Factors Influencing Adoption of Agile Project Management in Construction Industry

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Abstract

Construction industry is a labor-intensive industry defined by its capability to deliver complex and unique projects with stringent quality requirements against constrained time and cost parameters. In civil construction projects, project uncertainties, strong customer demands, technological disruptions and challenging environments demand a more adaptive approach to civil construction. Agile approaches are a proven project management technique that has given rise to a more adaptive approach and successful outcomes to software development projects. Today, project teams use agile methodologies in several industries beyond software development to meet customer demands in an environment disrupted by advanced technology. Past literature suggests that even though extensive evidence exists about effective use and benefits of agile project management approaches in the software industry, there is a lack of empirical studies in the construction industry and projects. Using data from 530 respondents from different industries and geographic regions, we have tested the main factors influencing adoption of agile project management and further examined the moderating effects of other variables. Our findings suggests that people factors, agile practices and Construction 4.0 (technologies that digitize, automate and integrate the construction process) are the main drivers of agile project management in construction industry. Further, factors such as organization culture, business needs, project characteristics & close communication influences agile project management in construction industry.

Keywords: Agile Project Management, Construction 4.0, Construction Projects.

I. INTRODUCTION

Globally, projects have emerged as the way for works to be executed and for resolving the problems. According to Project Management Institute (PMI), the world's leading project management organization, we live in the Project Economy where organizations worldwide deliver value to stakeholders through successful completion of projects. Organizations value project management as a strategic competency for driving changes arising from massive shifts in technology, using technologies like artificial intelligence to meet the evolving customer expectations. Project management professionals use different tools, techniques and approaches to meet the changing requirements of each project.

The challenge in project management is to balance conflicting constraints. The four most common constraints being: time, cost, scope and quality called as the "Iron Triangle". Fixing all these four project constraints at the start of every project would work only when every aspect of the project is precisely known in advance and problems do not occur in the course of the project. This ingrained project management methodology of fixing everything at the start of every construction project is the cause of many project failures. For this reason, it is imperative for the project management methodology adopted

in the construction industry to change and be more flexible to accommodate possible changes in the course of the project, with a view to maximize value to the client/customer.
Construction project work ranges from definable works with are characterized by clear and proven procedures to high-uncertainty works that are characterized by new designs and innovative solutions for works that have not been carried out earlier. Traditional predictive project management approaches are inefficient for managing high uncertainty projects that have high rates of change, complexity, and risks, as this approach aims at determining the bulk of the project requirement upfront prior to starting the execution of the project, and controlling the project changes through a change request process.
In addition, organizations currently face extreme competition and disruption due to new technologies, market shifts, and social changes, forcing them to perform differently, driven by the need to be more efficient, effective, and innovative. To survive in this competitive market, it has become essential for construction companies to reduce delivery schedules, provide on-time project delivery, improve customer satisfaction and improve returns on investment (ROI). Fichera (2016) suggests that the type of project management methodology has a significant effect on project success.

1.1 Research Problem and Hypothesis

The biggest threat to the construction industry is the lack of new project opportunities. A large pool of organizations in the market would soon be competing for far fewer projects. The construction industry needs to get ready for the post COVID world of potentially fewer projects, faster turnarounds and innovative technology. It is imperative for construction companies in the market to prioritize on a transformation process to operate in the post COVID world. The approach to construction also needs to be reviewed to create a more productive and cost-effective industry in this fast-changing environment.
Construction companies have experienced opportunities that technology has brought in to reduce wastage and achieve better control on project constraints like quality, time, and budgets. The challenges are the slow pace of technology adoption, high implementation cost, organizational system and process changes, enhanced skill requirements, etc. The complexity in construction projects will further demand massive investments in innovation and technology that will further transform the industry to the next level.
Business models of Construction 4.0 imply strong communication networks that support real time data transfer between different companies, factories, suppliers, logistics, resources and customers. This transformation to real-time access to data and intelligence has transformed the way of conducting business and managing business models all over the world. This has become more challenging in the current financial and economic situation to support business growth and profitability. Organizations are required to recognize the need for the change and be more flexible and quick in response to the fast-changing and challenging business environment to meet business objectives.
Therefore, the question arises as to:
"Which project management approach should an organization adopt so as to create and respond to change and deal with uncertainty, that too in an uncertain and turbulent environment?"
A belief that this thesis holds is that adoption of Agile Project Management in construction could be one answer to the above question. There exist a number of pre-requisites that might be required to adopt agile practices and these pre-requisites might be the reason why there is no universal order in introducing agile practices (Nurdiani, Börstler, Fricker, Petersen, & Chatzipetrou, 2019). "Agile transition prerequisites" is one the major phases of "Agile transition and adoption process". Providing these prerequisites before

