

## A comparative analysis of the implementation of the Software Basic profile of ISO/IEC 29110 in thirteen teams that used predictive versus adaptive life cycles

Mirna Muñoz, Adriana Peña, Jezreel Mejía, Gloria Piedad Gasca-Hurtado, María Clara Gómez-Alvarez and Claude Y. Laporte

[mirna.munoz@cimat.mx](mailto:mirna.munoz@cimat.mx), [adriana.pena@cucei.udg.mx](mailto:adriana.pena@cucei.udg.mx), [jmejia@cimat.mx](mailto:jmejia@cimat.mx),  
[gpgasca@udem.edu.co](mailto:gpgasca@udem.edu.co), [mcgomez@udem.edu.co](mailto:mcgomez@udem.edu.co), Claude.Laporte@etsmtl.ca



# AGENDA

---

- ❑ Introduction
- ❑ Background
- ❑ Method for implementing the ISO/IEC 29110 series
- ❑ Comparison in the implementation of the Basic profile of ISO/IEC 29110
- ❑ Discussion
- ❑ Conclusions and Future work

# INTRODUCTION

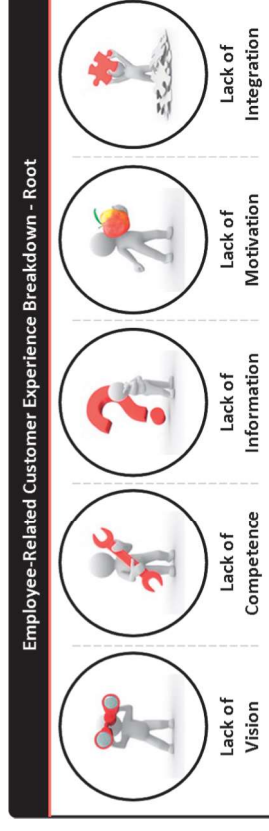
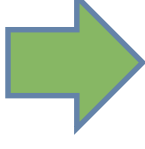
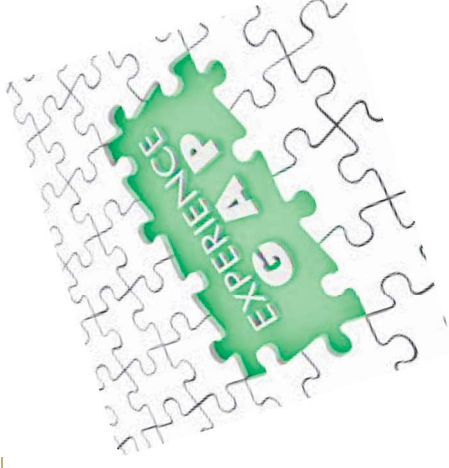
---

- Software standards and models for the software industry are elaborated to contribute to the development of quality products within budget and schedule, by optimizing efforts and resources.
- The implementation of proven practices contained in these models and standards in real environments of software development organizations represents a current challenge.



# INTRODUCTION

- Especially for very small entities (VSEs), i.e. enterprise, organization (e.g. public or non-profit organization), project or department having up to 25 people, that must work harder in order to survive, and at the same time spending time and effort on improving their operation and processes.



- A common problem that most VSEs face is the lack of knowledge and practical experience regarding the implementation of software models, such as the CMMI®, or software engineering standards such as the ISO/IEC/IEEE 12207 lifecycle processes standard.

# INTRODUCTION



- This paper presents the results of the implementation of the software Basic Profile of the ISO/IEC 29110 in 13 VSEs of Mexico composed of teams from 2 to 6 people and using two types of life cycles (i.e. predictive and adaptive).
- This analysis was done, since one of the main features of ISO/IEC 29110 is that it can be implemented in VSEs using any development approach or methodology including, for example, agile, evolutionary, incremental, or test-driven development, among others.
- This paper aims to identify the effort invested by software teams in order to improve their processes using the software Basic profile of ISO/IEC 29110 as a framework

# BACKGROUND

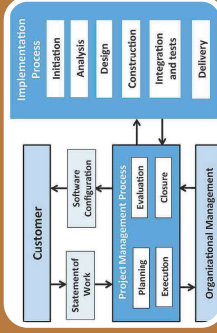


## TEAM

- The growth on software requirements has made the software development to be essentially performed by a team
- Better results can be achieved when people with particular social skills are assigned to different phases of a project, those that best match their skills

## ISO/IEC 29110 series

- The ISO/IEC 29110 series of software engineering standards and guides have been developed to assist VSEs to improve their systems or software development process
- It can be used to establish processes in VSEs using any development approach or methodology



