

# Organizational Culture and Organizational Commitment in Software Product Line Institutionalization: the Perspective of Organizational Change



Youngkeun Choi

**Abstract:** *This study aims to investigate what factors of organizational culture are associated with successful institutionalization of software product line and to explore if organizational commitment has a mediation effect on the relationship between these factors of organizational culture and software product line performance. To do this, this study collected data from 352 employees of a Korean company by survey method. Also, a structural equation modeling has been taken. As a result, as a result of the three organizational cultural types first proposed to take into account the features of the software engineer, result-oriented culture, open system culture, and employee-centered culture increase their commitment to the organization. Second, software engineers' emotional commitment to organizations improves SPL performance. Finally, software engineers' emotional, organizational commitments mediate the relationship between employee-centric culture and SPL performance. This study is the first one to show the organizational culture types associated with psychological contracts and to understand how these organizational cultural types affect software product line performance through organizational commitment. The results of this study provide conceptual insight to administrators who want to find organizational culture types without sacrificing software product line performance.*

**Keyword:** *organizational change; organizational culture types; psychological contract; organizational commitment; software product line*

## I. INTRODUCTION

Software product line (SPL) is promising and is becoming a promising phenomenon for a lot of organizations which do software (S/W) development, significantly increasing the productivity of the S/W development. However, it is relatively challenging to introduce new practices such as SPL in existing organizational configurations unless appropriate organizational management plans are introduced. The best strategy is doomed to fail if an organization struggles against some resistance to new technologies and changes.

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Beckhard and Harris [1] regard organizational change as a transition from an organization's current state to the future or to a target country. Todd [2] regards change management as a systematic approach and proposes a theoretical framework that includes strategy and processes. In particular, the overall institutionalization process includes organizational culture and individual efforts to gain knowledge, skills, and motivation to start, implement, and manage SPLs effectively.

Thus, organizational culture may influence the process of institutionalization of SPLs within an organization. Organizational culture is significant in successfully institutionalizing SPLs in an organization, but few studies have focused on it. Ahmed et al. [3] show that organizational commitment positively influences SPL performance. So, can organizational culture reduce, support, or enhance the commitment of organizations to SPL performance? However, there is little perspective in what type of organizational culture positively impacts SPL performance through organizational commitment. Based on these gaps in the academic and working-level study, the following issues are raised:

RQ: What types of organizational culture in an organization influence employees' organizational commitment and SPL performance?

This study aims to shed light on certain types of organizational cultures associated with the successful institutionalization of SPLs and to identify how these types of organizational cultures affect perceptual consequences related to SPL performance. This study applies psychological contract theory in a special context related to organizational commitment and SPL performance. Also, the proposal does not reduce SPL performance but provides conceptual insight to administrators who want to develop and organize an increasing culture.

## II. THEORY AND HYPOTHESIS

### A. Theoretical background

Generally, SPL performance-related issues include: Motivates software engineers to do their best for SPL performance. These problems can be studied in the perspective of research areas, including psychology and sociology, which provides insight to motivation.



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This research leads us to understand that organizational culture is one of the significant elements of the individual. However, these effects have not been reviewed in the SPL context, and the possibility of impacting SPL performance has not been established previously. Psychological contract theory [4] provides a framework to comprehend the organizational culture of SPL and the attitudes of software engineers and the relationships of individuals to the right processes as part of psychological engagement results and exchanges with the organization. Way

Many organizational behavioral theorists believe that it is essential to be fit between individuals and organizations. One measure of fitness is perceptual and depends on the notion of personal psychological contract [4]. The psychological contract depends on recognition rather than reality are different from other types of contract. Due to the unrecorded nature of the psychological contract, it has some difficulty in their assessments. Psychological contracts extend the concept of loyalty and commitment to the organization, focusing on both employees and employers, and forming the basis for personal-to-organizational fit [4]. Namely, failure of an intermediate manager to perform a psychological contract can negatively affect employee behavior.

Changes in the working environment should increase employee independence, redefine psychological contracts, and adjust the implementation of psychological contracts [4]. The relatively long payback period for SPL engineering requires consistency in the commitment of the organization to accomplish its strategic objectives. By examining the exemplary conduct of organizational commitment in the view of psychological contracts, a research model provides a framework to understand the influence of organizational culture on SPL performance. The model suggested in this study suggests that organizational culture in the organization affects employees' organizational commitment to SPL performance. The usage of organizational commitment as a vehicle between the impact of organizational culture on SPL performance is intentional and is located to maintain consistency with the principal works of Russo and Park [4] regarding psychological contracts.