moving to Agile increases the chance of success in transition to and adoption of Agile and leads to fewer challenges during the change process (Gandomani & Nafchi, 2016).
The aim of the research is to determine the most significant factors that influence adoption of Agile Project Management in the construction industry.

II. LITERATURE REVIEW

2.1 Construction Project

Construction projects are very expensive and time consuming; therefore, their failure may result in losing huge amounts of money and valuable time invested in those projects. Time and cost are important in all construction projects (Albayrak, 2020). They are the two major indices of project success, which are closely related, and they affect all project stakeholders in the construction project. Projects that are delayed also suffer cost overruns and major changes to the initial scope of work often increases the budget and completion time.
Civil construction projects always involve plan driven processes. Construction projects can progress seamlessly only if all the resources like construction materials, tools, equipment and skilled labor are available in adequate quantities as and when required as per plan. The project would suffer delays if one critical resource does not reach the construction site on time.
Uncertainty and risk are the common characteristics of most construction projects and hence, risk monitoring and control are very essential for construction project success (Rahimi, Tavakkoli-Moghaddam, Iranmanesh, & Vaez-Alaei, 2018). Mega construction projects are inherently high-risk and complex (Xu, Liu, Ma, Deng, Chang, Ni, & Zhou, 2020). The use of complex and custom-made designs further leads to errors and extra utilization of men and materials, all of which ultimately increase the cost of construction and time to market.
Construction projects involve multiple key stakeholders beyond the owner, the design consultant and the general contractor. Construction project managers must also coordinate with local authorities, material vendors, plant and equipment suppliers, fabricators and subcontractors to complete a project successfully. Keeping track of multiple project stakeholders and coordinating the project activities to deliver project deliverables on time is a herculean task.

2.2 Construction 4.0

We live in an era where technological disruption is the norm. Organizations worldwide are harnessing innovative technologies to change the way they function, and most importantly the way they manage their projects. The construction industry must adopt technological innovations to respond to a fast-changing world. The use of robotic-assisted printing systems for building repair applications, as well as for exploring collaborative working with other robots or drones to assemble printed parts or apply coating materials (i.e. painting), will be a major trend in the future. (Craveiroa, Duartec, Bartoloa, & Bartolod, 2019).
The Fourth Industrial Revolution (Industry 4.0) has changed the manner in which current business models function by decreasing market barriers to entry and the way organizations compete with each other in the market. The revolution in the construction industry (Construction 4.0) was fundamentally a change toward better digitization as various innovative technologies and equipment like prefabrication, automation, 3D printing, virtual reality, drones, sensors, IT surveillance systems and applications, robots, and mobile networking systems are being used to assist project management practitioners to better

