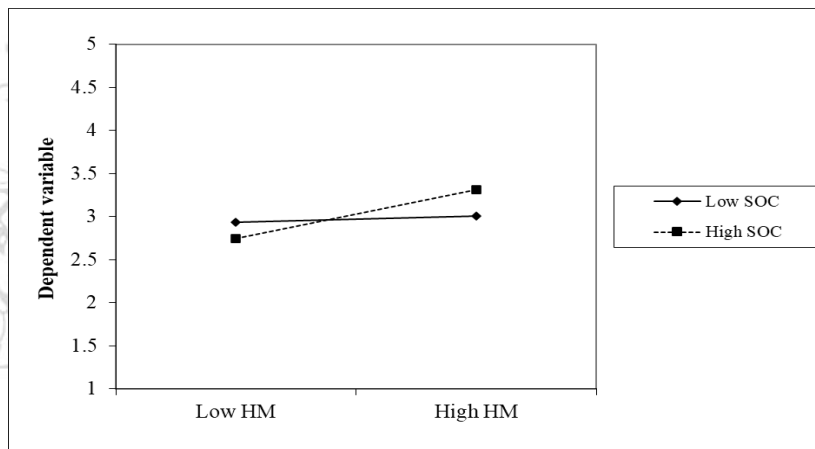


Figure 3:RC\*HM

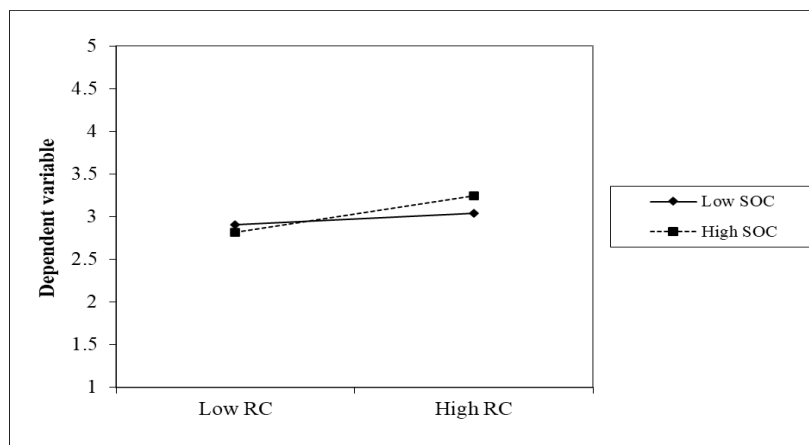


Figure 4:SCC\*SOC

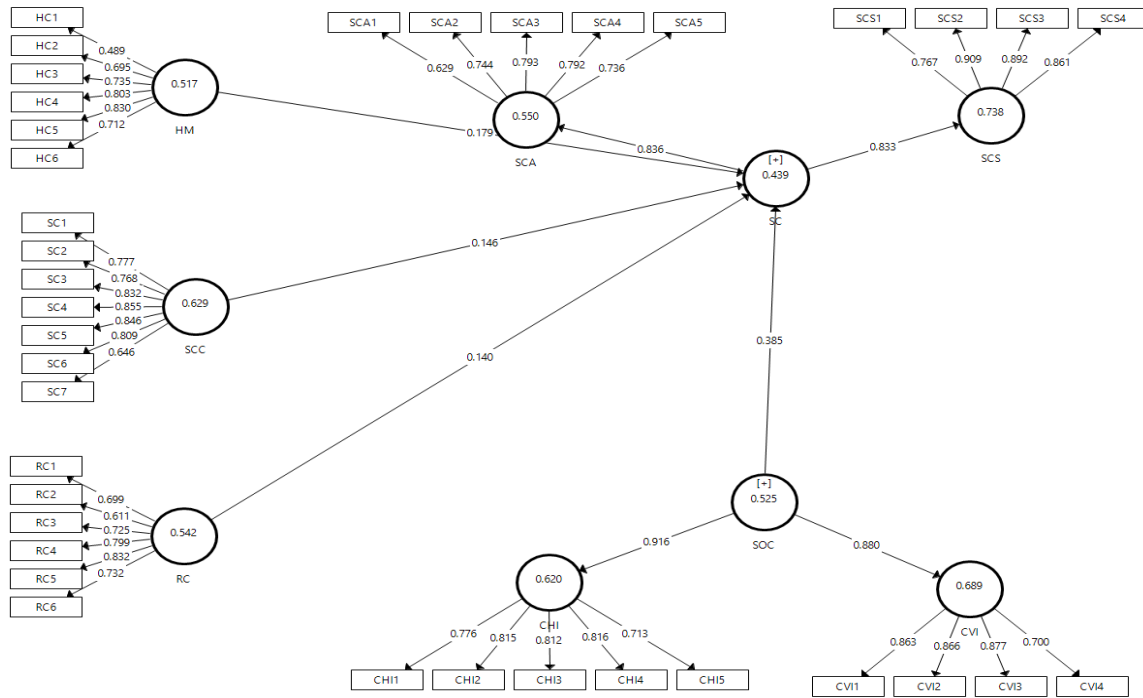


Figure 5: Measurement Model

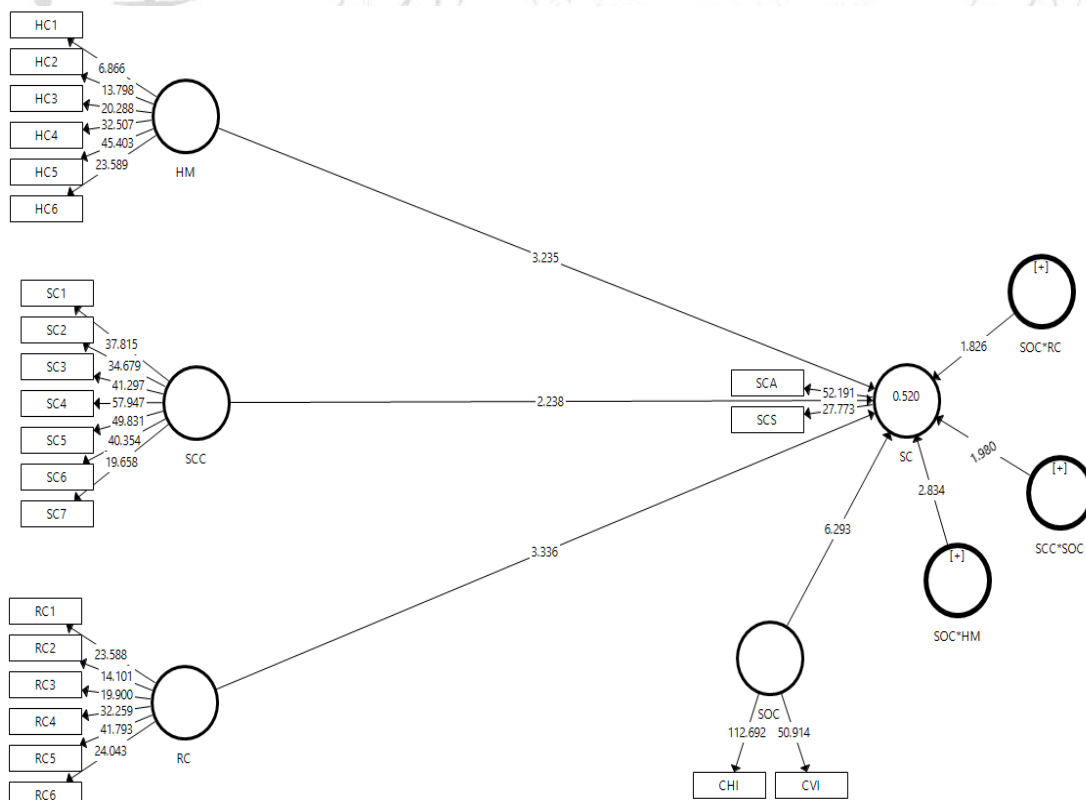


Figure 6: Structural Model

**PLS-Predict**

To evaluate the predicted performance of the model, predictive relevance was used. Cross evaluation with holdout samples was used to assess predictive validity, as said (Shmueli et al., 2016).As indicated in the table below, RMSE, MAE, and MAPE were lower than the corresponding number in LM. This indicates that the model has strong out-of-sample predictive power.