## Software Development Life Cycles

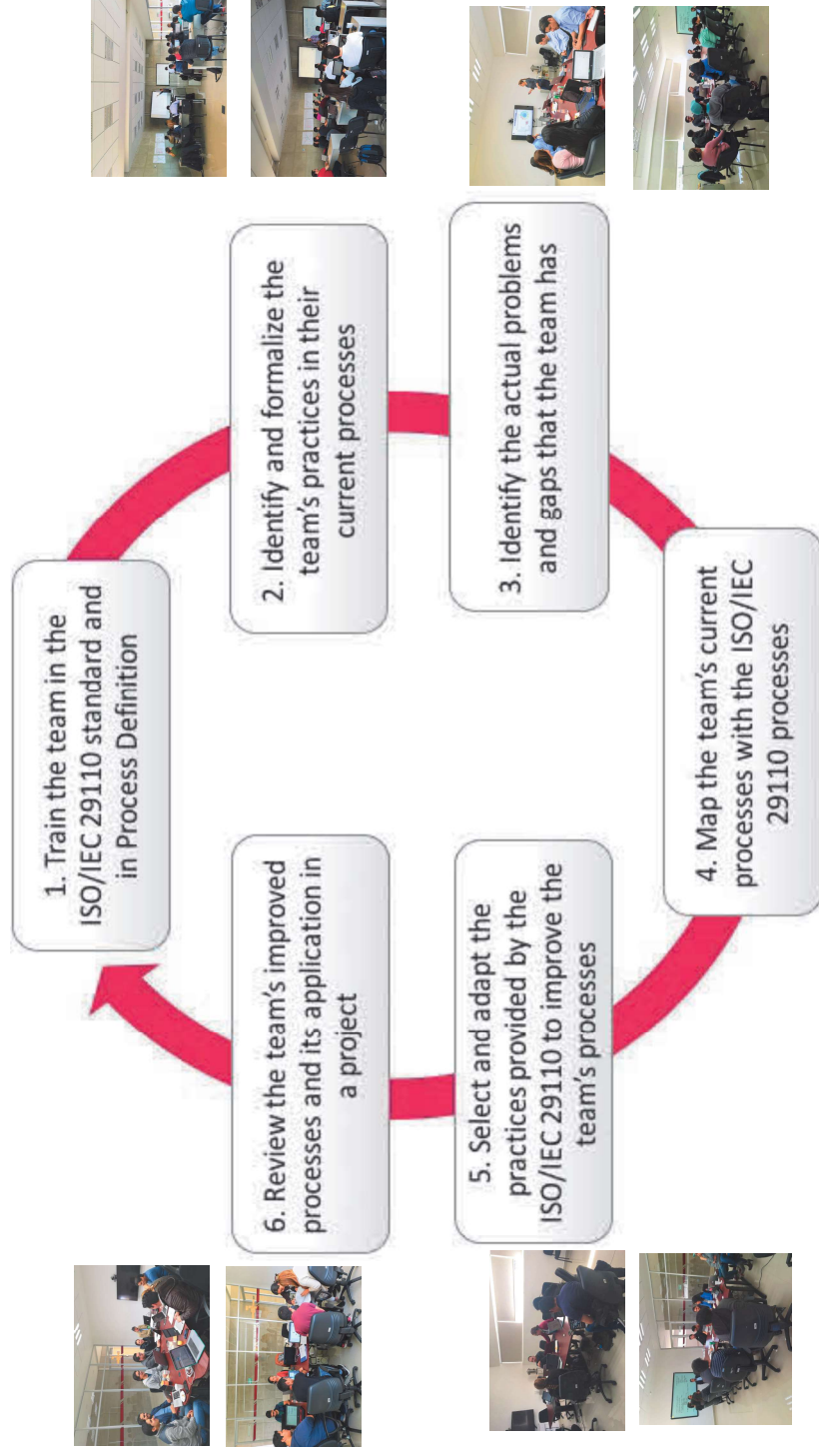
- *Predictive life cycles methodologies:* (1) they focus on defining the overall scope for the product and project; (2) they develop a plan to develop a product and any associated deliverables; (3) they proceed to execute the plan through the phases to achieve the goal; (4) they manage carefully the changes and the required re-planning and a formal acceptance. Examples of these life cycles are: Team Software Process (TSP®) and Waterfall.
- *Adaptive life cycles methodologies:* (1) they focus on decomposing the goal of the project in requirements and work to perform and allocate it in a product backlog; (2) they determine the work to be done in the next iteration, selecting items from the product backlog; (3) they proceed to execute the select items so that, at the end of the iteration, they can be able to present a product ready to be reviewed by the customer; (4) they intent to respond to a high number of changes. An example of this life cycle is Scrum





