

APPLIES - Method for evaluAting organization's motivation and Preparation for adoPtting product LInEs

Version

1.0-a2

Guidelines for expert reviewers

February 2018

Contact

Luisa Rincón*, Raúl Mazo°, Camille Salinesi°

*lfrincon@javerianacali.edu.co**

*PhD student, Centre de Recherche en Informatique,

*Université Paris 1 Panthéon Sorbonne, Paris - France

*Pontificia Universidad Javeriana, Cali, Colombia

°{ camille.salinesi, raul.mazo}@univ-paris1.fr

°{ Associate professor, Professor}, Centre de Recherche en Informatique
Université Paris 1 Panthéon Sorbonne, Paris - France

Content

APPLIES - Method for evaluAting the feasibility of adoPting Product LInES	3
1. Introduction.....	3
2. Framework overview.....	3
2.1 APPLIES-motivation	4
Part A. Motivation assessment model	4
Part B. Process to analyze company's motivation	4
2.2 APPLIES-preparation	5
Part C. Preparation assessment model	5
Part D. Process to assess company's preparation.....	5
3. Final remarks	8
Bibliography	8

APPLIES - Method for evaluAting the feasibility of adoPtIng Product LInES

1. Introduction

APPLIES stands for framework for *evaluAting organization's motivation and Preparation for adoPtIng product LInES*. This framework intends to provide quality information to companies that do not know if a product line approach is viable to their case, whether these companies have heard previously about the product line approach or not. Specifically, the framework might be applied by consultants, project managers, product managers or any person who would like to convince management levels to adopt a product line initiative. APPLIES is not intended to replace the decision-makers, rather, it provides a systematic approach to support their judgments prior they take any decision in favor or against adopting a product line. APPLIES is being developed as part of the Luisa Rincon's Ph.D. led by Professors Camille Salinesi and Raúl Mazo of Paris 1 Panthéon Sorbonne University. This document presents the version 1.0-a2 of APPLIES.

2. Framework overview

APPLIES has two components: *APPLIES-motivation* and *APPLIES-preparation*.

- *APPLIES-motivation* identifies drivers that motive the adoption of a product line approach in a company.
- *APPLIES-preparation* assesses to what extent a company is prepared to transit towards a product line approach and helps users to identify points where particular attention is necessary.

Both *APPLIES-motivation* and *APPLIES-preparation* are composed by an assessment model and a process. The assessment model organizes a collection of factors that gives the basis for the evaluation. The processes in turn are the collection of steps to conduct the evaluation and get the results. Figure 1 shows an overview of the components of APPLIES.

A tool available online¹ was created to support the framework. This was implemented as a spreadsheet with four sheets. The first sheet, called "motivation instrument", presents the motivation assessment model and supports the process associated with this component of the framework. The second sheet, called "assessment instrument" supports steps (a) to (f) of the *APPLIES-preparation* component. Finally, sheets three and four show the charts that summarize the results of *APPLIES-preparation*.