understand the industry processes in real time. The level of ambition and desire for technological advancement in the construction industry is constantly rising.
Supply chains have been disrupted globally because of the COVID-19 pandemic and its aftermath, including material shortages, hike in material prices, slowdown of construction projects, and related cost overruns in the project. To mitigate the impact of rising prices, contractors must use materials as efficiently as possible in the construction projects. With the help of project management software like Primavera, the requirement of all resources can be visualized for all construction activities and can be planned in accordance with the available resources, and it can be checked if resources would be adequate to meet the project schedule.
Procurement has always been important in construction projects, but planning purchases has become more critical post the COVID-19 pandemic. By using Building Information Modeling, contractors can optimize material quantities, select qualified vendors in advance and properly plan purchase order issuances to meet the project schedule requirements.
Designing the optimal layout for mechanical, electrical & plumbing installations is a challenge, especially when there are many components sharing small spaces. Modern design software like Revit can generate accurate 3D models, and engineers can visualize savings opportunities that are difficult to be perceived from 2D drawings. Today there exist versatile software solutions for the building construction industry, which could be utilized for functions like 3D design, automatic quantity takeoff, and mechanical, electrical & plumbing services clash detection, simulation / modelling, procurement and equipment management. Employing software can provide the benefit of saving time and reducing project costs. In addition, use of software and technology allows faster, optimum design and approval process.
Today, mature organizations in the market that have a legacy of long years, but are slow innovators are struggling to compete with young startup organizations that are able to innovate and rapidly produce products that fit their customer’s requirements. There is a need for all these mature organizations to adopt an agile mindset in order to survive in this competitive market.

2.3 Agile Project Management

Agile Project Management (APM) is an approach for adaptation and responding to change in an uncertain and turbulent environment. Gubinelli, Cesarotti, and Introna (2019) define Agile as an iterative approach that puts the customer at the center, and allows for greater flexibility and greater compliance with the concept of value for the customer.
Agile techniques and approaches are focused on prioritizing competing parameters and are effective in managing disruptive technologies. Customer satisfaction is the first and foremost core principle of Agile and its highest priority is to provide early and continuous delivery of value.
Agile software development uses a set of agile frameworks and practices based on core agile values and related principles to succeed in a particular context through collaboration between self-organized cross-functional teams and deliver value to clients/Customer. Keeping these agile values and principles in mind, we could discover better ways to create and respond to change and deal with uncertainties through various practices. A particular context shall guide which Agile framework, practices and techniques to use to collaborate with the cross-functional team and deliver value to customers.

2.4 Adoption of Agile Project Management

Case study findings of Zuzek, Gosar, Kušar, and Berlec (2020) suggest that Agile Project Management practices, even when implemented separately, positively impact project success in terms of both efficiency and stakeholder satisfaction, and can thus help in establishing an economically, socially, and environmentally more sustainable workplace. The adoption of at least one agile method improves the outcomes of quality, satisfaction and productivity over the use of other methods, without a statistically significant increase in cost (Abbas, Gravell, & Wills, 2010).

Project teams are using agile approaches in a variety of industries beyond software development to meet customer demands in an environment disrupted by advanced technology (Alliance, A.G.I.L.E., 2017). With the help of agile in construction based on Building Information Modeling, it is possible to reach a sharp increase in design operation efficiency, particularly with respect to: collaborative design, project coordination, reduction in project duration, reduction in costs, reduction in claims and disputes and improvements in product quality (Tomek & Kalinichuk, 2015). Major benefits associated with application of agile in construction and designing projects are reduction in project costs, improved project productivity, quality and client/business satisfaction (Jin, 2017).

The literature review shows that agile methods offer considerable potential for application in construction but there are significant hurdles to their adoption in the actual phase, which should be overcome to reap the benefits.

III. METHODOLOGY

Quantitative analysis was used in this research. This would be best suited to allow for statistical measurement to understand the most significant factors influencing adoption of agile in the construction industry.

A systematic literature review was carried out to understand all the important factors that influence adoption of Agile Project Management. All the factors found in the literature were analyzed using a frequency distribution table to identify the top seven factors that influence adoption of Agile Project Management. Then a survey (Quantitative method) was carried out with 530 respondents to rank the most important factors influencing adoption of Agile Project Management.