Based on the framework, the following sections support the relationships described in Figure 1 and present suggestions for this study. Research models and related proposals are based and supported on existing literature in social exchange theory.

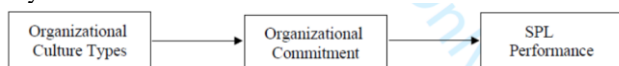


Figure 1 Conceptual research model.

## B. Hypothesis development

Presence is defined in various ways throughout the Relevant studies that take into account the study of relationships, organizational commitment to relationships, loyalty to employers, integration of personal and organizational goals, and identification or attachment to an organization on behalf of the organization are ready for considerable effort and are a member of the organization [5]. Crewson [6] defined the organization's commitment as three elements, including its belief in and acceptance of organizational goals and values, its desire to work hard for the organization, and its desire to remain a member of the

organization.

Therefore, practical organizational efforts for employees play an essential role in their performance. People in organizations with high organizational commitment are likely to work hard for performance. In the context of SPL, these software engineers tend to believe that they should do their best to affect the overall performance of SPL [3]. Therefore, make the following hypotheses:

H1 Organizational commitment plays a positive role in SPL performance

Organizational culture is generally defined in the way people think, which directly affects how they behave. Organizational culture is shown to be critical to the success of information technology (IT) projects related to organizational changes. Their findings were backed up by Cooper [7], which suggests that IT will be implemented in one of two ways when it conflicts with the culture of an organization. The system will be changed to match the existing culture. The alignment between organizational culture and cultural assumptions included in new methodologies such as SPL is critical to the success of SPL implementation.

However, there are few researches into how organizational culture affects SPL implementation and how organizations can foster organizational culture that helps them implement SPL. Culture also influences how well a person fits within a particular organization. Hofstede et al. [8] studied organizational culture in several national cultures and found that individual values and organizational practices should be integrated and demographic variables such as age and gender affect P-O fitness.

According to the literature review, P-O, suitable for organizational commitment among software engineers, was an area ignored in the SPL study. The reasons for these differences have not yet been studied. In this context, there is a compelling reason to identify among software engineers the type of organizational culture that drives the organization's commitment, which can determine SPL performance.

What types of organizational culture do you see in the software industry, such as SPL context? This is the key question of this process. Because the types of behavior of organizations can vary widely from industry to industry, generalization of organizational culture types is difficult. According to Hofstede et al. [8], working practices can be classified as process-to-result orientation, staff-to-work orientation, parochial versus expert, open-to-closed systems, loose vs. strict control, norm-to-practice. Considering that the software engineer for P-O is well suited to the organizational culture, select three ways of working that may be relevant to the SPL implementation context:

H2 Organizational culture types affect organizational commitment significantly.

H2-1 Result oriented culture affects organizational commitment positively.

H2-2 Open system culture affects organizational commitment positively.

H2-3 Employee oriented culture affects organizational commitment positively.

### III. METHODOLOGY

#### A. Sample

This study uses a survey method for empirical analysis. Survey methods are handy to collect data in large numbers of people effectively. Thus, this study selected a survey for data collection.

The study depends on answers from 352 software engineers working at 34 companies in Korea. Of the participants, 264 (75.0 %) were men, and 88 (25 %) were women. The proportion of software professionals who responded was categorized into broad groups (156 persons (44.4%), small and medium enterprises (91 persons (25.8%)), and multinationals (105 persons (29.8%)).

This study identified the response set by analyzing the response set before test verification and model testing. Response sets tend to answer questions in a specific way, regardless of the content of the item [9]. Two tests were also used for common method differences. First, Harman's single factor test for conventional methods was a satisfactory result. Additional tests for partial correlation were also performed [10]. This procedure specifies that the first element of the Principal Component Analysis must be introduced into the PLS model as a control variable. This is based on the assumption that the first element is most likely to be closest to a Common Method Variance (CMV) (if a bias is present). Assuming changes occur with factors [11]. There was no significant change in the difference described as expected. Therefore, the general method deflections do not seem to be a problem.

#### B. Data and measurement

The present study encompasses the measurement of five latent constructs, such as affective organizational commitment, result oriented culture, open system culture, employee oriented culture, and innovative behavior. These constructs were measured as follows. Affective organizational commitment was measured by the Organizational Commitment Questionnaire [5]. Organizational culture was measured to three dimensions of six dimensions which Hofstede [8] defines. SPL Performance was used a version of Faheem and Luiz [12] as the measurement of SPL performance. An additional eight questions were included for collecting demographic information such as gender, age, tenure, and job title.

