



Montréal 2020

24th Systems and Software
Product Line Conference

A multi-company empirical evaluation of a framework that evaluates the convenience of adopting product line engineering

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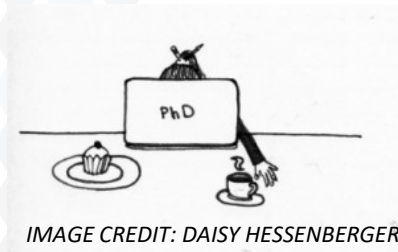




Who am I?

Luisa RINCON

New mom (learning and surviving)



PhD student

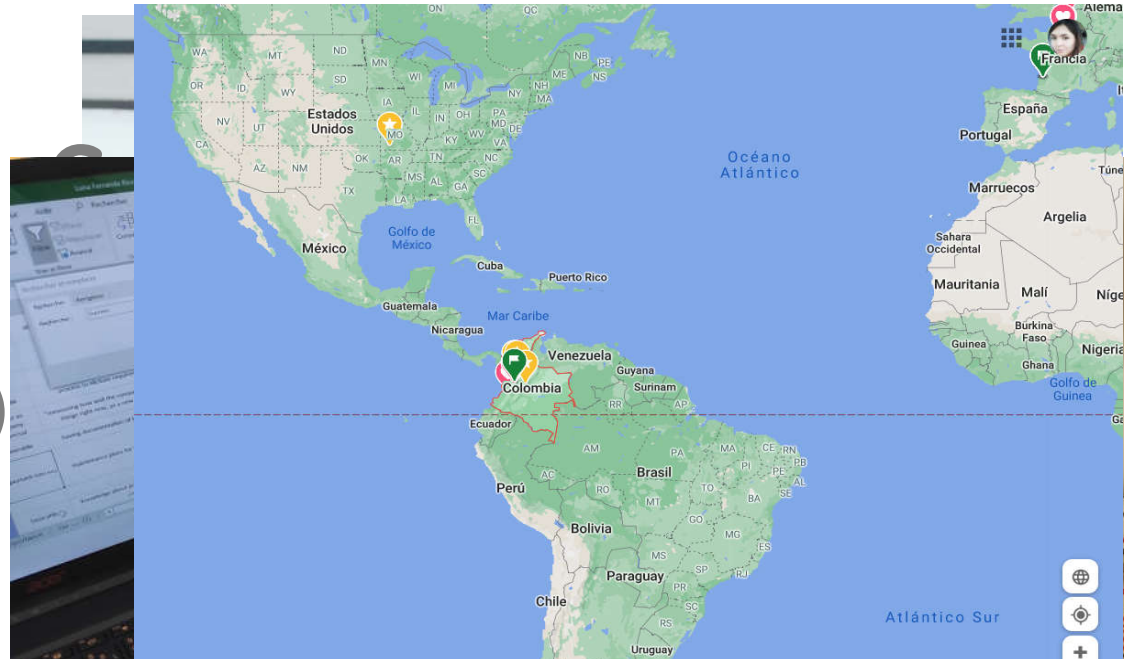
Interest: PLE adoption, empirical software engineering and change management

Assistant professor



Pontificia Universidad
JAVERIANA
Cali

Programming (Python, C) Software Engineering



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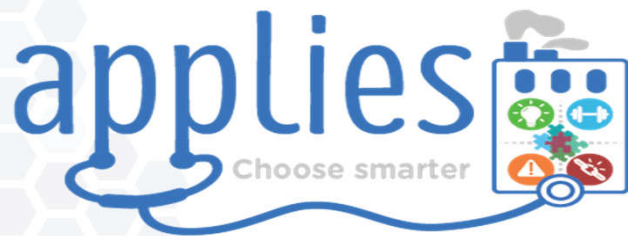
1.