The adoption of Agile Project Management (APM) will depend on the existing influencing factors that are favorable conditions for the proper application of the Agile Project Management practices. A research framework based on these influencing factors was formulated. A graphical representation as shown below in Fig. 1 depicts the possibility of interrelation of the independent variables with the dependent variables.

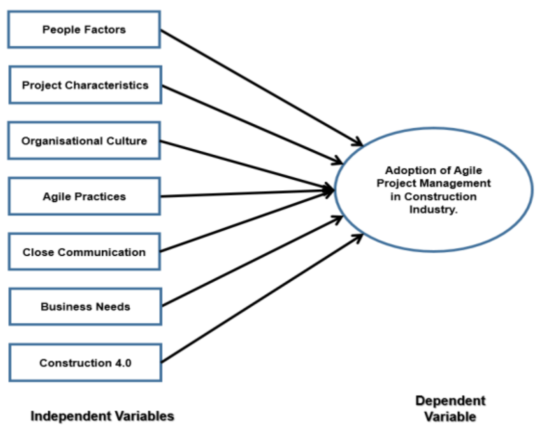

Figure 1: Research Framework

Adoption of the agile project in construction is the dependent variable. This is measured by the research outcomes viz. increase in customer satisfaction, increase in employee satisfaction, reduction in project risks, increase in organizational efficiency, increase in productivity, increase in product quality and leverage to digital transformation. The determinants influencing adoption of Agile Project Management in the construction industry are included among the independent variables. Seven independent variables influencing adoption of Agile Project Management were chosen from the extensive literature review. Frequency distribution tables were utilized to select the most frequent variables listed in the literature reviewed. All questions in the survey questionnaire were based on the research gaps identified in the existing literature on the seven independent variables. These factors were the identified as sub-variables for the study.

The questionnaire for the study was pre-tested with practitioners and industry experts through a pilot study. The objective was to determine whether the questions listed in the online questionnaire are pertinent and whether the responses are related to the survey objective. Suggestions and recommendations from the respondents and supervisors were scrutinized prior to incorporating them into the final questionnaire for distributing the survey questionnaire to the main sample for data collection.

The required data for analysis and interpretation for this research was collected from project management practitioners across the world and across different industries practicing project management. The final online questionnaire using Google forms was circulated through emails and WhatsApp. The questionnaire was also posted on LinkedIn and Facebook to have maximum global reach. Altogether 530 responses were obtained and the entire data was taken up for analysis.

The entire survey questionnaire was framed in such a way that every question asked was answerable and that the participant's anonymity was protected at all times. All participants' informed consent to participate in the survey was obtained by clearly informing the purpose of the survey. Valid research methodology has been adopted for analysis with accepted principles, clear methods, and reliable practices. The review panel (Supervisor and Ethics Committee) has monitored and controlled the entire research throughout the research period.

IV. ANALYSIS OF DATA

In this research, Structural equation modeling is used for analyzing the structural relationship between the variables. Structural equation modeling (SEM) and test reports was created using ADANCO 2.3 software. ADANCO has been designed with an emphasis on explanatory and confirmatory research to facilitate the analysis of causal relationships among constructs and the testing of theories (Benitez, Jose, Gautam & Henseler, 2018). The tests include but not limited to construct reliability, convergent validity, discriminant validity, indicator multi-collinearity, inter-construct correlations, analysis & hypotheses testing and t-values for the determinants of constructs. By default, ADANCO estimates the parameters of latent variables using consistent PLS and the parameters of emergent variables using traditional PLS. In that way, it ensures that users obtain consistent parameter estimates throughout the entire model.

4.1 Measurement Model

Structural equation models are defined by two sets of linear equations, viz. the measurement model (or outer model) and the structural model (or inner model). The measurement model specifies the relations between a construct and its observed indicators and the structural model specifies the relationships between the constructs (Henseler & Dijkstra, 2015).

