

Making it normal for 'new' enrolments: Effect of institutional and pandemic influence on selecting an Engineering Institution under Covid-19 pandemic situation

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Research Article

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Abstract

Covid-19 pandemic has enforced Indian engineering institutions (EIs) to bring their previously half-shut shades completely down. Fetching new admissions into EI campus during pandemic it has become 'now or never' situation for EIs. During crises situation institutions have struggled to come back on the normal track. The pandemic that has changed students' behavior and family's preferences drastically due to mental stress and emotional life attached with it. Consequently, it becomes prerequisite, and emergency need to examine the choice characteristics influencing selection of EI during Covid-19 pandemic situation.

The purpose of this study is to critically examine institutional influence and pandemic influence due to Covid-19 that affects students' choice about an engineering institution (EI) and consequently to explore relationships between institutional and pandemic influence. The findings of this quantitative research, conducted through a self-reported survey have revealed that institutional as well as pandemic influence have governed the EI choice under Covid-19 pandemic. Secondly, pandemic influence is positively affected by institutional influence. The study demonstrated that EIs will have to reposition themselves to normalize pandemic influence by tuning institutional characteristics that regulates situational influence and new enrollments. It can be yardstick for policy makers to attract new enrollments under pandemic situation.

Introduction

Worldwide, engineering education is viewed as a career of progressive growth, which has the potential to shape human skills (Blom & Saeki, 2011), social and quality of life (Rojewski, 2002), economy of the country (Cebr, 2016) and overall development of the country (Downey & Lucena, 2005). Thus, engineering education has proven to be a key factor for sustainable and profitable development of society. It encourages global competitiveness through engineering inventions for the benefit of society at large. However, despite of the fact that demand for engineers remained relatively high throughout the world, there are few aspirants willing to pursue engineering education. Creating an upswing for interest and fondness that makes students inclusion into engineering studies itself has been a challenge. The reports on engineering education about declining enrollments (AICTE New Delhi, 2021) in context to India and diminishing interest and trends worldwide (UNESCO, 2010) has signaled a warning bell for the overall development of hi-tech society. In India, gap in between available seats (capacity) at entry level and actual admissions in degree engineering is widening year by year, leaving approximately 5.9 lacs seats vacant in the year 2019–2020. All India Council for Technical Education, New Delhi, an apex body for governing technical education, has indicated that around 45% seats were remained vacant in academic year 2019–2020, which was noticed 38% in 2012–2013. Most of the studies have verified that the situation is due to the problems pertaining to awareness, attraction, recognition of needs and service offers (Kamokoty et al., 2015; Upadhayay and Vrat, 2017).

Selecting an institute as acknowledged by previous literatures, is a subtle and complex phenomenon (Hossler et al., 1989a) that involves multifaceted and inconsistent set of institutional influencing characteristics (Obermeit, 2012) (Chapman, 1981). It implicates a challenging progression for institutions as well as aspirant students (Hemsley-Brown & Oplatka, 2015b) and requires greater efficiency and effectiveness to make a concluding decision. Decisions regarding 'institutional choice' can change students' life forever (Iloh, 2019) and performance of the institutions as well. Selecting an engineering institution (EI) has not been received much consideration but practically missing in literatures, as the research drift was appeared to be inclined towards general higher education addressing to psychology, sociology, economics discipline (Paulsen, 1990). Today, most of the EIs in India with lower enrollments are at vilest position due to absence of practicing students' assessment in regard to their needs. Engineering education is highly contrasted with respect to multi-dimensional thoughts of students and institutional influence related to quality of staff and teaching-learning, infrastructure and facilities, course value and delivery, and outcome benefits.

Statement of the problem

There are certain evidences where higher education (HE) had needed to reform drastically due to the unforeseen situations or crises due to the political and economic changes arising out due to natural disasters (Schuh & Santos Laanan, 2006) and pandemic (Kim & Niederdeppe, 2013). It is seen that in such a situation HE institutions have struggled to come back on the normal track. (Aristovnik et al., 2020) has revealed that Covid-19 pandemic that has changed students emotional and personal life and has also changed their preferences, habit in regard to selection of HE. The survey conducted by The International Association of Universities has discovered that Covid-19 will affect future enrollment for upcoming academic years (IAU, 2020). Consequently, it becomes prerequisite, and emergency need to examine the choice characteristics influencing selection of EI during Covid-19 pandemic situation. Secondly, in such a pandemic situation, an examination of students' perceptions on choice characteristics holds a great practical importance for policy makers and administrators of EIs.

Objective of study

As informed by the evidence and problems discussed above, the main objective of this study is to critically examine choice characteristics related to institution and pandemic that influence students' choice for EI during pandemic and consequently to explore relationships between institutional and pandemic influence arisen out due to Covid-19. Above objective is underpinned by following research questions referring to selection of an EI during Covid-19 pandemic.

1. What are the important institutional and pandemic influencing characteristics that have influenced potential students' decision about selecting EI during pandemic?
2. How institutional influence and pandemic influence are coupled to each other?

Literature Review

This study embraces a systematic review (Bearman et al., 2012), progressed gradually through extensive searching, selecting and integrating literatures that has explored evolution and influence of choice characteristics responsible for selection of an institution. The literature review revealed that institute choice process has reformed over period in accordance with ecological changes (Jackson, 1988), informed awareness and understanding of institutional facilities (Nora & Cabrera, 1992). To make a pathway for prospective students, HE institutions should understand who are the students and what they expect from them and how their expectations can be met by educational offers (Han, 2014). Hemsley-Brown & Oplatka (2015) learned that despite of ample literatures, there is no assured list of choice characteristics that influence and confirm students picking up a specific institute. The following section described at length about the characteristics linked to institutional influence that are accountable for students' choice decision.

Institutional influence

Institutional influence is a set of characteristics which magnetizes prospective students towards institutions. These characteristics are clustered on financial vs non-financial offers, academic vs non-academic facilities and services and tangible vs intangible factors (Hossler et al., 1989b) (Yamamoto, 2006) which are reviewed as under.

Proximity to hometown

Proximity relates to the nearness of hometown from the institution. Being close to institution is a significant factor for students in selecting an institution (Turley, 2009). It also increases chance of acceptance for the particular institution (López Turley, 2009), as distance travel is associated with cost, time and efforts (Chapman, 1981). In case of engineering study due to heavy workload, it can provide extended hours for study at home and enough time for social and other activities if EIs are situated near to students' hometown.