Context



APPLIES structure

Assessment framework



Inputs- rate statements

Qualitative scale



Designed by jaimeChavarriaga

Self-assessment instrument

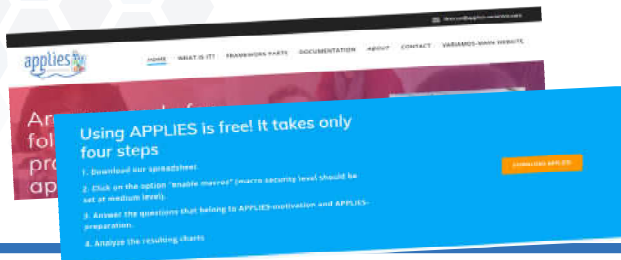
<https://applies.variamos.com>

Strength-based drivers			Select all that apply ↓
Retain customers	The organization retains its current customers due to the variability among their products		
Gain customers	The organization gains new customers due to the variability among their products		Yes
Legacy code	The company has legacy reusable code that it would like to refactor into a more maintainable form		

APPLIES-motivation

How to use APPLIES-preparation ...			
Go through each assessment criterion and rate their sub-criteria. This tool automatically computes the score of each assessment criteria and updates the resulting charts which are visible in the sheet "Preparation results".			
NOTICE THAT In case you are unsure whether a statement is true or not in your company select the "Don't know" option. In case you consider a statement does not			
Dimension/Assessment criterion/Sub-criterion	Pending sub-criteria	Sub criteria Input Rating (ordinal)	Criteria Outputs Relative importance Criteria score
Operational			
Internal	Commitment of key actors	2	Very important 0,00
Internal	Managers will support the initiative for exploring a product line solution		
Internal	The product line project would have a project leader with authority to take decisions and support the idea of change		
Internal	Degree of control over product specification		Important 0,00
	The organization control how the product is developed		

APPLIES-preparation



III Workshop on Empirical Experiences on Software Reuse (WEESR 2020)

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Designed by Jaime Chavarriaga

Preparation score

2,77

Low prepared

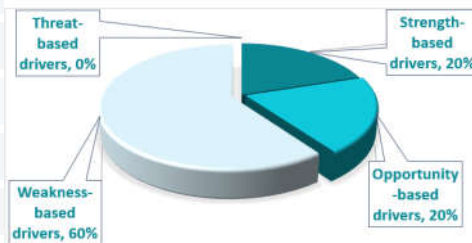
Outputs - Analytical charts

APPLIES- Preparation resulting charts

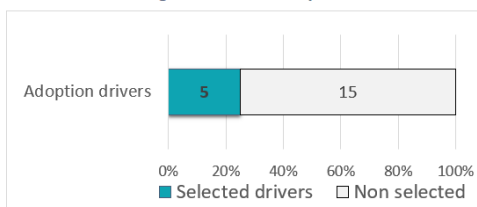
Our recommendation

The organization is probably not prepared for adopting a product line approach, and the change effort is likely to fail. Examine the lowest scoring assessment criteria to identify specific areas where your organization may be least ready for the change.

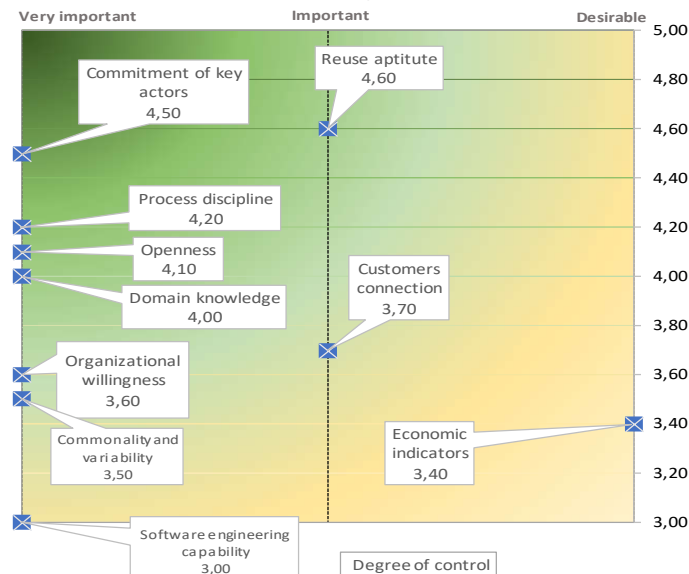
ATK – Share of selected drivers



ATK – Alignment with adoption drivers



Relative importance



Internal criteria

Score by dimensions



Summary



Strengths

III Workshop on Empirical Experiences on Software Reuse (WEESR 2020)

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By using APPLIES people would have information such as...