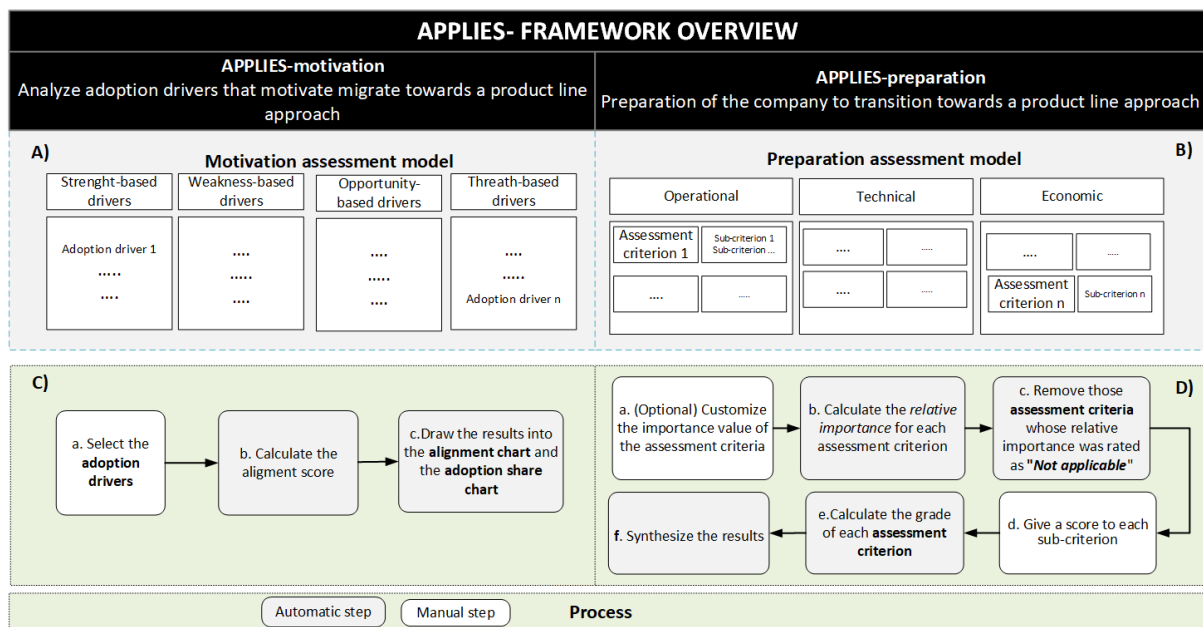


Figure 1. APPLIES Framework overview

¹ Available online in <https://github.com/lufe089/APPLIES.git>

2.1 APPLIES-motivation

This part of the framework helps companies discover to what extent they feel identified by the adoption drivers that have been reported in the literature. *APPLIES-motivation* aims to answer the question: *which specific needs in a company might be addressed by a product line production approach?*

Part A. Motivation assessment model

The motivation assessment model consists of a set of drivers that have motivated companies to adopt a product line. For instance, the company Dialect adopted a product line approach due to their difficulty for deriving new products economically (Staples and Hill, 2004), while repeated maintenance tasks and the management of an uncontrolled set of product parts triggered the product line adoption in companies as Engenio and FISCAN (Hetrick et al., 2006; Li and Chang, 2009). On the other hand, Salion adopted a product line approach because it was a prerequisite to its survival to deliver customized products quickly (Clements and Northrop, 2002). In total four types of drivers were identified: drivers motivated by organizational strengths, opportunities, weaknesses, and threats.

Part B. Process to analyze company's motivation

APPLIES-motivation follows a three-step process to identify drivers that motive a company for adopting a product line approach. These steps are: (a) select the adoption drivers, (b) calculate the alignment score, and (c) draw the results into charts. Each step is explained below.

Step a. Select the adoption drivers

Users of *APPLIES-motivation* select from the collection of adoption drivers provided those aligned to the organization case/conditions. Figure 2 shows an extract of the motivation instrument in which users of *APPLIES-motivation* complete their selection.

Organization's name (please complete)		
Name	Strength-based drivers	Select all that apply ↓
Retain customers	The organization retains its current customers due to the variability among their products	<input type="checkbox"/>
Gain customers	The organization gains new customers due to the variability among their products	<input type="checkbox"/>
Legacy code	The company has legacy reusable code that would like to translate into a more maintainable form	<input checked="" type="checkbox"/> Yes

Figure 2. Motivation instrument screenshot. Selection of the adoption drivers

Step b. Calculate the alignment score

APPLIES-motivation calculates the percentage rate of adoption drivers selected by the user. This percentage represents to what extent the organization feels aligned with the adoption drivers that have been reported in the literature. Also, *APPLIES-motivation* calculates the share of the selected drivers among the four types of drivers. This information shows whether the company motivation for adopting a product line come from organizational strengths, opportunities, weaknesses or opportunities.

The hypothesis that motivates our work leads us to think that more an organization identifies itself with these drivers, the more it will be sensible to adhere to the product line approach. This hypothesis is supported by Susanto [68], most successful change effort begins when some individuals start to look at the company situation to identify potential crisis or great opportunities that will arise.

Step c. Draw the result into charts

Two charts present the alignment score calculated in step two. Figure 3 shows an example of both charts. Part (A) of this example shows that 7 over 20 of the adoption drivers were and from this previous selection the 57% of the drivers were motivated by organizational weaknesses (Figure 3 part b).