Table 5: PLS-Predict Summary

	PLS				LM				PLS-LM			
	RMSE	MAE	MAPE	Q <sup>2</sup> -Predict	RMSE	MAE	MAPE	Q <sup>2</sup> -Predict	RMSE	MAE	MAPE	Q <sup>2</sup> -Predict
SCA1	0.795	0.609	20.586	0.253	0.831	0.613	21.592	0.183	-0.036	-0.004	-1.006	0.07
SCA2	0.714	0.554	17.057	0.32	0.752	0.573	18.568	0.246	-0.038	-0.019	-1.511	0.074
SCA3	0.75	0.583	17.207	0.201	0.763	0.572	17.251	0.174	-0.013	0.011	-0.044	0.027
SCA4	0.85	0.654	21.843	0.222	0.882	0.661	23.43	0.163	-0.032	-0.007	-1.587	0.059
SCA5	0.823	0.647	21.781	0.286	0.869	0.676	24.668	0.204	-0.046	-0.029	-2.887	0.082
SCS1	1.105	0.821	38.047	0.157	1.142	0.856	40.651	0.1	-0.037	-0.035	-2.604	0.057
SCS2	0.985	0.763	29.772	0.215	0.993	0.759	31.288	0.202	-0.008	0.004	-1.516	0.013
SCS3	0.92	0.736	26.943	0.266	0.937	0.729	28.478	0.239	-0.017	0.007	-1.535	0.027
SCS4	0.686	0.503	16.78	0.487	0.734	0.561	19.796	0.413	-0.048	-0.058	-3.016	0.074

**NOTE:** HC=Human Capital, SC= Structural Capital, RC= Relational Capital, CHI= Sustainability Oriented Curriculum (Horizontal Integration), CVI= Sustainability Oriented Curriculum (Vertical Integration), Student Sustainability Competencies=SSC , Attitude (SCA), Skills (SCS)

**Discussion**

The impact of co-creation of intellectual capital on student sustainability competencies in the higher education of Pakistan has been validated in this study. This particular study also implies that by co-creating human, structural and relational capital improves the student sustainability competencies with a sustainability oriented curriculum as the mediator.

The findings of this study also encourage the higher education institutes to engage students in various activities for improving the sustainability competencies of students. Earlier studies have also confirmed that involving students in value co-creation enhances their sustainability competencies (Cebrián & Junyent 2015; Keeys & Huemann, 2017; Cebrián et al., 2019). However, those studies mostly focused on the behavioral aspect of the value co-creation and rarely addressed the complete resource integration aspect. A few studies have further linked the value co-creation to improved trust and commitment of students that benefits in building long term relationships (Perello-Marín et al., 2018; Foroudi et al., 2019). The participation of students and staff in the advancement of the human capital empowers students and removes the barriers that inhibit students from playing their active role. The active participation has two fold benefits; it improves the satisfaction in the higher education institute and also incorporates the skills that are needed for the employability (Edvardsson et al., 2011; Dollinger & Lodge, 2020). The employers are looking for the employees that have the leadership qualities that can help in teamwork and decision making.

The knowledge, skills and attitude that human capital brings to higher education is rented and the institutes do not own this as it vanishes as soon as the staff and students leave the institutes. It is the collective wealth that is built only when the experience and knowledge of faculty meets the creative abilities of students. Therefore its importance has been highly stressed and is called the basic ingredient that fosters the culture of innovation and creativity (Kumari et al., 2019).). Since innovation is highly dependent on the joint efforts of staff and students knowledge and skills, human capital holds a primary position in the value co-



creation process (Dollinger & Lodge, 2020).. Similarly students sustainability competencies cannot be improved unless the knowledge transfer and creation at both ends i.e. faculty and students is encouraged. Hence the value co-creation in higher education institutes is needed to improve agility, knowledge, skills and attitude of human capital. Furthermore, value co-creation also helps in understanding the emerging needs and trends in the society and adapting the educational services accordingly.

Similarly the role of relational capital has been highlighted in previous studies for improving the interpersonal and communication skills (Kohtamäki et al., 2013; Xiao et al., 2020; Ritala et al., 2021). With student exchange programs and other knowledge exchange activities the value adding process improves. Therefore, inter and intra-organizational activities are highly motivated by researchers (Holm & Kringelum, 2022; He et al., 2022). This eventually improves the student sustainability competencies where they can compare and analyze the skills and attitude needed for developing sustainable society.