- **Do we Need it?**
- Do we have the **capacity** to undertake that change?



Designed by jaimeChavarriaga

[Evaluation] Topics of interest

Usefulness

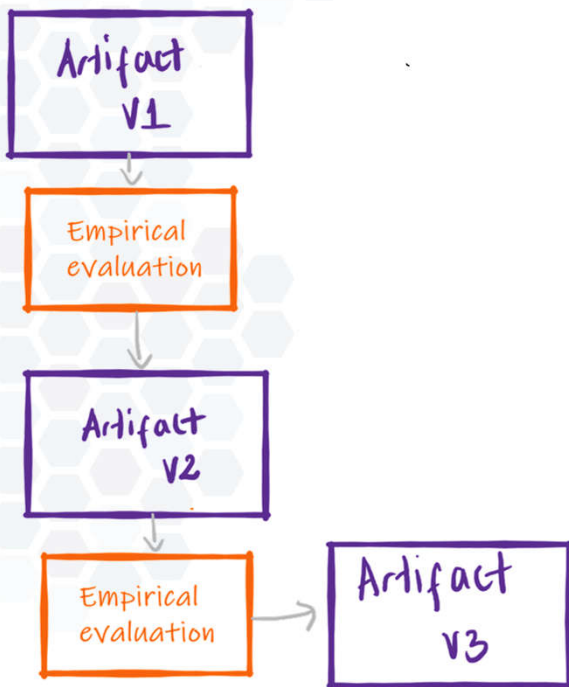
Intention to
use

Ease of use