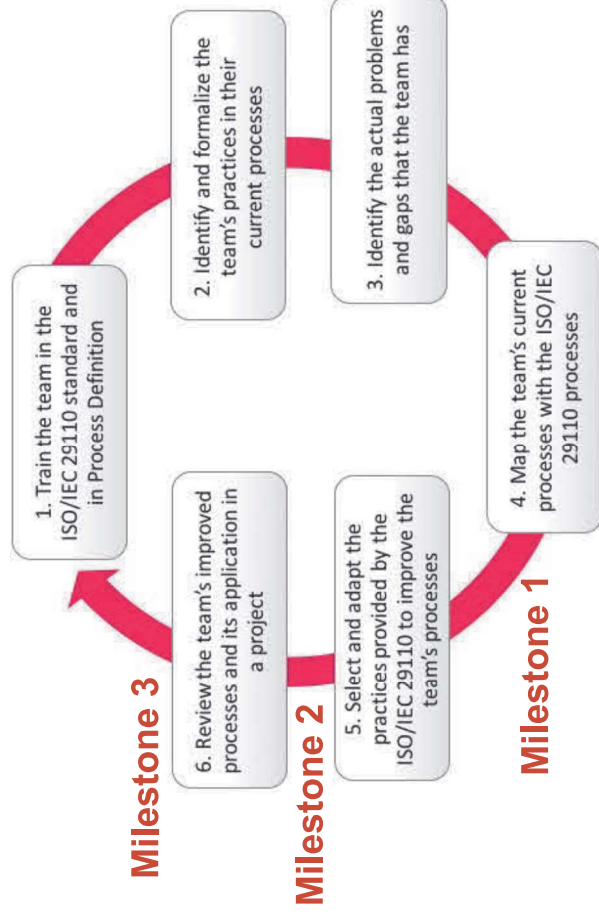
# METHOD FOR IMPLEMENTING THE ISO/IEC 29110 SERIES

Six-step method followed by each team during the adoption of the software Basic profile of ISO/IEC 29110



# METHOD FOR IMPLEMENTING THE ISO/IEC 29110 SERIES

How the Six-step method was implemented?



A set of meetings were performed.

Three milestones meeting were held to assess the practices coverage allowing us to perform the comparative among teams, as follows described:

(Milestone 1): we call this milestone initial diagnostic. This milestone was set after the execution of four steps of the method, because at this moment teams have their current processes defined;

(milestone 2): we call this milestone middle diagnostic. This milestone was set after the execution of the step five of the followed method, because at this moment teams start the adoption of ISO/IEC 29110 to their processes and according to their way of work;

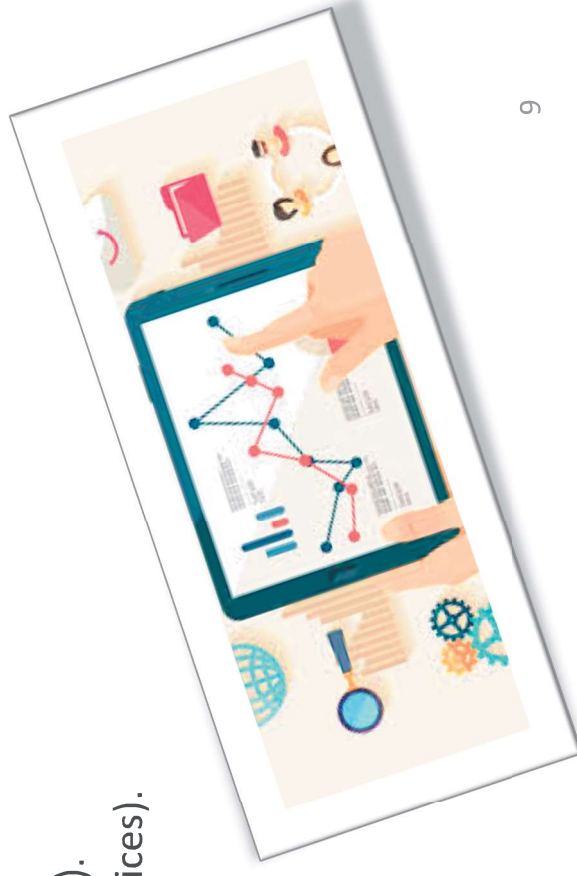
(milestone 3): we call this milestone final diagnostic. This milestone was set after the execution of the sixth step of the method, because at this moment teams were ready to start a formal audit process to be certified to the software Basic profile of ISO/IEC 29110



## COMPARISON IN THE IMPLEMENTATION OF THE BASIC PROFILE OF ISO/IEC 29110

---

- The comparison was made by isolating other factors and considering only the followed method on a quantitative analysis.
- The analysis aims to identify differences and similarities among teams to understand the impact of following a method to implement the Basic profile of the ISO/IEC 29110.
  - Identify the effort invested by software teams in order to improve their processes using the software Basic profile of ISO/IEC 29110 as a framework
- To carry out the analysis we established the coverage levels as next described:
  - High level (from 46-67 number of practices).
  - Medium level (from 23-45 number of practices).
  - Low level (from 0-22 number of practices).