Goodness of fit is measured using Square Root Mean Residual (SRMR) in this empirical study. The standardized root mean squared residual (SRMR Hu & Bentler, 1998) quantifies how strongly the empirical correlation matrix differs from the model-implied correlation matrix. Lower the SRMR value, better the model. Table 1 shows how ADANCO reports goodness of fit. A Square Root Mean Residual SRMR < 0.1 is acceptable, which implies less than 10 % error or 90 % model accuracy.

Goodness of model fit (saturated model)

	Value	HI95	HI99
SRMR	0.0913	0.0415	0.0433
d_{ULS}	6.1740	1.2774	1.3905
d_G	1.6991	0.6898	0.7334

Table 1; Goodness of model fit

The quality of a research framework/model is evaluated with the help of validity and reliability. Validity measures whether this model measures accurately what it is intended to measure and it is a measure of how well the model performs its function. Reliability is an indication of the consistency of the research model for repeated measurements. Reliability is the indication of a measurement model‘s ability to give similar results when applied at different times.

Cronbach’s Alpha & other Indicators are used to determine the reliability of Overall model. Cronbach’s alpha is a lower bound estimate of the reliability of sum scores pertaining to a reflective measurement model. Table 2 shows how ADANCO reports construct reliability. Cronbach’s Alpha & other Indicators are greater than 0.80, which indicates very good reliability levels. A high reliability score means that the model produces the same consistent results while using the same model for repeated tests using the same method under the same context.

Construct Reliability

Construct	Dijkstra-Henseler's rho (ρ_A)	Jöreskog's rho (ρ_c)	Cronbach's alpha(α)
PF	0.8328	0.8755	0.8240
PC	0.8383	0.8784	0.8286
OC	0.8353	0.8789	0.8282
AP	0.8610	0.9019	0.8543
CC	0.8774	0.9036	0.8666
BN	0.8608	0.9033	0.8572
CN	0.8239	0.8906	0.8162
BE	0.9211	0.9346	0.9181

Table 2: Construct Reliability

In order to determine the validity of the measurement model Convergent Validity and Discriminant validity are used. Convergent validity indicates the degree of relationship between observed variables that measure the latent variable. Table 3 shows how ADANCO reports construct's unidimensionality. Reflective constructs exhibit sufficient unidimensionality if their AVE exceeds 0.5 (Fornell & Larcker, 1981). A high validity score means that the model produces results that are accurate and corresponds to the real characteristics & variations in the physical population.

Convergent Validity

Construct	Average variance extracted (AVE)
PF	0.5846
PC	0.5915
OC	0.5927
AP	0.6975
CC	0.6531
BN	0.7003
CN	0.7310
BE	0.6716

Table 3: Convergent Validity

Discriminant validity means that two conceptually different constructs must also differ statistically. The Fornell-Larcker criterion (Fornell & Larcker, 1981) postulates that a construct's average variance extracted should be higher than its squared correlations with all other constructs in the model. ADANCO includes a table, called "Discriminant Validity: Fornell-Larcker Criterion"containing the reflective constructs' average variance extracted in its main diagonal and the squared inter-construct correlations in the lower triangle (see Table 4). Discriminant validity is regarded as given if the highest absolute value of each row and each column is found in the main diagonal (Dijkstra & Henseler, 2015). If, Squared Correlations (values below the diagonal) < AVE (Diagonal Value), then No significant correlation.

Discriminant Validity: Fornell-Larcker Criterion

Construct	PF	PC	OC	AP	CC	BN	CN	BE
PF	0.5846							
PC	0.4574	0.5915						
OC	0.3761	0.5409	0.5927					
AP	0.5009	0.4341	0.4723	0.6975				
CC	0.4118	0.5282	0.5172	0.5796	0.6531			
BN	0.4875	0.5615	0.5475	0.5794	0.6205	0.7003		
CN	0.4358	0.5018	0.4051	0.5361	0.5188	0.6022	0.7310	
BE	0.2670	0.5436	0.5307	0.3599	0.5145	0.6015	0.4937	0.6716

Squared correlations; AVE in the diagonal.