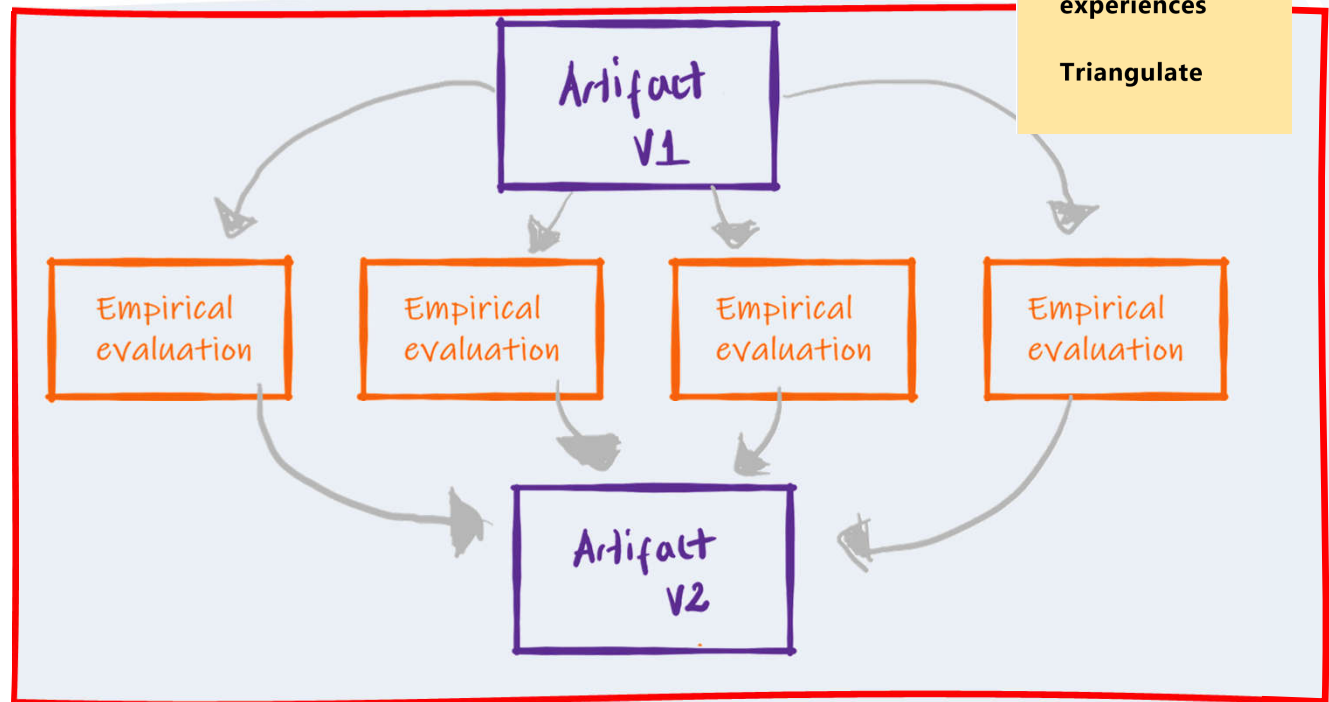
Improvements

[Evaluation] Strategies to find evidence

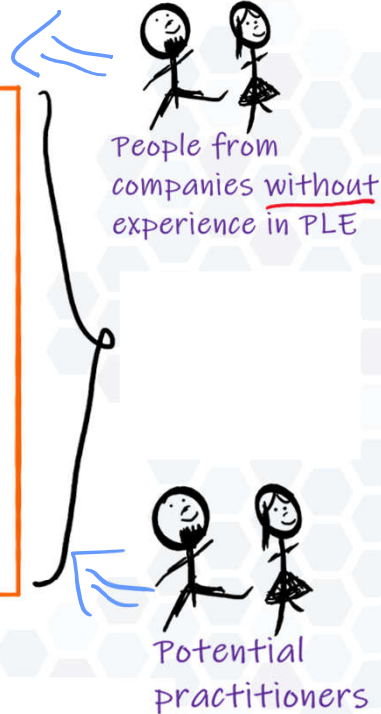
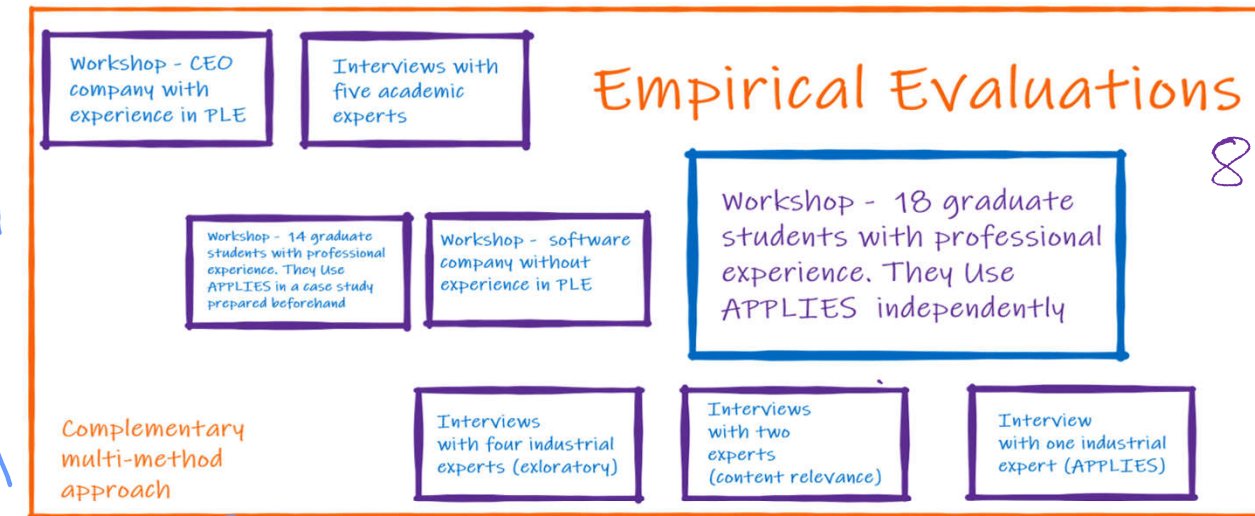
- Evolutionary approach
 - (Wood et al., 1999)