The last source of value co-creation that the current study has validated is the structural capital that impacts the student sustainability competencies. As no organization in current times can move forward with a proper integration of tangible assets with the knowledge, therefore the structural capital holds an important position in value co-creation. Structural capital is the main source that differentiates one organization from other in terms of innovative tools, culture and technologies. Consequently, the more HEI is equipped with the value co-creation in these aspects, the more its students will be skilled. Various researchers have addressed the non-availability of proper structural capital in developing countries, as a main factor of lagging behind in sustainable development goals (Kamaluddin & Rahman, 2009; Rossi & Magni, 2017; AlQershi et al., 2021). The structural capital has no value unless it is properly adopted and diffused in the functions of higher education (de Matos Pedro et al., 2020; Secundo et al., 2020). Hence, to improve the efficiency and effectiveness of the human resource, a proper integration and co-creation of structural capital is required.

This model has also contributed to the literature by validating the role of sustainability oriented curriculum as moderator. If students are provided with the opportunities to learn sustainability oriented content, both in inter-disciplinary and multidisciplinary context, they will have a broader vision of sustainable development. They will understand more about the features and dynamics of sustainability in their lives and in their societies. Therefore, HEI must not wait to start separate programs on sustainability, as it can be part of major programs in the higher education.

The promotion of value co-creation will not only enhance the sustainability competencies of students, but will also benefit the institution as the positive word of mouth helps in improving the image of the universities. In this digital era where students have access to a larger audience, introducing innovative programs and activities will ultimately benefit the HIEs. The most recent example is the COVID-19 lockdown and commencement of educational services through online services has challenged the education system to be more adaptive, innovative and flexible. Therefore, it is required that rather than focusing on budget, universities must pay a close attention to enhancing the existing intellectual capital and value co-creation for enhancing the student sustainability competencies.

## Conclusion

This article provides useful findings that address two major gaps. Firstly it provides evidence that value co-creation of intellectual capital can help HEIs in improving the student sustainability competencies. Secondly it addresses the gap in developing countries regarding the education for sustainable development. The findings reveal that the vision of education for sustainable development needs to be transformed from teacher centric to learner centric. As the increasing demand for sustainability education are increasing for better societies, the open minded participation of students is required for acquisition of skills and attitude that enhances the capabilities of the students. Furthermore, the co-creation process will improve the

idiosyncratic resources of HEIs, based on knowledge and skills, which will eventually help in gaining competitive advantage.

The study also highlights the importance of sustainability oriented curriculum, both vertically and horizontally for the improvement in the overall education for sustainable development. The HEIs must realize the importance of sustainability and hence should focus on integrating the concepts of sustainable development at every level. This needs major improvement in Pakistani context where education for sustainable development has just entered the corridors of the Higher education. Although the HEC Pakistan is making efforts for green and sustainable campuses but this is not enough and collaborative efforts are required for experiential learning, creative, innovative and practice-based learning. It is quite obvious that the change in the educational sector will take time but the aftermaths will be long lasting and fruitful for the students, universities and societies.

### Recommendations for Practitioners

As the universities are also working on the marketing strategies that could enhance their reputation and image, therefore focusing on the marketing concepts such as value co-creation can help in accentuating the goodwill. Furthermore, with collaborative activities HEIs can increase the satisfaction and confidence of students in their institutes and will facilitate the HEIs to retain students for post-graduate programs. The long term investment in education for sustainable development will bring more students as they will comment and spread positive word of mouth on social media, which is the main source of communication while searching for universities by fresh students. Therefore, more virtual channels for better communication must be designed at the university's end to connect, target and market the sustainability programs to the wider audience.

### Limitations and Future Research

The main limitation of this research is that it was conducted in a developing country, Pakistan. The education sector in Pakistan where HEIs are not fully equipped to meet the standards of the International Universities, therefore this study cannot be generalized to the developed countries or other geographical contexts. However, the study was helpful in gaining insights of the Pakistani Universities. In order to validate the model in developed countries, the study can be replicated and in fact can be compared for better evidence between the two contexts.

The second limitation of the study was reading the respondents of the study. The aim and objectives of the study directed to focus on the beneficiary of the higher education i.e. students, therefore, their responses were taken. However, it was felt that there are some programs in the HEIs that students are unaware of such as activities related to entrepreneurship which also makes sense, as students spend a limited time in universities and are not involved in all activities. So, for future studies researchers can also take the perspective of faculty through interviews. This will help in an in-depth understanding of co-creation and sustainability education along with the challenges at the university level.

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