Table 4: Discriminant Validity

The constructs considered in this research viz. People Factors (PF), Project Characteristics (PC), Organization Culture (OC), Agile practices (AP), Close Communication (CC), Business Needs (BN) and Construction 4.0 (CN) are significantly different constructs and there exist no significant correlation between the constructs. This means that each independent variables in this research differ from other independent variables.

4.2 Structural Model

The structural model comprises of exogenous and endogenous constructs and the relationships between them. In the Structural Model (Fig.2 in appendix A), ovals denote constructs, and arrows denote paths. The relationships between the constructs are usually assumed to be linear. The size and significance of path relationships are usually the focus of the scientific endeavors pursued in empirical research (Dijkstra & Henseler, 2015).

For every endogenous construct, ADANCO determines the R^2 and the adjusted R^2. The coefficient of determination (R^2) quantifies the proportion of an endogenous variable's variance that the independent variables explain. Possible R^2 values range from zero to one. The R^2 is not calculated for exogenous constructs (Dijkstra & Henseler, 2015). Table 5 shows how ADANCO reports the $R^2$and the adjusted R^2. R-Squared represents the proportion of the variance for a dependent variable that is explained by an independent variable or variables in a regression model. R-squared value > 0.50 is acceptable)but greater the R-square, better the model.

R-Squared

Construct	Coefficient of determination (R^2)	Adjusted R^2
PC	0.5877	0.5854
OC	0.5269	0.5242
CC	0.6430	0.6409
BN	0.7013	0.6996
BE	0.6833	0.6809

Table 5: R-Squared

Bootstrapping is a non-parametric approach to obtain inference statistics for model parameter estimates. ADANCO provides error probabilities and confidence intervals for path coefficients as well as indirect and total effects (Dijkstra & Henseler, 2015). Table 6 in appendix B, shows how ADANCO reports the total effects bootstrap results. ADANCO provides p-values for one-sided and two-sided tests as well as the lower and upper bounds of confidence intervals.

4.3 Summary of findings

1. The structural equation model has passed the tests of construct reliability & validity.
2. Structural equation modeling when tested between the independent variables and the dependent variable saw sixteen cause-and-effect relationships, four were found to be direct and twelve indirect.
3. Project characteristics (PC), organizational culture (OC) & business needs (BN) significantly influences adoption of agile project management in construction.
4. Close communication (CC) positively impact adoption of agile project management in construction.
5. People factors (PF) are mediated by business needs (BN), organization culture (OC) and project characteristics (PC) to significantly impact adoption of Agile Project Management in Construction Industry.
6. Agile practices (AP) are mediated by Business needs (BN), Organization Culture (OC) and Project Characteristics (PC) to significantly impact adoption of Agile Project Management in Construction Industry.
7. Construction 4.0 (CN) are mediated by Business needs (BN), Organization Culture (OC) and Project Characteristics (PC) to significantly impact adoption of Agile Project Management in Construction Industry.
8. Agile practices (AP) is mediated by Close Communication (CC) to positively impact adoption of Agile Project Management in Construction Industry.
9. Close Communication (CC) has no mediation effect on People Factors (PF) and Construction 4.0 (CN) to impact adoption of Agile Project Management in Construction Industry.
10. All the seven benefits (BE) namely increase in customer satisfaction, Increase in employee satisfaction , Reduction in project risks, Increase in organisational efficiency, Increase in productivity, Improvement in product quality and Digital transformation leverage used for determining the adoption of agile used as a measure of the research outcome showed strong influence.

V. CONCLUSIONS AND IMPLICATIONS

Agile is a mindset defined by Agile Manifesto values, guided by Agile Manifesto Values and enabled by various practices that are chosen & tailored by agile practitioners to meet specific project & organization needs. The goal of agile is to deliver continuous value to customers and achieve better business outcomes regardless of the approach used.