- Complementary approach
 - (Wood et al., 1999)



Research stages



Refined version





2.

Multicompany empirical evaluation

Participants



18
Potential
practitioners

Professional
experience (> 1)
Notions on PLE

Graduate students
24h course
on SPLE

Assignment

Learn about APPLIES (supervised)

Use APPLIES (independent)

Evaluate APPLIES (optional)

3

Stages

First empirical experience in
which people used
APPLIES without the supervision
of any researcher



19 spreadsheets
18 companies

6 companies with IT
departments

12 software
development
companies



9 responses



18 reports

Collected data

Analysis procedure



Consolidate items marked as unclear

How to use APPLIES-preparation ...
Go through each assessment criterion and rate their sub-criteria. This tool automatically computes the score of each assessment criteria and updates the resulting charts which
NOTICE THAT in case you are unsure whether a statement is true or not in your company select the "Don't know" option. In case you consider a statement does not apply to you eliminate the N/A values from the overall score providing you with a more accurate result.

Dimension/Assessment criterion/Sub-criterion	Pending sub-criteria	Unclear statements Problem unclear, redundant, needs more details	Explanation	Input Rating (ordinal)
Internal	Readiness to pay migration costs	1	3	
Internal	The enterprise is willing to pay the costs for training people in SPL engineering			
Internal	The company will allocate employees' time dedicated to product line adoption			
Internal	If needed it, the enterprise is willing to pay costs for modifying the organizational process			

Summarize closed-ended questions with descriptive statistics

B	C	D	E	F	G	H	I	J	K
¿Cuántos de experiencia profesional tiene?	Rango - tiempo de profesional	¿Trabaja actualmente ?	Si trabaja ¿Por favor explique en qué consiste su rol en la empresa ?	PU-1	PU-2	PU-3	PU-4	IU-1	IU-2
Mas de cinco años	2	Si	Consultor funcional y técnico en soluciones CRM	4	4	5	5	5	5
Mas de cinco años	2	Si	Analista 1 de gestión de aplicaciones, desarrollo y gestión	4	5	5	4	5	4

Use APPLIES

33%

67%

0%

10%

20%

30%

40%

50%

60%

70%

80%

90%

100%

*Written reports
[Optional questionnaire] Open-ended questions*

C:\Users\lfrin\OneDrive - Pontificia Universidad Javeriana Cal\Manuscript versions\Sources\APPLIES-data analisis4.mx20 - MAXQDA Analytics Pro 2020 (Release 20.2.1)

Home Import Codes Memos Variables Analysis Mixed Methods Visual Tools Reports Stats MAXDictio

New Project Open Project Document System Code System Document Browser Retrieved Segments Logbook Teamwork Merge Projects Save Project As Save Anonymized Project As External Files Archive Data Project from Activated Documents

Document System

- Eval#3.InterviewParticipant2(May8-2018)(spanish)
- Eval#3.FinalGroupDiscussion- Pilot (May8-2018) (spanish)
- Eval#3.OpenAnswers
- Eval#4.Documents (Convenient)
- Eval#4 - AgreatedDataDifferentCompanies-Comments
- Eval#4 - AgreatedDataDifferentCompanies
- Eval#4.OpenAnswers

Code System

- Improvements
- APPLIES-evaluation
- Operational considerations
- Perceived usefulness
- Intention to use
 - Why people would use APPLIES
 - People would recommend APPLIES to companies such...
- Ease of use
 - Content pertinence
 - Easy to use - operational
 - Easy to use - tool
 - Outputs-perceived usefulness
 - Outputs understandability
 - Content understandability

Document Browser: Eval#4.OpenAnswers (62 Paragraphs)

19 • Analista 1 de gestión de aplicaciones, desarrollo y gestión

20 • Me desempeño como el Director de Innovación(CINO), oriento la estrategia de continua transformación tecnológica con el fin de buscar innovaciones en Estrategia tecnológica, Procesos y Productos. Es una compañía de Base Tecnológica centrada en desarrollo de negocios con base en tecnología, especialmente software.