Location and locality

Location and locality is a structure of ambient conditions, speciousness and functional accessibility (Bitner, 1992) and is a swaying character in making institution choice (Gibbs & Knapp, 2012). Location gives impression of institute's site and its connectivity from hometown, while locality refers to culture, amenities, and facilities available in surrounding place wherein the institution is located. Overall it is credited with suitability, vicinity, attractiveness, accessibility, cost-effectiveness, safety and security (Hannagan, 1992; Kotler & Fox, 1995)

Image and reputation

Image and reputation in public minds plays a significant role in differentiating institutions (Imenda et al., 2004) and measured as one of topmost character influencing institution choice (Briggs, 2006) (Wadhwa, 2016). It is composed of a spectrum of small reputes such as academic and non-academic characteristics belonging to institution (Lafuente-Ruiz-de-Sabando et al., 2018). In the review of literature (Hemsley-Brown & Oplatka, 2015c) and in most of the research (Maringe, 2006b), image and reputation

of institutions provide first impression that embosses in minds of decision makers, even if nobody is having confront with institution.

Faculty profile

Faculty profile in terms of their qualifications, skills, competency and experience (Imenda et al., 2004) exerts a significant influence on students (Soutar & Turner, 2002) (Mazzarol & Soutar, 2002). Faculty ought to be profiled with high quality teaching (Woolnough, 1994) and should be a well-designer (De Courcy, 1987). Similarly they should be well-inspired, well-informed, passionate, open-minded, and responsive (Voss et al., 2007) to transform knowledge and to assist students for real-world exposure (Bhattacharya, 2004). (Magnell et al., 2017) has mentioned importance of faculty's attitude in assisting students for availing engineering curriculum.

Alumni image

Alumni are the tangible outcome of institutions and hence alumni concerns are important criteria in measuring performance of EIs. Alumni achievements are often exploited to exemplify the importance, eminence and image of institutions (Saunders-Smiths & de Graaff, 2012) and criteria for selecting an institution (Ho & Hung, 2008). Historically, alumni image with economic, market and social standing at all times have added glory to the reputation of their institutions and hence becomes benchmarking standards for prospective students (Pucciarelli & Kaplan, 2016).

Campus placements

Employment prospects are the potential outcomes and benefits that the prospective students and their family sought against time, efforts and money invested in HE institutions (Hemsley-Brown & Oplatka, 2015c) (Maringe, 2006a). Transition from education to employment is the straightforward motive of every student opting engineering study (Baytiyeh & Naja, 2012) and verified to be one of the most influencing characteristics in making institutional choice (Malgwi et al., 2005). Most of premium EIs have series of campus placement activities dealing with students' employment and upholding alliances between industry and academia. It has a major role in boosting employability skills (Markes, 2006) and accelerating industry-academia connection (Baytiyeh & Naja, 2012) to create employment opportunities for the engineering students.

Quality Education

Quality of education is a prime, discriminating, and prominent influencing characteristic of EI consigned to stay ahead in competitive market and to make a place in the minds of stakeholders. Several studies (Pandi et al., 2014) (Sakthivel & Raju, 2006a) (Sayeda et al., 2010) have emphasized importance of quality education in regard to holistic development of the institutions and in making institute choice decisions for the students (Kallio, 1995) (Mourad, 2011). Several items such as academic standard, industry linkage, campus placements contributes to the quality of education (Mahajan et al., 2014). Furthermore, for some researchers it implies to course delivery (Trum, 1992), infrastructure facilities (Sayeda et al., 2010), faculty (Gambhir et al., 2013), quality services (Viswanadhan, 2009), academic and

non-academic concerns (Jain et al., 2013) (Owlia & Aspinwall, 1998). Overall it has two-fold effect in terms of tangible and intangible outcomes (Natarajan, 2009).

Infrastructure and facilities

Importance of infrastructure and facilities are mentioned in numerous studies like (Nyaribo et al., 2012) (Sahu et al., 2013) (Price et al., 2003). It consists of building, equipment, infrastructure and amenities which are tangible possessions reflecting capacity of institute that streamlines the performance of curriculum delivery (Palmer, 2003). It can provide love-at-first-sight and becomes on-the-spot evidence for prospective students (Kotler et al., 2002). Delivering curriculum without existence of infrastructural assets and facilities is not possible for EIs as the delivery is more technical in nature.

Safety and security

Safety in the institute campus means the provisions made about residential, physical health, and life concerns to ensure the wellbeing of students (Ai et al., 2018), whereas, security as a broad term covers human rights, emotions and cultural values associated with students (Calitz et al., 2020). Literatures such as (Elliott & Healy, 2001) (Peters, 2018) have exposed that students contemplate it based on wellbeing and humanize culture, whereas (Calitz et al., 2020) revealed it traditions allied with the decision about selection of institution. The students feel comfortable with the health services, emergency and situational provisions delivered by the institute (Sakthivel & Raju, 2006b).

Curriculum delivery

In engineering education, curriculum delivery is the most influencing character and is found to be first priority in selecting an EI in the most of studies like (Moogan & Baron, 2003). It is associated with execution of a planned pedagogy supported by intangible services and tangible facilities that ensures continuous transfer of knowledge (Case et al., 2016). For engineering institutions, it can bring glory to the institute if delivered as per the needs but can take vilest situation if not handled properly. Curriculum delivery is performed mix-up modes such as online (Alawamleh et al., 2020), hybrid (Tan, 2020) (Sia & Adamu, 2020) and regular onsite delivery depending on the situational crises. Although all having its own advantage and dis-advantage in regard to involvement of theory vs practical, technology vs human, and competency skills achieved, the degree to which it facilitate accessing, practicing and implementing knowledge is more important (Shay, 2014). To attract enrollments, delivery of engineering curriculum is to be considered as backbone that transforms engineering knowledge into practical applications (Hemmo & Love, 2008).

Value for money

Value for money is an intangible characteristic and deemed to be an anxiety for students that influence their selection of institution. In engineering study, the nature of costs is differential which includes tuition, travel, residential and food costs, day-to-day academic costs which are more expensive than other higher education. Some studies have exhibited cost of education as a package of rewarding value benefit entailing, value and quality (Ivy, 2008) (Joseph et al., 2005), time and effort (Kotler & Fox, 1985), effort

and opportunity (Wu et al., 2020). Degree of engineering, employment opportunities, skills gained, and social status are the foreseen values for the students against their financial investment.