Our findings suggest that project characteristics, organizational culture & business needs significantly influences adoption of agile project management in construction. Close communication has only positively impact on adoption of agile project management in construction. In addition, the three main drivers of agile project management in construction include people factors, Agile practices and Construction 4.0 (technologies that digitize, automate and integrate the Construction Process). In addition, the research determines seven significant outcomes/ benefits of adoption of agile project management in construction industry to include increase in customer satisfaction, increase in employee satisfaction, reduction in project risks, increase in organizational efficiency, increase in productivity, increase in product quality and leverage to digital transformation.

Agile is an effective and efficient project management methodology that when properly implemented leads to improved results. Goal should be to deliver a successful project meeting the project constrains with satisfied project stakeholders and there should be willingness within the organization to change, adapt, evolve and be aware of how best to manage the project context.

The survey of literature evidenced that agile methodologies are empirical, i.e. only a general framework can be derived and a specific methodology utilized differs from team to team and project to project. Hence, agile experience with agile methods is an important factor. As teams gain experience in agile practices, their transition starts from predictive to hybrid to agile practices. In addition, a step-by-step approach is considered reasonable for gradual and successful adoption of agile, rather than all at once, which may pose several risks and problems. Thus, a hybrid approach to project management considering both predictive and agile practices would be a more appropriate approach to Construction.

In addition, it is not mandatory to use a single approach throughout the entire project as using both predictive and agile approaches, known as the Hybrid Approach is not uncommon. The key is to check the project for its inherent characteristics to determine the best approach to be applied for the project to be successful.