21 • [one of the participants didn't provide any answer pq no trabajaba]

22 [Si tuviera que asesorar a una compañía sobre si adaptarse a una línea de productos, qué tan probable es que usted use APPLIES para hacer su diagnóstico?

23 ¿Por qué si o por qué no lo usaría?]

24 • Me gusta la idea de tener una herramienta que ayude a medir o visualizar por qué es necesaria la LPS en la empresa o por qué no, además porque muestra mejor dónde están los errores y cómo se podrían atacar.

25 • Requiere grandes estudios poder llevarlo a cabo

26 • Creo que la cantidad de preguntas no son suficientes o faltan preguntas que pueden jugar un papel importante.

27 • La usaría, por que es una herramienta que abarca todos los factores que se deben tener en cuenta en una línea de productos.

28 • Excelente y práctica

29 • Me parece que da una buena idea de que factores son positivos y negativos para la implementación de las LP. Se puede realizar un análisis a partir de estos resultados.

30 • Lo usaría por los aspectos que evalúa.

31 • Es un marco de trabajo entendible y las preguntas son puntuales, abarca aspectos sensibles de las organizaciones.

Retrieved Segments

Activate documents and codes to retrieve coded segments ...



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3.

Results and lessons learned

Results [Perceived usefulness –intention to use]

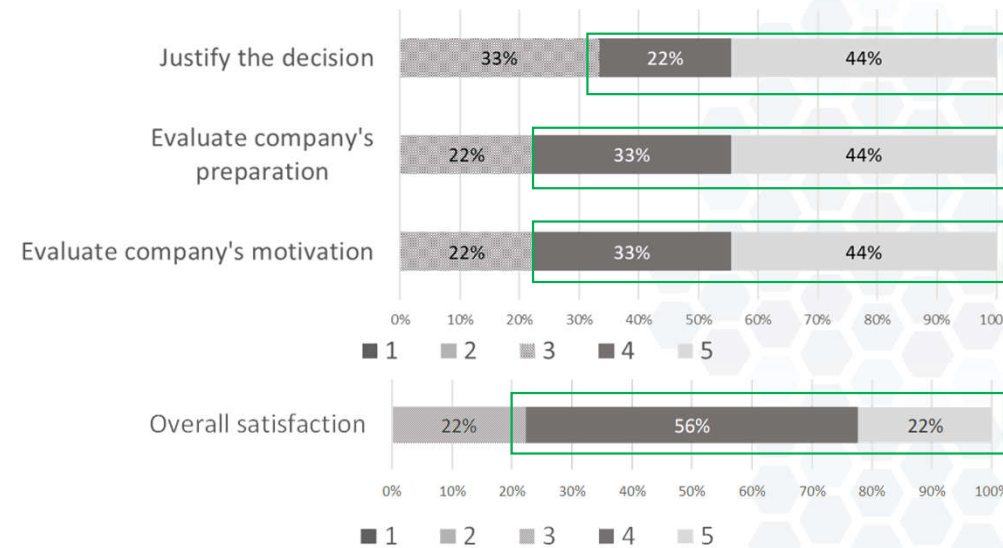
People that evaluated
APPLIES **considered that it is useful** ✓