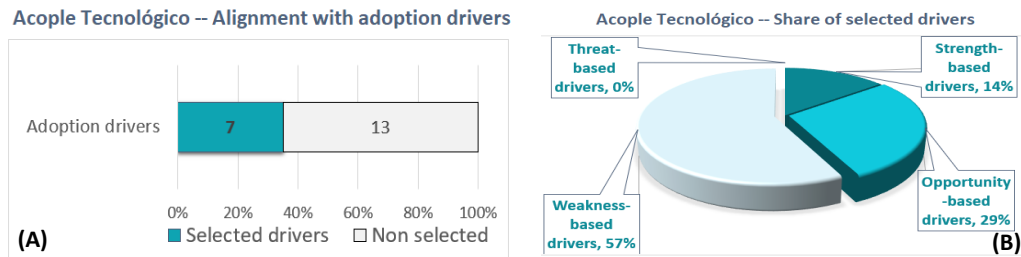


Figure 3. Motivation charts examples. Part (A) Alignment with adoption drivers chart. Part (B) Share of selected drivers chart.

2.2 APPLIES-preparation

The component *APPLIES-preparation* provides well-founded reasons that help the users of the APPLIES method to know what aspects should be improved or require more urgent attention.

The aim of *APPLIES-preparation* is to answer the question: *to what extent a company is prepared for adopting a product line production approach?*

Part C. Preparation assessment model

Different factors should be considered to evaluate the preparation of a company to adopt a product line approach. The preparation assessment model organizes factors compiled from an analysis of the literature. In total, the preparation assessment model has 67 sub-criteria, 17 assessment criteria and 3 dimensions.

At the upper level (see Figure 4), dimensions are the perspectives of analysis from which *APPLIES-preparation* assesses the company preparation, i.e., operational, economic and technical. The operational dimension includes criteria to evaluate to what extent the product line approach fits in the organizations' culture, processes, or practices. The technical dimension includes criteria to evaluate to what extent the organization has the technical capability for transitioning towards a product line approach. Finally, the economic dimension includes criteria to evaluate to what extent the associated cost and benefits would be materialized if a product line approach is pursued.

Next at the middle-level, each assessment criterion is a signal that we use to determine how well prepared for adopting a product line production approach the company is. Assessment criteria could be internal or external. On the one hand, internal criteria are those in which the organization has some influence. For example, the domain knowledge, the commitment of the managers or the potential products of the product line. On the other hand, external criteria are those factors over which the organization has no control, for example the market potential.

Finally, at the lower-level of the assessment model, the sub-criteria are the information that users of *APPLIES-preparation* should rate to evaluate the company performance of each criterion.

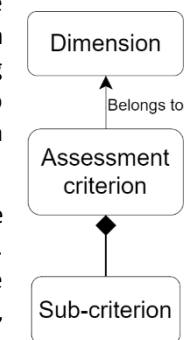


Figure 4. Preparation assessment model structure

Part D. Process to assess company's preparation

APPLIES-preparation follows a six-step process to assess company's preparation. Those steps are: (a) customize the importance value of the assessment criteria (optional); (b) calculate the relative importance for each assessment criterion; (c) remove the assessment criteria whose relative importance is rated as "not applicable"; (d) give a score to each sub-criterion, (e) calculate the grade of each assessment criterion; and (f) synthesize and draw the results. Step (a) and (e) require inputs from APPLIES users, while the remaining steps are automatically executed in the assessment instrument that supports *APPLIES-preparation*. Each step is explained below.

Step a. Customize the importance value of the assessment criteria (optional)

Companies might have different and independent prioritization criteria. *APPLIES-preparation* allows users customized the importance of any criteria at any time during the evaluation. This customization is done with a number between zero and three. Zero means the criterion is irrelevant to the organization, one means the criterion is desirable, two means the criterion is important and three means it is very important. This number hereinafter will be called *customized importance value*.

Steps b and c. Calculate the relative importance of each assessment criterion and remove those assessment criteria whose relative importance is rated as “not applicable”

The relative importance represents how relevant each criterion is in comparison with the preparation of a company for adopting a product line approach. There are three categories that *APPLIES-preparation* includes to represent this importance: *very important*, *important* and *desirable*.

APPLIES-preparation calculates the relative importance of each assessment criterion combining information from two different strategies: *evidence from the literature* and *stakeholder opinions*. On the one hand, each assessment criterion has a suggested importance value that we assigned from a literature review. On the other hand, from getting information from stakeholders *APPLIES-preparation* takes into account the customized importance value assigned by the user in step (a) of this process. In this third step, *APPLIES-preparation* uses both values, the suggested importance, and the customized importance to calculate the relative importance of each criterion following the matrix depicted in Table I. For example, if the suggested importance value for the criterion *commitment of key actors* is 3 and the customized importance value is also 3, the relative importance value assigned to this criterion is “very important”.