### IV. RESULT

Evaluating the reliability and validity of the measured values before the hypothesis test [13]. A component-based approach to structural equation modeling was used because the model included a formative configuration.

#### A. Analysis of reflective measures

Tests were conducted to assess convergence and validity and reliability of the reflection measurements. First, factor loads were used to set convergence validity. For each of these elements, a load greater than 0.70 is interpreted as indicating convergence validity. The second indicator of convergence was also used. Here, it is assumed that for the mean-variance (AVE) extracted for each sentence, a value higher than 0.50 represents sufficient convergence. The test results mean that both conditions are met.

Disciplinary aptitude is shown when the square root of the AVE is higher than the correlation between the structures [14]. The AVE is 0.7649 and 0.7501 for organizational commitment and SPL performance, respectively, and the correlation between structures is 0.2119. For the second test of discriminant validity, individual items receive a higher load. It can be assumed that it possesses sufficient discriminant validity [13]. The measured values based on both tests are sufficiently discriminative. Stability is set by examining internal consistency measurements for each structure. Structures above the level of 0.70 are considered to have sufficient reliability [15].

#### B. Analysis of formative measures

Substances such as result-oriented culture, open system culture, and employee-oriented culture [16] were tested alternative to validity and reliability. Display the correlation pattern between items and temporary variables in the MTMM (Multi-Trait, Multi-Method) matrix to assess convergence and determination effectiveness [17].

Convergence validity is evaluated by examining the correlation of item composition [18]. Convergence validation is demonstrated when items are loaded heavily into the syntax. The result indicates that the item weight is essential at a significant level of 0.05, with the exception of five indicators. Five non-critical items were further analyzed according to the prescription to interpret the results officially measured [19].

A prescription developed by Cenfelletti and Basselier [19] distinguishes between relative and absolute contributions to an indicator. Relative contributions are relationships between metrics and criteria and keep other predictors constant. The importance of one metric compared to another in the same structure. The total contribution is the relationship between metrics and criteria, ignoring other predictors. In some cases, both aspects need to be considered to understand the effect of an indicator better. For example, an indicator may have a relative or unimportant relative contribution to the architecture. Nevertheless, we can still make significant contributions. Therefore, if the relative contribution (measured by indicator weights) is low, the total contribution (indicated by the item load) should also be considered.

In this study, five items have a relatively low contribution, so you should consider a unique relationship with the relevant configuration. The total contribution to the 5 items is important. The values are 0.743, 0.731, 0.721, 0.717, and 0.714, respectively. Thus, the contribution of the indicators is relatively low compared to other indicators, but there is a strong and unusual volume relationship with each configuration [19]. Also, there were no patterns in wording, polarity, or content between the topics describing the differences, and no conceptual problems with a structural definition. Therefore, it was decided that the item was not theoretically justifiable and should be maintained, rather than removing it and abandoning it and changing the meaning of the structure. Finally, the evidence of discriminative validity is presented when an item is more correlated with a different configuration measurement value and each configuration measurement value than with its composite value [17].



**C. Structural modeling**

Since this model consisted of reflective and configurable structures, boot strap sampling was used to test the proposed relationship between the structures [13]. Path coefficients and t-values were acquired through this procedure and are shown in Table 1. The results indicate that all paths are significant at  $p < 0.05$  confidence level.

**Table I: Path coefficients and their t-values**

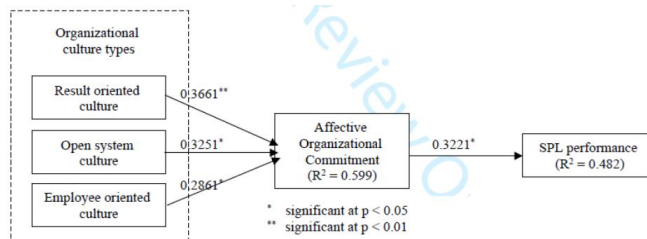
Hypothesis	Path coefficient( $\beta$ )	t-value	Significance	Outcome
H 1	0.3221	2.131	$p < 0.050$	Supported
H 2-1	0.3661	2.287	$p < 0.010$	Supported
H 2-2	0.3251	2.919	$p < 0.050$	Supported
H 2-3	0.2861	2.712	$p < 0.050$	Supported

Following the Baron & Kenny [21] step to establish an intervention to ensure that the affective organizational commitment of the organization mediated the relationship between each organizational culture type and SPL performance. First, results-oriented culture, open systems culture, and employee-oriented culture have proven to be relevant to SPL performance. Second, it was judged that each was related to affective organizational commitment. Third, affective organization commitments are positively associated with SPL performance. Finally, results-oriented culture, open system culture, and employee-oriented culture were introduced into the model, but some paths were not statistically significant or other path coefficients were reduced. Therefore, as shown in Table 2, there is sufficient empirical support to conclude that affective organizational commitment mediates the relationship between organizational culture (result-oriented culture, open system culture, employee oriented culture) and SPL performance.