Pandemic influence

Pandemic influence is. Pandemic influence referring to this study is all about pandemic situation triggered due to Covid-19 pandemic situation occurred due to corona virus. It is an external influence that affects customer's behavior due to psychological perceptions about the situation (Belk, 1975). Covid-19 is a disease triggered by corona viruses first discovered in December 2019 that causes respiratory illness spread through small saliva in the form of droplets and aerosols arising out due to close human contacts (Ciotti et al., 2020). As indicated by World Health Organization, physical and social distancing is the only credible way to constrain its spread. It has taken out higher education by storm and hence turns out to be most challenging condition in the history of engineering education. The US based study, (Aucejo et al., 2020) has showed the influence of the Covid-19 pandemic is extremely heterogeneous on HE. In past, during situational crises, (Rosenthal et al., 2014) emphasized on appropriate curriculum delivery and (Kim & Niederdeppe, 2013) suggested students' support system as an important factor in normalizing the situation and continuing pedagogy.

After unlocking of pandemic restrictions in August 2020 in India, admission process for engineering studies for new enrollments for academic year 2020–2021 in the state of Maharashtra was completed in January 2021. EIs were able to commence academic sessions for newly joined students from February 2021, as per the guidelines (UGC, 2021a) and State Government norms, that restricted onsite pedagogy with 50% batch size on rotation basis. Meanwhile, there were lots of pros and cons about curriculum delivery under Covid-19 pandemic situation. To some authors, online delivery is most suitable during pandemic to continue education further (Gautam & Gautam, 2020; Liguori & Winkler, 2020). However, it has been simultaneously condemned adversely due to various reasons such as technology availability, academic loss and ongoing interest (Bird et al., 2020) (Zia, 2020) (Tesar, 2020). Some authors suggested hybrid / blended delivery (Rashid & Yadav, 2020; Sia & Adamu, 2020) as an solution to continuing pedagogy during pandemic. (Aristovnik et al., 2020) has revealed that the pandemic with emotional life has also affected certain behavioral characteristics in terms their likings and preferences. Pandemic situation has stressed potential students to think more about better accessibility and fitness. Therefore there is an urgent need of policy reforms that sustain mental health as well social emotions of students (WHO, 2020). (UNESCO, 2020) is of judgment that education has to be redefined or reduced and replaced or enhanced to engage students particularly to avoid academic, social and emotional loss. (Chadha et al., 2020) on recent study on UK engineering students articulated that there is more need of implementing new reforms to ensure engineering students should not go down its pathway.

Thus, pandemic influence referring to this study is EIs' efforts and provisions for making engineering education sustainable by providing suitable facilities, and support services that mitigate the impact of pandemic on students' pedagogy by following governments guidelines about social distancing.

Research gap and significance of study

A lot of researchers have notarized variety of characters influencing selection decision about institution, originated due to different culture, economic and social reforms but all were administered under non-pandemic situations. Many researchers felt that students' behavior is changed during covid-19 pandemic and there is urgency to reposition the framework of policies which demanded future research that urge to explore institutional choice characteristics and pandemic influence during the pandemic.

Moreover, there is no such a research as on date that provide knowledgeable relationships between students' perception on EI selection during Covid-19 pandemic. The importance and timeliness of this study is boundless as it aimed to explore radical changes that has materialized on students' choice characteristics during Covid-19 situation.

Conceptual framework and hypothetical model

The literature review has shown that choice decision is based on attractive and beneficial offers made by the institutions in regard to tangible facilities and intangible services. However, during Covid-19 pandemics, process of evaluating alternatives involves more intellectual and meticulous screening of institutional characteristics and external influence of pandemic that decides suitability and accessibility of educational services by following social distancing norms that restrains infection and spread of disease, Covid-19.

Based on the theoretical and conceptual framework as stated above and specified objective of study, following hypothetical model (refer Figure I) will stand for answering research questions. Following null hypothesis is to be validated based on students' perceptions.

Hypothesis (H₀)

There is no significant relationship between students' perceptions on institutional influence and pandemic influence while selecting an engineering institution under Covid-19 pandemic.

Research Methodology

Research design

This study is a marketing research about an educational dilemma associated with EI choice particularly during Covid-19 pandemic. Synthesis of literature review processed aligned with objective of this study has made this study to implement quantitative method due to its ability in framing hypothesis (Borrego et al., 2009), capabilities to operate on multivariate statistical data (Creswell & Creswell, 2017), ability to analyze relationships with definiteness (Creswell, 2012b) and being reliable (Steckler et al., 1992) and successful in educational research (Tight, 2015).

The judgment of what students really receive from the HE service as against their expectations is often based on the evaluation of students' perceived experience (Yelkur, 2000). Therefore, this study has considered students' perceived experience as being primary customers of HE (Maringe & Gibbs, 1989).

Primary data is collected using survey method that is best suitable as per (Kotler et al., 2016) for collecting preferences and choices from a large number of responses. The students who recently have enrolled in EIs during Covid-19 pandemic situation were selected as a population of this study, purposefully. A purposive sampling has been chosen decisively because of the knowledge and judgement of researcher (Creswell & Creswell, 2017), special situation (Neuman, 2013) and investigating new issues (Etikan et al., 2016) about 'EI choice' during Covid-19 pandemic.

The study is set to report the perceived experience of students about their pathway into an engineering institution during the pandemic. EIs offering degree course in engineering and technology situated in the North Maharashtra region of India have been chosen as sampling frame of this study. Admission process for the admission to first year degree engineering program for academic year 2020–2021 has been conducted under the control of competent authority of Maharashtra State, India and has come to an end on January 31, 2021. Sampling units consisting newly joined students from a batch of academic year 2020 – 2021 who recently have experienced of their EI selection process under Covid-19 pandemic were chosen from sampling frames. A total of 4300 e-mail address of students representing academic batch of 2020–2021 from 39 units of sampling frame (EIs) were collected on researcher's request through e-mail during February 2021. To make students more responsive, self-reported survey (Kolb, 2008) was conducted over internet via Google-form-tool during February 1–15, 2021.

During pandemic self-reported survey was very useful as it has avoided direct contacts with the respondents during pandemic but at the same time has ensured its reach to the expected respondents (students). This method also assisted to receive responses quickly by providing respondents a better flexibility in time and place and on the other hand has also avoided researcher's bias. The survey had received overall 922 responses at a response rate of 21% in the mid of February 2021. (Creswell, 2012a) recommended sample size that at least 20 sample per variable. This study has included twelve independent variables with 922 valid responses. Sampling size of 922 for assessing twelve variables, that derives 77 sample per variable is enough defensible against the traditional arbitrary ratio of 20:1 (Maxwell Scott, 2000).