People that evaluate APPLIES
have **intention to use** it in the future ✓

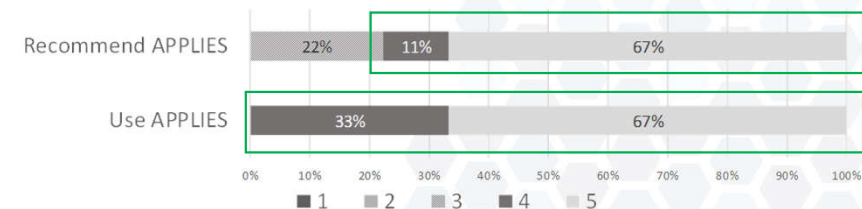
"I managed to obtain the weaknesses that the company has, and from this I had a basis to define what was right for the company"

*"**APPLIES** covers not only the company's technical capabilities but also the organizational aspects and interests that the company might have from a business perspective. This coverage generates strong confidence in the evaluation"*

Perceived usefulness (n = 9)



Intention to use (n = 9)



Results [Ease of use - understandability]

The *content, charts and final report* require adjustments to improve its understandability

(Questionnaire, spreadsheets)



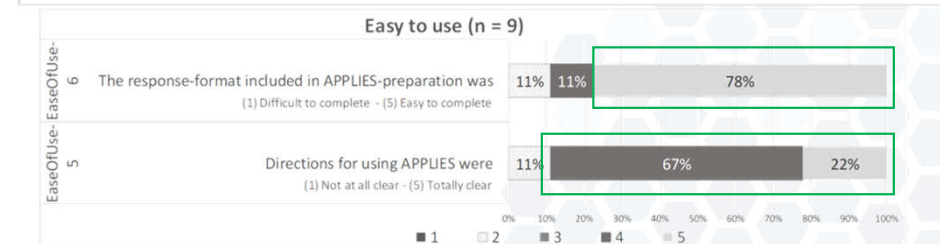
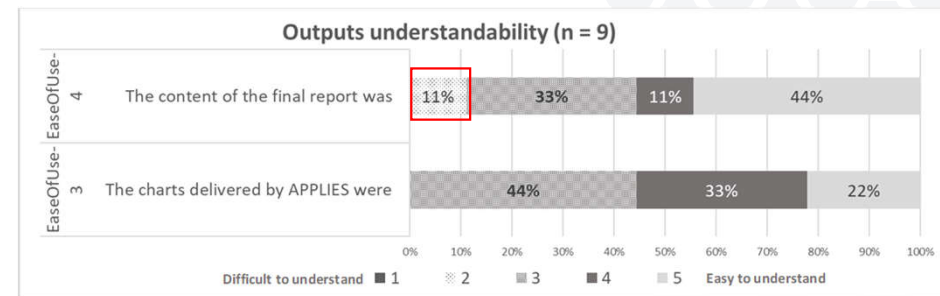
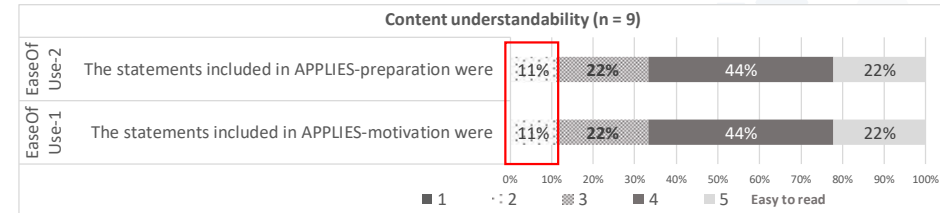
Directions for using APPLIES were clear to most of participants

(Questionnaire)



Most of participants considered the *response format* was easy to use

(Questionnaire)



Results [Ease of use - operation]

English -- limits the understanding
(Satisfaction questionnaire)



The charts that summarize
companies' motivation were
less used than expected
(Written reports)



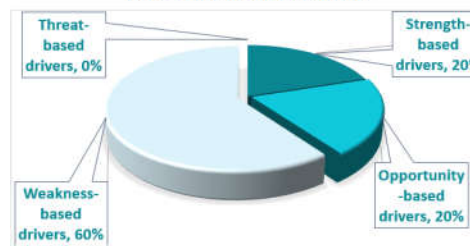
The ease of use of the
spreadsheet that supports
APPLIES
does not prevent users from
performing the evaluation