TABLE I. MATRIX TO DETERMINE RELATIVE IMPORTANCE COMBINING THE SUGGESTED IMPORTANCE AND THE CUSTOMIZED IMPORTANCE

Customized importance value	Suggested importance value			
		1	2	3
	3	Important	Important	Very Important
	2	Desirable	Important	Important
	1	Desirable	Desirable	Important
	0	Not applicable	Desirable	Desirable

Step d. Give a score to each sub-criterion

APPLIES-preparation users should rate the sub-criteria corresponding to the remaining criteria from the step c. This rate should respect a Likert-type including the following values: (5) completely agree (4) agree (3) don't know (2) disagree and (1) completely disagree. Notice that this scale has equal numbers of positive and negative positions and provides the option “don't know” as a neutral value to give respondents a ‘get out’ if they can't value a statement or are unsure. Figure 5 shows a screenshot of the assessment instrument. As can be seen in this figure, the column K is the place where the users assign the score of each sub-criterion. It is worth to say that even if the users of *APPLIES-preparation* rate the sub-criteria with categorical labels, *APPLIES-preparation* uses the number associated to each label to calculate the score of each criterion as is explained in the next step.

	A	D	E	K	R	S	V	X
	Dimension/Preparation criterion/Sub-criterion /Statement		Pending sub-criteria	Sub criteria	Criteria			
				Input Rating (ordinal)	Suggested Imp	Inputs Customized Imp value	Outputs Resulting importance	Criteria score
4	Operational							
5	Internal	Commitment of key actors	1		3		Very important	2,00
6	Internal	Relevant stakeholders will support the initiative for exploring a product line solution		Agree				
7	Internal	The product line project will have a "product line champion" or "angel" at a high level of hierarchy						
8	Internal	Customers connexion	2		2	1	Desirable	1,75
9	Internal	The organization uses feedback from customers to develop new products or services		Strongly agree Agree Don't know Disagree Strongly disagree				
		The organization is able to attract		Strongly				

Figure 5. Assessment instrument screenshot

Step e. Calculate the grade of each assessment criterion

The score of each criterion is calculated as a grade-point average among all the sub-criteria that make up the assessment criterion. For example, the criterion *commitment of key actors* has two sub-criteria. If the evaluator

rates the first sub-criterion with “strongly agree” and the second sub-criterion with “disagree” the score of the criteria *commitment of key* is 3.5 which is the average between 5 from “strongly agree” and 2 from “disagree”.

Step e. Synthesize the results

Current version of *APPLIES-preparation* sets in three the cut-off value that separates good results from bad results. Internal criteria with the score below of the cut-off value are weaknesses and external criteria in the same case are threats. On the other hand, internal or external criteria with scores equals or upper than three are classified as strengths or opportunities respectively.

At the end of this step, *APPLIES-preparation* identify the criteria that result in opportunities, threats, weaknesses, and strengths that the organization should face when a product family approach is introduced in the company. This information is the input for drawing a chart named “preparation grid”. Figure 5 presents a screenshot of this grid. At the top left side of the “preparation grid”, it holds criteria that are opportunities, while at the bottom left side it holds threats. On the other hand, at the top right side, the grid holds criteria which are strengths in the organization, while at the bottom right side it holds criteria which are weaknesses.

Each criterion is placed in the matrix considering three elements: its resulting score, its relative importance and its type (internal, external). The resulting score is calculated as an average of the sub-criteria that make up it. As an additional perspective of information, the preparation grid has a color progression in their background. This background pretends to call attention to crucial points: we assume that very important criteria with high scores are more relevant than desirable criteria with high scores. Similarly, very important criteria with low scores are more critical than desirable criteria with low scores. Having this information is important for the organization to plan short-term and long-term strategies for transitioning towards a product line approach.