Scale design and data collection

Quantitative survey is administered with a list of structured closed-ended questionnaire that developed on the guidelines provided by (Cohen et al., 2007) and (Ary et al., 2010). Questionnaire was initiated with introductory part, Section I, explaining the purpose and importance of the study. Section II represented three questions on students' personal characteristics such as gender, social class, and native place. Section III was associated to influencing institutional characteristics which are evidenced under literature review and recommended by academic experts. The section encompassed twelve choice characteristics that are continuous in nature that influenced students' decision about selection of their EIs. In this regard, students are requested to rate on Liker-scale (1 to 5) about their perceived experience on proximity, location and locality, image and reputation, faculty profile, alumni records, campus placements, quality education, infrastructure and facilities, safety and security, curriculum delivery, value for money and lastly, suitability under Covid-19 pandemic situation. Before entering into actual survey, validity and reliability of

questionnaire has been tested through pilot testing (Kenneth, 2005) with few samples selected from a sampling units to understand its language and sequence of questions and was noticed to be suitable for conducting actual survey.

Data analysis and statistical results

Making institutional choice under Covid-19 pandemic situation is a new difficult encounter for the students. In such a situation where influencing characters ruling choice decisions and their connections are unfamiliar, data examination is executed by two-step approach (Anderson & Gerbing, 1988). To find out relationship between influencing characteristics associated with EIs and pandemic influence, Exploratory Factor Analysis (EFA) and Structural Equation Modelling (SEM) is performed. EFA is first performed to develop constructs (latent variables) from item scales (observed variables), followed by confirmatory factor analysis (CFA) performing structural equation modelling (SEM) to predict the relationships between the extracted constructs (Byrne, 2013a). In first stage, factor analysis by EFA was performed on twelve influencing characteristics that recognizes importance in selecting an EI during Covid-19 pandemic. The second stage incorporated CFA and SEM by developing a measurement and structural model that represent the best relationship between components extracted from EFA. The data were analyzed and performed with the techniques available in the statistical software SPSS 25.0 and AMOS 25.0. Before arriving on results of EFA and SEM, statistical fitness of data in terms of sample adequacy, reliability and validity are justified as discussed below.

Statistical fitness of data

Reliability based on internal consistency has been successfully validated by Cronbach alpha, item-total correlation, and split-half technique available in SPSS under reliability analysis (refer Table I). Values of Cronbach alpha are above 0.6 for all scale items that has confirmed scales' internal consistency (Churchill Jr, 1979) and are best fit for the purpose (Nunnally & Bernstein, 1967). Next, corrected item-total correlation which are noticed above 0.33 indicated good internal consistency of scales (Briggs & Cheek, 1986) and are found below 0.85 that proves no potential issues on multicollinearity (Kline, 2005). Split-half method successfully correlated one half of the scale items with the other reaming half. For both parts, the value of Spearman-Brown coefficient displayed the same value (0.93) within the parts, which is expressed that observed variables have more internally consistency with their latent variables (Ho, 2006). Composite reliability (CR) and average variance extracted (AVE), for each extracted of latent variable derived from EFA were calculated (Refer Table I). That obtained values are well above the acceptable level of 0.7 (Fornell & Larcker, 1981) for CR and above 0.5 for AVE (Joseph et al., 1998). Lastly, Tukey's Test was effective in detecting no additivity that confirmed sufficient estimate of power.

The scale items under this study signifying influencing choice characteristics about EIs, are collected from rigorous analysis of literatures. Beside this, academic experts of EIs have confirmed these influencing characteristics responsible for inclusion of students into EIs. Factor loadings for all observed variables are well above 0.4, indicates that all twelve scale items are loaded strongly and significantly confirming to strong construct validity for their respective latent variables (refer Table I). Finally, no single

scale items was noticed to have factor loading above than 0.4 across another construct (excluding own construct) which suggested that all scale items clarify sound discriminant validity (Ho, 2014) (Joseph et al., 1998). Because each scale item only has loaded on one latent variable, there is evidence of convergent and discriminant validity.

Step I - Scale reduction and component extraction by EFA

EFA is proceeded to determine how, and to what extent, the observed variables are connected to their underlying component (latent variable) (Byrne, 2005). To start with EFA, all twelve choice characteristics have been processed with varimax rotation keeping Eigen value above 1.0 (Ho, 2006). Overall, twelve scale items have demonstrated a high level of potential for being factorized, with a Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy at value 0.958 which is greater than required value (> 0.5) as suggested by (Joseph et al., 2006). Further, with the value of $\chi^2 = 7328.117$ with $df = 66$ significant at $p < 0.000$, Bartlett's test of sphericity has shown creditable adequacy for factor analysis (Cerny & Kaiser, Henry, 1977).

EFA has extracted two main components having common features within component, however, are dissimilar across the components (refer Table I). First component has been extracted from ten scale items (C1 to C10) accounting for 59.2 percent of variance and is labeled as 'institutional influence' (II) as all ten scale items represent traditional institutional characteristics that were usually accessed by students during non-pandemic situation for EI selection. Cronbach alpha for this component is 0.944. Second component explains 8.77 percent of variance that exhibited eigenvalue 1.052 (above 1.0). It comprises of two scale items (C11 and C12) symbolizing choice characteristics that influence potential students under this Covid-19 pandemic in directing EI choice decisions. This component is classified as 'pandemic influence' (PI). Cronbach alpha for this component is 0.627, lower than previous one, due to few item scales associated with it, however within the acceptable limits (Tavakol & Dennick, 2011). Labeling of components are created on the type of scale items it houses and its relevance to the reviewed literature on institutional choice. Factor loading for first extracted component is ranged from 0.682 to 0.847 and for second component it is in between 0.619 to 0.923 showing strong construct validity. The hypothetical path model has been estimated to assess the explanatory power of all independent observed variables associated with the latent variables. Then, Step-II is proceeded to justify their strength and significance of relationships by performing CFA and SEM as discussed below (Table II, II and Figure II).

Table I: EFA results with reliability and validity					
Observed variables		Mean	Corrected Item-Total correlation	Latent variables	
				Component 1	Component 2
Choice characteristics	Code				
Location and locality	C1	3.992	0.745	0.761	--
Image and reputation	C2	4.044	0.759	0.799	--
Faculty profile	C3	3.964	0.805	0.847	--
Alumni profile	C4	3.906	0.789	0.822	--
Campus placements	C5	3.979	0.769	0.825	--
Quality education	C6	3.937	0.785	0.809	--
Infrastructure and facility	C7	3.911	0.794	0.805	--
Safety and security	C8	3.972	0.783	0.798	--
Curriculum delivery	C9	3.929	0.789	0.794	--
Value for money	C10	3.764	0.677	0.682	--
Proximity	CC1	3.329	0.464	--	0.923
Suitability under Covid-19	CC2	3.502	0.464	--	0.619
No. of scale items				10	2
Eigen value				7.105	1.052
% variance				54.369	13.603
α based on standardized items				0.944	0.627
Composite reliability				0.945	0.757
AVE				0.633	0.618
Component labeling				Institutional influence (II)	Pandemic influence (PI)

Table I: EFA results with reliability and validity

Notes: Extraction method: principal component analysis (PCA).