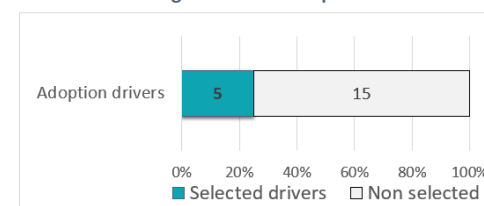
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Dimension/Assessment criterion/Sub-criterion	Pending sub-criteria	Sub-criteria Input Rating (ordinal)	Criteria Outputs Relative importance Criteria score
Operational			
Internal	Commitment of key actors	1 2	Very important 0,00
Internal	Managers will support the initiative for exploring a product line solution		
Internal	The product line project would have a project leader with authority to take decisions and support the idea of change	Totally almost totally Monthly Sometimes Not at all Don't know N/A	
Internal	Degree of control over product specification	1	Important 0,00

ATK -- Share of selected drivers



ATK -- Alignment with adoption drivers



A	B	C	D	E	F	G	H	I
 A framework for evaluating company's preparation and motivation for adopting product lines (v 1.0.4a) by Luis Rincon								
Welcome! This tool that implements the APPLIES framework.								
APPLIES is a free framework for evaluating in a systematic, objective and repeatable way company's motivation and preparation for adopting product lines. As a result, APPLIES intends to provide information for supporting the judgments of decision-makers prior they take any decision in favor or against adopting a product line. This framework expects to be useful to consultants, project managers or any person interested in advising management levels to choose a product line initiative. APPLIES ask for some product-lines related concepts, <i>THUS IT IS RECOMMENDED</i> that you have at least a <i>BASIC</i> notion about <i>WHAT IS THE PRODUCT LINE ENGINEERING</i> approach before using APPLIES.								

Results [Improvements]

Potential new factors
(Satisfaction questionnaire)

Introduce basic terms
*(Satisfaction questionnaire,
written report)*

Review the pertinence of the
adoption drivers
(Written reports –
spreadsheets)

Check limitations on the
reliability
(Written reports –
spreadsheets)

Results [categories of adopters]

Unprepared adopter (2)

Motivation ✓

Preparation 

Potential adopter (9)

Motivation ✓

Preparation 

Ready adopter (4)

Motivation ✓

Preparation ✓

Unmotivated adopter (4)

Motivation 

Threats to validity



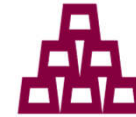
Internal validity

- Subject-expectancy effect
 - Optional and anonymous questionnaire (9 answers)
 - Maximum grade -> complete the assignment
- Ignorance of other similar alternatives
- Quality of the responses



External validity

- Convenience sample -> They represent potential users of APPLIES



Construct validity

- Link data sources and their interpretation
- Test-retest coding

Empirical evaluation - summary

What - APPLIES

How –18 potential practitioners – 18 different companies

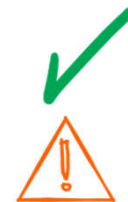
Satisfaction questionnaire, spreadsheets, reports

Results

Perceived usefulness and intention to use

Ease of use

Improvements



What we would do differently?

Expand the
information requested
in the report

*How easy it was to collect the information
and problems they had*

Change/complement
the questionnaire
with a focus group



4.

Conclusions

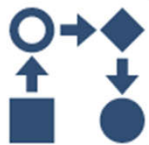


Conclusions



APPLIES

Solution to self-assess company's motivation and preparation for adopting PLE



Experimental settings

Usefulness, intention to use, ease of use, improvements
18 participants use APPLIES to evaluate 18 companies
Satisfaction questionnaire, spreadsheets, written reports



Lesson learned

Expand the information requested in the report
Change/complement the optional survey with a focus group