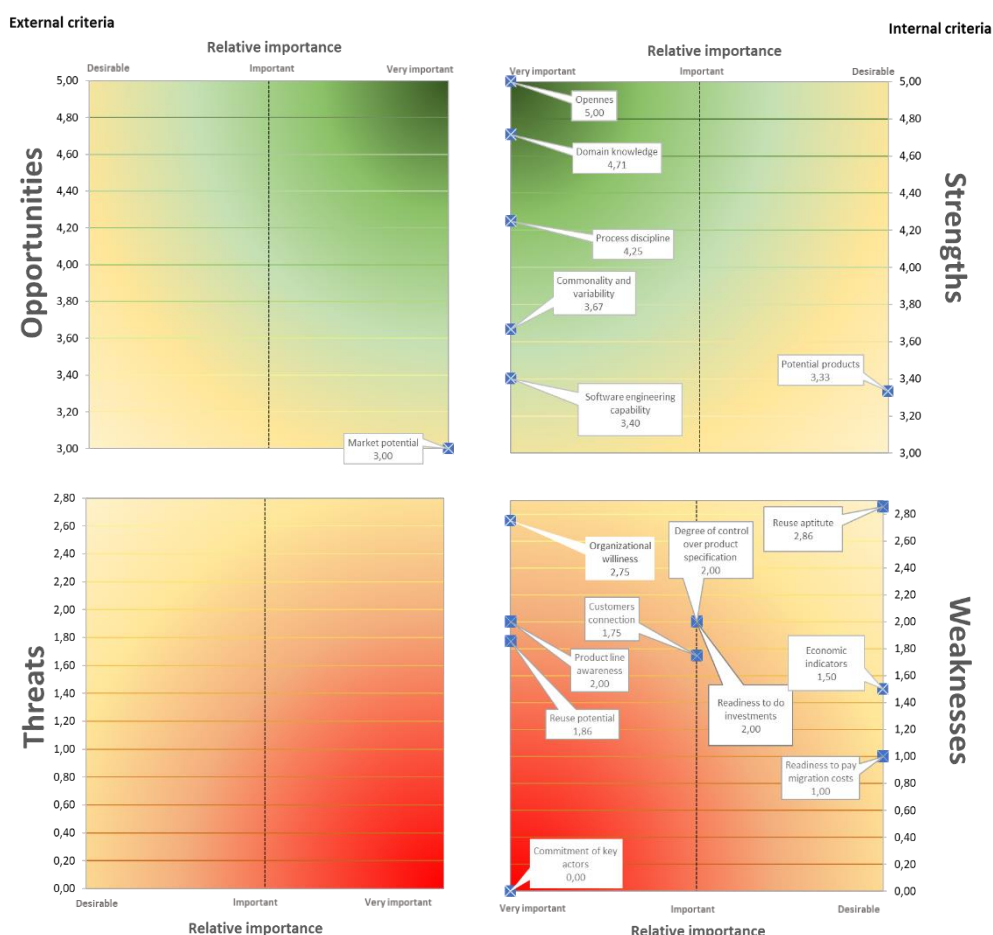


Figure 6. Screenshot example of a preparation grid

3. Final remarks

We invite you to answer the survey you received attached to the same email that you receive this guide. With your feedback you will help us to improve the structure and content of the assessment models that compose APPLIES. In this way we will have a better version before using APPLIES in real cases.

We thank you very much for your time, effort and support.

Luisa Rincon
Raul Mazo
Camille Salinesi

Bibliography

- Clements, P.C., Northrop, L.M., 2002. Salion, Inc. : A Software Product Line Case Study, Technical Report CMU/SEI-2002-TR-038.
- Hetrick, W.A., Krueger, C.W., Moore, J.G., 2006. Incremental return on incremental investment: Engenio's Transition to Software Product Line Practice, in: Companion to the 21st ACM SIGPLAN Conference on Object-Oriented Programming Systems, Languages, and Applications - OOPSLA '06. ACM Press, New York, New York, USA, p. 798. doi:10.1145/1176617.1176726
- Li, D., Chang, C.K., 2009. Initiating and Institutionalizing Software Product Line Engineering: From Bottom-Up Approach to Top-Down Practice, in: Proceedings of the 33rd Annual IEEE International Computer Software and Applications Conference. IEEE, pp. 53–60. doi:10.1109/COMPSAC.2009.17
- Staples, M., Hill, D., 2004. Experiences Adopting Software Product Line Development without a Product Line Architecture, in: Proceedings of the 11th Asia-Pacific Software Engineering Conference. IEEE, pp. 176–183. doi:10.1109/APSEC.2004.50