Rotation Method: Varimax with Kaiser Normalization.

Rotation converged in three iterations with extraction of two components.

Step II – Executing measurement model through CFA and SEM

CFA and SEM is performed as per the guidelines suggested by (Byrne, 2013a; Schumacker et al., 2010). CFA method is employed to examine factor structure of all influencing characteristics (observed variables), whereas SEM is used to model a network of structural relationships that exist in between observed variables and latent variable.

In the beginning, the model is specified as per the results of EFA and hypothetical path model. Pathways are drawn accordingly. To prove the hypothesis, one-way directional path is connected from II to PI to test the relationship in between institutional and pandemic influence. Institutional influence (II) is exogenous and pandemic influence (PI) is endogenous variable reliant on II. Overall, the model is constituted by 27 variables that consisted 12 observed and 15 unobserved variables and is accompanied by 14 exogenous variables and 13 endogenous variables as displayed by the SEM output. SEM measurement model that executed CFA through SPSS AMOS is shown in Figure II.

The model that has been identified with sample size of 922 is over-identified and recursive with $\chi^2 = 197.218$, $df = 52 (> 0)$ suggesting appropriateness for estimating various pathways (Khine, 2013). Sample size of 922 included in this study, has justified enough sampling adequacy based on Hoelter's critical N displayed in SEM output (Hoelter, 1983). By selecting Maximum Likelihood estimation method (Byrne, 2013a), SPSS AMOS automatically displayed estimations for all relationships with standardized as well as unstandardized estimates, which are presented in Table II and III.

Table II: CFA estimates			
Choice characteristics (endogenous variables)	R^2	Total effects based on SRW (β)	
		On account of II	On account of PI
Observed Variables			
C1	0.562	0.750	0.000
C2	0.581	0.762	0.000
C3	0.689	0.830	0.000
C4	0.667	0.817	0.000
C5	0.623	0.789	0.000
C6	0.671	0.819	0.000
C7	0.680	0.824	0.000
C8	0.660	0.812	0.000
C9	0.667	0.816	0.000
C10	0.494	0.703	0.000
C11	0.171	0.263*	0.413
C12	0.773	0.560*	0.879
Latent Variable			
PI	0.406	0.637	0.000

Notes: SRW, Standardized regression weights; R^2 , Squared Multiple Correlations; *, indirect effects.

Source: SPSS AMOS

Referring to Table II, values of R^2 for all endogenous variables are ranged in between 0.406 to 0.689, which indicated moderate (more than 0.50) to substantial (more than 0.75) strength in estimating endogenous variables as recommended by (Joseph, 2009) (Cohen et al., 2013), except for proximity (C11) ($R^2 = 0.171$, $\beta = 0.413$) which showed weak strength of estimation but adequate estimates (Chin, 1998) as data narrates to unpredictable human behavior. Higher valued of standardized estimates (β) accumulated on institutional characteristics (C1 to C10) by the virtue of institutional influence (II) proved to be strong estimation. In case of pandemic influence (PI) ($R^2 = 0.406$, $\beta = 0.637$), the strength of determination is moderate with 40.6% of its variance is explained on account of institutional influence (II). This means if II increases by one standardized unit, PI will rise by 0.637 standardized units. Proximity (C11) is explained with 17 percent of its variance on account of PI. It will rise by 0.413 if PI goes up by

one standardized unit (direct effect) and will rise by 0.263 standard units if II goes up by one standard unit (indirect effect). On the other hand, 77.3 percent of variance of suitability under Covid-19 (C12) is estimated by PI. It will increase by 0.879 standardized units if PI goes up by one standardized unit (direct effect) and will increase by 0.560 if II goes up by one standard unit (indirect effect).

Exogenous component, institutional influence (II) is assembled with 41.7% of its variance ($CR = 12.039 > 1.96$, $p < 0.001$), which is a moderate strength and reasonable value in behavioural research. Referring to Table III, CR values associated with all pathways showing relationships in between latent variable (II) and observed variables (C1 to C10) and in between latent variable (PI) and observed variable (C11) are above 1.96. This further confirmed that strong convergent validity exists as all scale items utilized in the CFA model have shown statistically significant loadings in hypothesized directions (Hair et al., 1998). In case of relationships in between two latent variables, II and PI, based on B value, there is a positive relationship between them indicating that if II goes up by one unit then PI will go up by 0.942 units.

Table III: CFA – Variance and relationships with internal consistency				
Variance and relationships	<i>B</i>	SE	CR	<i>p</i> -value
Component II (Variance)	0.417	0.035	12.039	< 0.001
(Relationships)	0.988	0.045	21.873	< 0.001
C1↓II				
C2↓ II	0.967	0.044	22.231	< 0.001
C3↓II	1.058	0.044	24.171	< 0.001
C4↓ II	1.062	0.045	23.789	< 0.001
C5↓II	1.003	0.044	23.014	< 0.001
C6↓II	1.075	0.045	23.861	< 0.001
C7↓II	1.063	0.044	24.010	< 0.001
C8↓II	1.019	0.043	23.672	< 0.001
C9↓II	1.037	0.044	23.785	< 0.001
C10↓II	1.000	–	–	–
Component PI (Relationships)				
C11↓PI	0.562	0.068	8.282	< 0.001
C12↓PI	1.000	–	–	–
Hypothesis PI↓II	0.942	0.057	16.434	< 0.001
Notes: Relationship: observed variable and latent variable, <i>B</i> , regression weights; SE, standard error; CR, critical ratio.				

Source: SPSS AMOS

Model fitness and Hypothesis validation

Fitness indices obtained for the measurement model of this study are noticed in accordance with various fitness indices recommended for SEM and hence supports the plausibility of the relations among variables (Teo, 2013) (refer Table IV).

Research hypothesis of this study that states there is no significant relationship between institutional influencing characteristics and pandemic influencing characteristics involved in choice decision of EIs under Covid-19 pandemic situation is tested by the knowing the relationship $II \downarrow SI$ (refer Table III and Figure II), which exposed that this relationship is statistically significant in positive direction ($B = 0.942$, $CR = 16.434$, $p < 0.001$). One unit rise in II will result in 0.942 unit increase in PI. Hence null hypothesis H_0 is rejected, and alternative hypothesis H is accepted.