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Appendix A

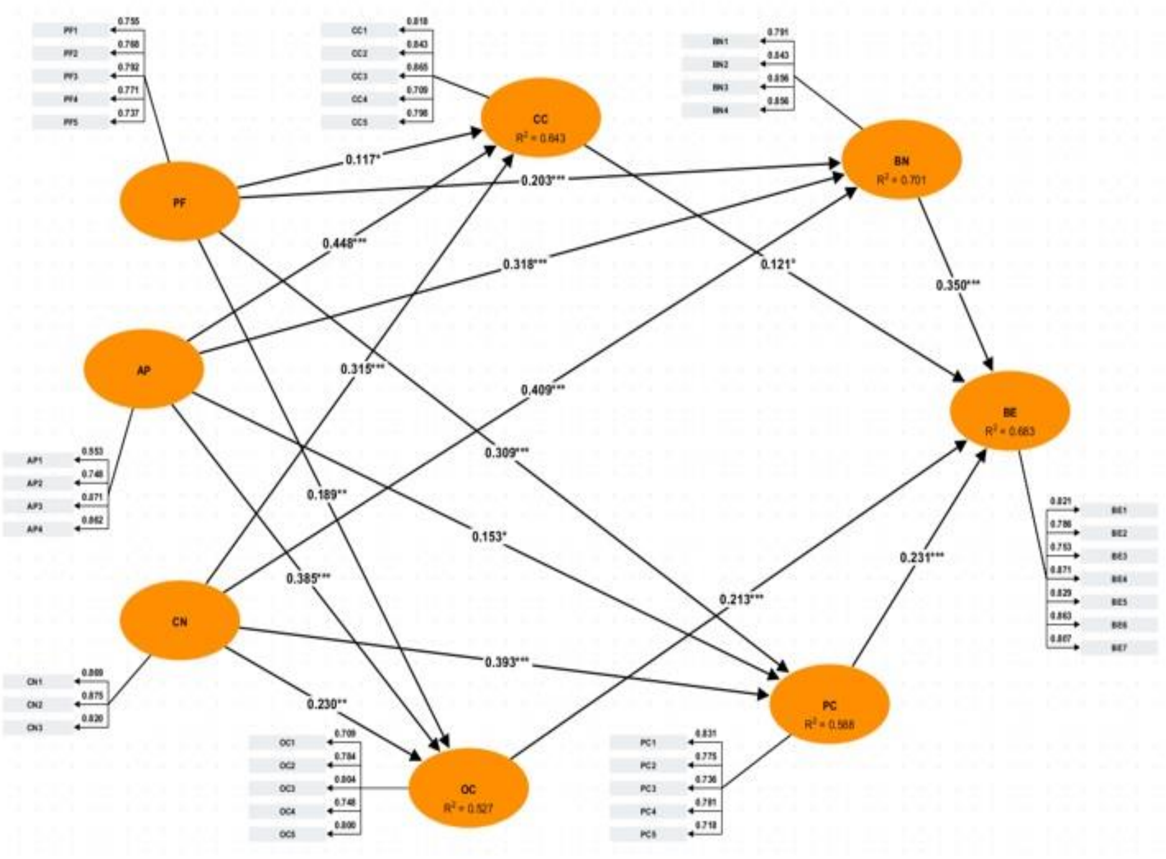

Figure 2: Structural Equation Model

Appendix B

Total Effects Inference

Effect	Original coefficient	Standard bootstrap results					Percentile bootstrap quantiles			
		Mean value	Standard error	t-value	p-value (2-sided)	p-value (1-sided)	0.5%	2.5%	97.5%	99.5%
PF -> PC	0.3092	0.3087	0.0587	5.2631	0.0000	0.0000	0.1557	0.1907	0.4203	0.4549
PF -> OC	0.1890	0.1860	0.0638	2.9598	0.0031	0.0015	0.0196	0.0607	0.3125	0.3461
PF -> CC	0.1165	0.1175	0.0571	2.0405	0.0414	0.0207	-0.0224	0.0052	0.2337	0.2661
PF -> BN	0.2033	0.2035	0.0509	3.9966	0.0001	0.0000	0.0658	0.1040	0.3043	0.3416
PF -> BE	0.1968	0.1937	0.0343	5.7309	0.0000	0.0000	0.1027	0.1270	0.2629	0.2851
PC -> BE	0.2305	0.2297	0.0643	3.5859	0.0003	0.0002	0.0557	0.0983	0.3512	0.3792
OC -> BE	0.2131	0.2142	0.0630	3.3822	0.0007	0.0004	0.0570	0.0954	0.3415	0.3852
AP -> PC	0.1526	0.1556	0.0596	2.5613	0.0105	0.0052	0.0113	0.0400	0.2746	0.3133
AP -> OC	0.3854	0.3863	0.0727	5.2991	0.0000	0.0000	0.1898	0.2430	0.5233	0.5710
AP -> CC	0.4479	0.4463	0.0580	7.7266	0.0000	0.0000	0.3059	0.3355	0.5640	0.5991
AP -> BN	0.3176	0.3194	0.0533	5.9605	0.0000	0.0000	0.1715	0.2131	0.4231	0.4552
AP -> BE	0.2826	0.2810	0.0379	7.4476	0.0000	0.0000	0.1792	0.2035	0.3531	0.3756
CC -> BE	0.1208	0.1206	0.0711	1.6999	0.0892	0.0446	-0.0595	-0.0173	0.2631	0.3093
BN -> BE	0.3501	0.3504	0.0719	4.8705	0.0000	0.0000	0.1646	0.2085	0.4912	0.5313
CN -> PC	0.3925	0.3900	0.0659	5.9572	0.0000	0.0000	0.2263	0.2653	0.5205	0.5571
CN -> OC	0.2296	0.2311	0.0721	3.1843	0.0015	0.0007	0.0485	0.0931	0.3764	0.4323
CN -> CC	0.3155	0.3163	0.0611	5.1637	0.0000	0.0000	0.1585	0.1968	0.4375	0.4767
CN -> BN	0.4093	0.4073	0.0566	7.2366	0.0000	0.0000	0.2697	0.2986	0.5209	0.5558
CN -> BE	0.3208	0.3263	0.0395	8.1182	0.0000	0.0000	0.2279	0.2501	0.4049	0.4281

Table 6: Total Effects Inference