**Table II: Testing mediation effects of Avatar self-identification**

Organizational culture types	Dependent variables: SPL performance	Dependent variables: Affective organizational commitment	Dependent variables: SPL performance (Affective organizational commitment included)
Result oriented culture	$\beta = 0.3101, p < 0.05$	$\beta = 0.2825, p < 0.05$	$\beta = 0.2915, p = 0.12$
Open system culture	$\beta = 0.1723, p < 0.05$	$\beta = 0.3223, p < 0.05$	$\beta = 0.1429, p = 0.13$
Employee oriented culture	$\beta = 0.2883, p < 0.05$	$\beta = 0.3220, p < 0.05$	$\beta = 0.2329, p = 0.02$

The model's explanatory forces were taken into account by observing the R2 of the endogenous structure [18]. As Figure 2 shows, this model accounts for 59.9% of the difference between emotional organizational arrangements and 48.2% of the difference between SPL performance. All hypotheses are supported. Finally, some factors have been introduced to control the commitment of emotional organizations. Includes the total number of employees in the position, organization term, career period, gender, age, training, recent sex, training format, and current location. Organization term and training recent last names have been found to be significant ( $\beta = 0.1771, p < 0.05$  and  $\beta = 0.2814, p < 0.05$  respectively).



**Figure I. The P-O fit model of psychological contract in organizational culture and SPL Performance**

**V. CONCLUSION**

This article proposed a P-O fitted model of a psychological contract in organizational culture and SPL performance. However, the overall institutionalization process includes organizational culture and individual efforts to gain knowledge, skills, and motivation to start, implement, and manage SPLs effectively. Ahmed et al. [3] show that organizational commitment has a positive impact on SPL performance. Therefore, there is an organizational culture that can reduce, support, or enhance the commitment of organizations related to SPL performance. However, there is little insight into how organizational culture influences SPL performance.

By applying a psychological contract, I proposed the P-O fit model in organizational culture and SPL performance. This study examines the types of organizational culture associated with psychological contracts and identifies how these organizational culture types affect perceptual outcomes associated with SPL performance. I agree with the psychological contract approach of organizational culture types and propose three types of organizational culture that positively impact SPL performance, taking into account the characteristics of software engineers.

As a result, as a result of the three organizational cultural types first proposed to take into account the characteristics of the software engineer, the central culture, the open system culture, and the employee-centered culture increase their commitment to their organization. Second, software engineers' emotional commitment to organizations improves SPL performance. Finally, software engineers' emotional, organizational commitments mediate the relationship between employee-centric culture and SPL performance.

This research has made a significant theoretical contribution. First, this study makes contribution to research by creating the evidence that supported organizational cultural theory and software engineers' SPL performance. Second, empirical evidence from this study further enhances understanding of the impact of organizational culture on software engineers' SPL performance and complements more knowledge in this area. The study also found that management is significant. First, software development companies are able to gain an understanding of organizational cultural issues in motivating software engineers to overcome barriers and increase their chances of achieving desired results. Second, the result is that software development companies recommend that organizational culture should be result-oriented, open-system, and employee-oriented.



In particular, studies have shown that software engineers have increased the potential for SPL performance when an organization has an employee-oriented culture. The results of this study help you better understand the software engineer's SPL performance, but there is a potential for generalization in this study. It's hard to say whether we can generalize our research into other parts of the world. Because there is no study on this subject, the generalization of this study's results can depend on verification and replication in different environments and regions.

This study suggests the expansion of this study and future research. First, the results of this study can be generalized if they are replicated and verified in different regions and circumstances. This study recommends using the same model in other developing countries for future research. Second, researchers in the future need to look at what's more theoretical and what's. For example, software engineers are not convinced of the new methodology because the software technology is changing very fast. Therefore, self-efficiency in new methodologies that can be increased by learning new technologies, methodologies, and processes can be critical to keeping software engineers up to date on the latest methodologies. It is an excellent research issue as to how self-efficiency motivates software engineers. Finally, the study used survey methodologies and sample sections to collect data. Scholars of the future may attempt a termination study to determine the causal relationship between organizational culture type and SPL performance.

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