Table IV: Fitness of model				
Fitness indices	Recommendable limits for model	Measurement model under study	Literature support	Interpretation about Model fitness
χ^2	Insignificant for N < 250	197.218 (Significant for N = 922)	(Anderson & Gerbing, 1988)	Good fit
Ratio χ^2/df	< 5 for (N > 500)	3.793 (N = 922)	(Marsh et al., 1988) (Marsh & Hocevar, 1985)	Good fit
Hoelter's critical N	N = 368 (minimum) for $p < 0.001$	N = 922	(Hoelter, 1983)	Good fit
TLI	> 0.95	0.975	(Tucker & Lewis, 1973)	Good fit
CFI	> 0.95	0.980	(Bentler, 1990)	Good fit
RMSEA	< 0.5 (p of close fit > 0.05)	0.55 (p of close fit > 0.05) Fit of model is close	(Hu & Bentler, 1999)	Good fit

All scales under study are empirically tested for reliability and validity using both EFA and CFA. The SEM model has successfully presented a combination of hypothetical path model and CFA model that statistically answered research questions and validated research hypothesis of this study and henceforth research objective is achieved here. By comparing the indices required for good fit (refer Table IV) the model – ‘choice influencing characteristics under Covid-19 pandemic situation’ has achieved a good fit as specified below.

$\chi^2(52, N = 922) = 197.218$, $p < 0.001$, CFI = 0.980, TLI = 0.975, RMSEA = 0.055 (CI90 0.047, 0.063, $p = 0.146 > 0.05$)

The model has thus demonstrated that the performance of the concept appears to be stable and robust with all relationships that are hypothesized appeared to be measuring what this study has set out to evaluate.

Statistical inference and discussions

This study has verified the influence of choice characteristics associated with EIs and Covid-19 pandemic in regard to selection of an EI during Covid-19 pandemic situation. It has also verified relationship between institutional characteristics and pandemic characteristics arisen due to Covid-19 situation. Despite the fact that performance of institutional influencing characteristics in pandemic situation is as usual as appeared in ordinary situations, it incredibly has affected pandemic influencing characteristics through proximity to hometown and suitability of under Covid-19.

During pandemic, institutional influence ($\beta = 0.417$) is significantly accumulated by the usual institutional choice characteristics. This also evidenced by several literatures as discussed below when situation was non-pandemic.

Importance of location and locality ($\mu = 3.992$, $R^2 = 0.562$, $\beta = 0.750$, $B = 0.988$) in making EI choice is evidenced by this study. During Covid-19 pandemic, 'infected area' related to corona virus are the key anxieties for students and hence they assess it in terms of its' spaciousness, airy ventilations, accessibility and suitability of facilities and amenities wherein it is situated. Similar findings were stated under non-pandemic conditions by (Sovansopha, 2019), which showed a good location and locality is constructive in fetching enrolments into the campus.

Trust and beliefs are the key dimensions of image and reputation (Finch et al., 2013). During pandemic, when almost nobody is aware about the EIs performance, students have no other options but to rely on the EIs for providing suitable crises management practices (Maringe & Gibbs, 2009) for continuing pedagogy that mitigate the risk of Covid-19. Further, as buying behaviour of customers in a pandemic crisis are believed to be a function of organizational reputation and trust (Coombs, 1998), EIs having good image and reputation are more likely to be trusted under Covid-19 situation. Because of this, students in this study, has perceived image and reputation as an important characteristic ($\mu = 4.120$, $R^2 = 0.581$, $\beta = 0.762$, $B = 0.967$) in selecting their EIs.

Faculty acts as facilitator and mentors in preparing, interacting and motivating students for achieving their academic goals (Salami, 2007). Their support and motivation can be vital for students' emotions which students desperately require during pandemic to improve their distress for better psychological well-being (Sood & Sharma, 2021). This is why, faculty profile ($\mu = 3.964$, $R^2 = 0.689$, $\beta = 0.830$, $B = 1.058$) as usual is treated as important influencing characteristic that facilitated choice of EIs. (Bao, 2020) has documented similar conclusions in terms of importance of faculty assistance in impacting and sustaining higher education during Covid-19 pandemic period.

Alumni status is another causative characteristic of EIs, vital for potential students and their family in making their EI choice. Alumni's overall status such as their reputation gained after graduation (Ho & Hung, 2008) and their employment position (Kalimullin & Dobrotvorskaya, 2016) holds significance during pandemic situation, as students can analyse the risk involved in enrolling in particular EI against the benefits the students receive after their graduation. This appeared to be true in this case as students have valued alumni ($\mu = 3.906$, $R^2 = 0.667$, $\beta = 0.817$, $B = 1.062$) in making their EI choice.

As majority of entry level jobs in engineering profession during pandemic are diminishing, campus placements can only provide students a breakthrough that make their engineering career worthwhile. During pandemic, campus placement activities of EIs can offer rewarding benefits offered in terms of skill development that makes students competitive in the world and offers better employment opportunities in job crises situation during pandemic. This is what students under this study might have perceived and hence campus placement ($\mu = 3.979$, $R^2 = 0.623$, $\beta = 0.789$, $B = 1.003$) of EIs is proven to be a governing character in deciding EI choice, which is evinced by (Matusovich et al., 2020a).

This study has revealed that quality education ($\mu = 3.937$, $R^2 = 0.671$, $\beta = 0.819$, $B = 1.075$) is an important institutional characteristic in deciding EI choice. The notion of 'quality' in higher education is a function of tangible facilities, intangible services and human relations. Students under this study has acknowledged its importance in delivering excellence learning atmosphere during Covid-19 pandemic situation, the need of this is also notified by (Zuhairi et al., 2020).

Infrastructure and facilities ($\mu = 3.911$, $R^2 = 0.680$, $\beta = 0.824$, $B = 1.063$) is a backbone and fundamental support system of higher education system that needs to be rendered through its suitability, accessibility and affordability to continue pedagogy during pandemic situation (Raaper & Brown, 2020). Hence students under this study have been influenced in making their EI choice.

During pandemic situations, preventive measures and following mandatory standards and guidelines (UGC, 2021a) is the only way for delivering pedagogy for students' overall wellbeing (Cheng et al., 2020). Today, safety and secured arrangements are contemplated to be a personal protection shield for students during pandemic situation. For this reason, this study has observed safety and security ($\mu = 3.972$, $R^2 = 0.660$, $\beta = 0.812$, $B = 1.019$) as a key influencing characteristic in making EI choice.

Curriculum delivery during pandemic is the most difficult challenge for engineering studies and redesigning it via online or onsite or hybrid mode in pandemic situation in an urgent need (Cahapay, 2020) that reduces burden of cost and workload, and eases mental stress. In pandemic situation, successful curriculum delivery is entitled with gaining, accessing, and practicing knowledge, and skills building that keeps students' interest live through inculcating proper social distancing. Therefore, curriculum delivery ($\mu = 3.929$, $R^2 = 0.667$, $\beta = 0.816$, $B = 1.037$) is a key character of EIs have influenced students in choosing their EIs.

During pandemic situation cost-effectiveness, convenience, time, and efforts spent are more vital as they relate directly to the mental and health conditions of students. For this cause, value for money ($\mu = 3.764$, $R^2 = 0.494$, $\beta = 0.703$) has made positive influence in directing students' decision making.

Referring to proximity ($\mu = 3.329$, $R^2 = 0.171$, $\beta = 0.413$, 0.263 , $B = 0.562$), this study has indicated that it has impacted in creating pandemic influence though low influence but does affect students' choice. The lower ratings on the importance than other choice characters might be because of the fact that EIs are general situated at a distance that are far from hometown of students and they might have no other option but to select it. However, it is controlled by pandemic as well as institutional influence in positive direction. This means, if pandemic influence increases, proximity also increase. This means that students will choose that EI which is nearer to their hometown as this decreases the distance travelled, saves time and cost for family, and sustains health related safety and security during pandemic. This further justified that EIs situated nearby students' market are better in position to be selected by the local students (Matusovich et al., 2020b), particularly in the pandemic situation. This also supports to the findings of (Mok et al., 2021) who realized that institutions which are placed at a far distance have more to work on reframing policies to make it suitable for students during pandemic to attract them.

The influence of suitability under Covid-19 pandemic has been employed first time in this study. It denotes an environment that brings normality into engineering pedagogy with the ease of accessibility and flexibility that is appropriate under Covid-19 situation by following social distancing standards. It ($\mu = 3.502$, $R^2 = 0.773$, $\beta = 0.879$, 0.560) comes out be a major outcome of pandemic influence and is affected by both pandemic influence as well as institutional influence that is helpful in determining institute choice.

Lastly, pandemic influence is well governed under the impact of institutional influence. It is thus confirmed that traditional choice characteristics strongly directs the students' perceptions about institutional standings in crises situation like Covid-19 and its suitability under pandemic situation. Hence it is recommended that EIs must reposition themselves to be perceived suitable under Covid-19 pandemic situation.

Implications, suggestions, and contribution

According to the findings of this study, along with the consideration of pandemic influence, traditional institutional influencing characteristics must be reconsidered to enhance suitability under pandemic. During pandemic, institutional characteristics are seemed to have strong and positive impressions on perceptions of pandemic influence including suitability under Covid-19 that enhances institutional choice. Thus, this study has explored that how existing institutional characteristics can control situational influence. Following are managerial implications and suggestions envisioned for effective performance of EIs during pandemic by reframing institutional characteristics.

During pandemic, institutional governance and best practices involving quality education, care taking faculty, students centric facilities and suitable curriculum delivery that keeps the interest of students

ongoing, minimizes their academic loss, creates a feeling of being affiliated and justifies them as an ethical engineer are very important in developing high prestige and high reputation of EIs (Gill et al., 2018). Further, incorporating quality infrastructure and facilities along with effective crises management measures (Maringe & Gibbs, 2009) during pandemic will trigger positive insights about quality of EIs (Hemsley-Brown & Oplatka, 2015a).

With one action, it has two-fold benefits for the EI during pandemic. First, providing quality education and services will improve image and reputation positively (Khoi et al., 2019). Secondly, it will build trust for EI's commitments in providing quality services. It will achieve students' reliability and confidence on quality provisions rendered by the EIs during pandemic. EIs further need to endorse co-creating mechanism for providing and processing of vital information about their offers for informed choice decision (Mogaji & Maringe, 2020). EIs stakeholders such as faculty, existing and alumni students who are the real experience holders and directs sources of spreading 'word-of-mouth' about 'suitability' during pandemic.

Due to immobility of institute's physical assets, EI has little to work on proximity. However, as this study has predicted importance of proximity to hometown, it becomes binding on local institutions to provide excellent educational services with social distancing norms to grab new enrollments. The EIs must realize that 'all size does not fit all'. EIs should inhouse all required facilities that meets diversity's expectations under Covid-19 pandemic. Success of EIs further will be dependent on how far it creates a 'house of reliance' (Nandy et al., 2021) for them. All such efforts will ultimately develop institute image (Manzoor et al., 2020) and long-lasting relationships (Clark et al., 2017) which is the need of hour foreseen in creating future market for EIs during pandemic situation.

Nevertheless, EIs should process their repositioning by following pandemic guidelines issued by government and apex authorities (UGC, 2021b) from time to time. If the pandemic carries with us for a long life, then the institute will have to open up other options such as small campuses and relocating in remote places (Gross, 2020).

This study to the knowledge of authors is first to present insights on performance of choice characteristics during Covid-19 pandemic that are utilized to select an engineering institute during pandemic situation (2020–2021). Guessing is, it is also first to come up with new look-out 'pandemic influence' which is noticed to be a significant utility in evaluating choice characteristics under pandemic. It has successfully examined and explored relationship of suitability and proximity with influence of pandemic as well as traditional institutional characteristic. Next it has come with significant evidence that traditional institutional influencing characteristics associated with the EIs are positively in relationship with pandemic influence. This is the main contribution of this study.

The study has arrived with substantial hopes for academicians and policy makers. As it has firmly established and deeply rooted in most challenging task: administering new enrollments. EIs will have to reposition themselves to normalize pandemic influence by tuning institutional characteristics. EIs as well as aspiring students will be known about how choice decisions are influenced under pandemic. SEM model of this study can be a yardstick for EIs in staying ahead in competitive market. In the future, if

pandemic is continued to be with us for long time, this study is a lot of supportive with its revolutionary road that is visible and feasible in bringing future students into EI campus. Accordingly, the study has added new and substantial materials and thus, has made several key contributions to the existing body of knowledge.

Conclusion

COVID-19 has impacted enormously to higher education sector globally including Indian EIs. It has tightened its knot around EIs that enforced to bring their previously half-shut shades completely down. The EIs are now at more risk while doing nothing during pandemic. Potential students live and grow with their life-dream 'institute going'. Regardless, mindset of both EIs and potential students should be tailored to 'show must go'. Fetching new admissions into EI campus before pandemic was a difficult task and during pandemic it has become 'now or never' situation for EIs. However, current study has analytical mapped influence of choice characteristics that regulates pandemic influence and are useful in choice decisions under pandemic.

The main objective of this study, to examine the influence of choice characteristics and consequently, to critically explore relationships of institutional influence and pandemic influence during covid'19 pandemic. Research questions were qualitatively answered, and associated hypothesis was statistically validated. Firstly, the study has noticed that traditional institutional characteristics governing choice decisions also have predominant influence in pandemic situation. Next, the results have confirmed that proximity and suitability of EIs under pandemic are the key characteristics that are statistically and positively linked to pandemic influence. Specifically, the findings exposed positive relationship in between various traditional institutional influence and pandemic influence, where institutional influence is strongly commanding on pandemic influence.

To culminate, at this moment, it is dubious that how EIs will be weathering 'new normality' during pandemic. The answers to this question are very much reliant on EI's resilience in reframing student-centric practices that governs suitability under pandemic. For the moment, it is time to 'change for better' in the form of tangible and intangible provisions that intensifies demand for engineering education and expediting choice decisions during the pandemic. This evolution may bring 'normality' to 'new' enrollments, can become revolutionary transformation in the future ahead!

Limitations and future research

Like any research that employs a limited sample, this study is restricted to the fact that it deals with a single context, North Maharashtra region of India, so that its findings cannot be directly generalized. All things considered, current study's sincerity and relevance lies in exploring relationship of 'pandemic influence' with traditional influencing characteristics. Realizing these facts, plenty of research doors are open to investigate its influence pertaining to the institutions offering study in other disciplines in different regions. Such future studied may report various relationships as choice characteristics and

pandemic impact varies with the region wherein the institutions are situated, consequently various perspectives on pandemic influence and suitability of the institutions can be acquired under pandemic.

Next, the survey was conducted during the Covid-19 pandemic and the findings may not be similar in a normal situation. Another fact is that choice process for students basically begins in their pre-college days. In India, as this pandemic has arrived in the year 2020, some students may not have much exposure to its influence. Henceforth, future research is encouraged periodically but frequently that includes choice process over the entire pandemic period. Pandemic influence and suitability under Covid-19 are utilized first time in this study to give general idea about their relationship with choice characteristics in selecting EIs under pandemic. Though it has escorted sufficient progressions on choice characteristics in first attempt, more refined and detailed scale can be developed in future research.

Declarations

Conflict of interest statement

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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Figures

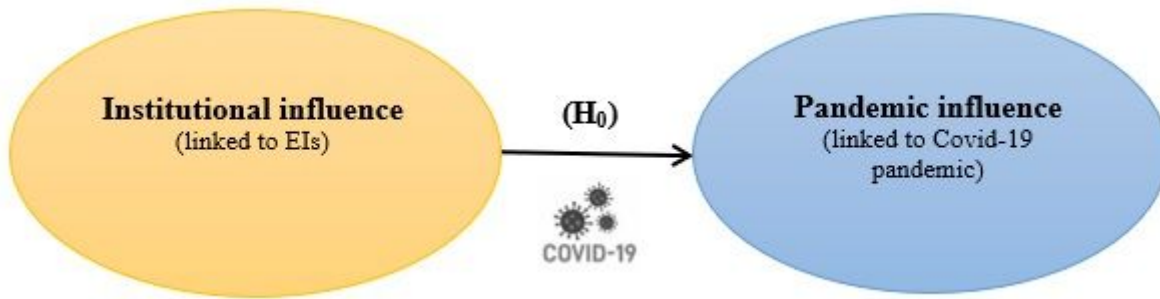


Figure 1

Hypothetical path model on 'choice influencing characteristics under Covid-19 pandemic situation'
 Source: Own

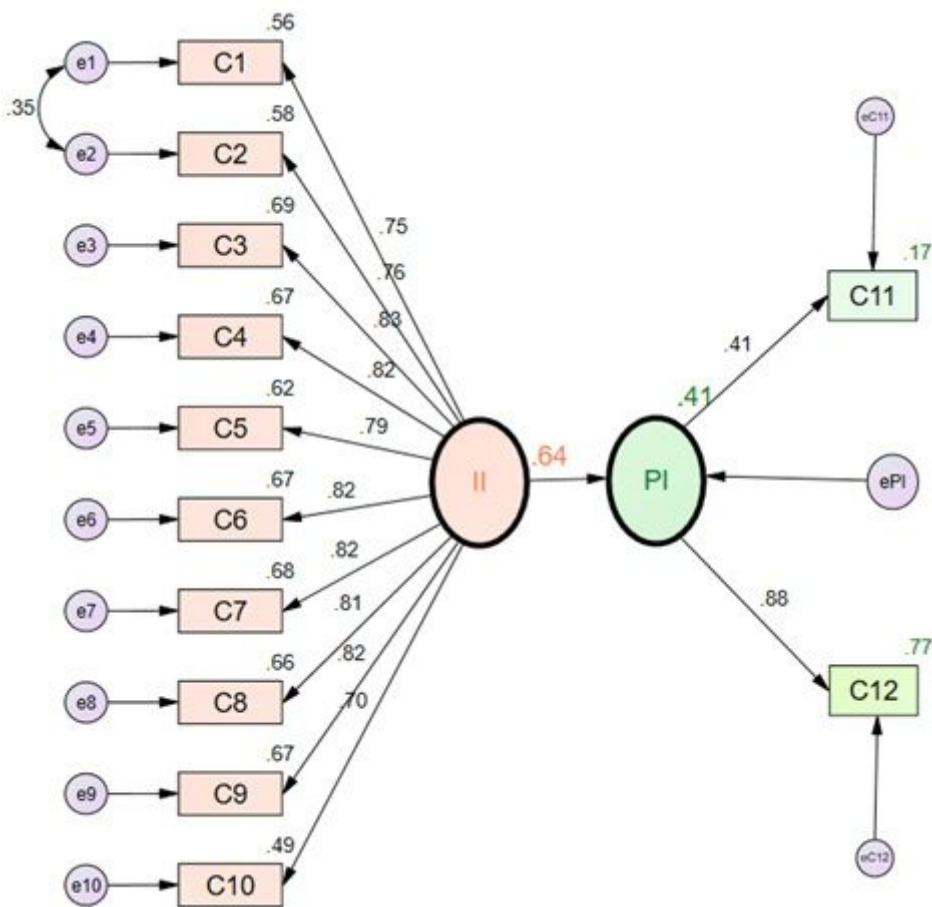


Figure 2

Structural equation modelling on 'choice characteristics during pandemic' Source: SPSS AMOS