# COMPARISON IN THE IMPLEMENTATION OF THE BASIC PROFILE OF ISO/IEC 29110

## Teams Description

Team ID	# of members	Methodology	Developed product	# of meetings	Trained period
E1	2	None, but using some agile practices	Embedded software	5	2017
E2	5	Hybrid: TSP-Scrum	Automation of the quality management system	6	2017
E3	5	Scrum	System of inventory control	5	2017
E4	4	Scrum	Medical consultation management	5	2017
E5	5	Scrum	System for a fitness center management	5	2017
E6	5	Scrum	Insurance management	5	2017
E7	5	Hybrid: CMMI <sup>®</sup> -Scrum	Transport management system	2	2017
E8	5	Waterfall	Registration system for research projects	5	2018
E9	4	TSP	Social service monitoring system	6	2018
E10	3	Waterfall	Chemistry laboratory system	2	2018
E11	4	Hybrid: CMMI <sup>®</sup> -Scrum	Livestock system	4	2018
E12	5	Methodology based on CMMI <sup>®</sup> model	Professors assessment system	5	2018
E13	4	TSP	Access control to Linux laboratory	6	2018

[illegible]

# COMPARISON IN THE IMPLEMENTATION OF THE BASIC PROFILE OF ISO/IEC 29110

---

Initial diagnostic comparison

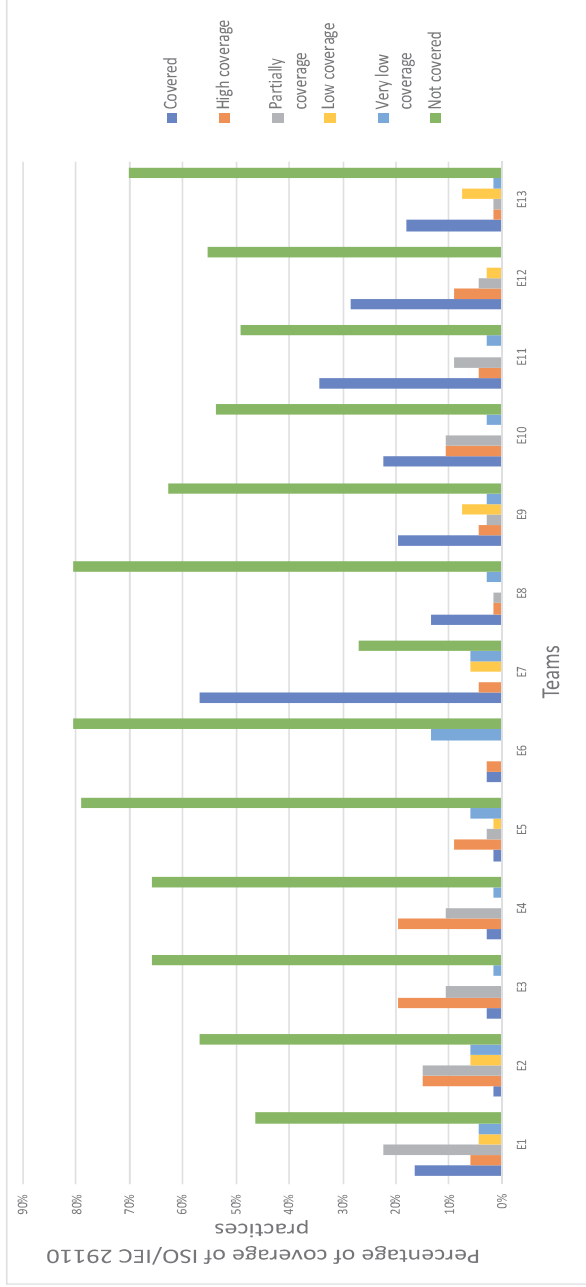
Middle diagnostic comparison

Final diagnostic comparison



# COMPARISON IN THE IMPLEMENTATION OF THE BASIC PROFILE OF ISO/IEC 29110

## Initial diagnostic comparison

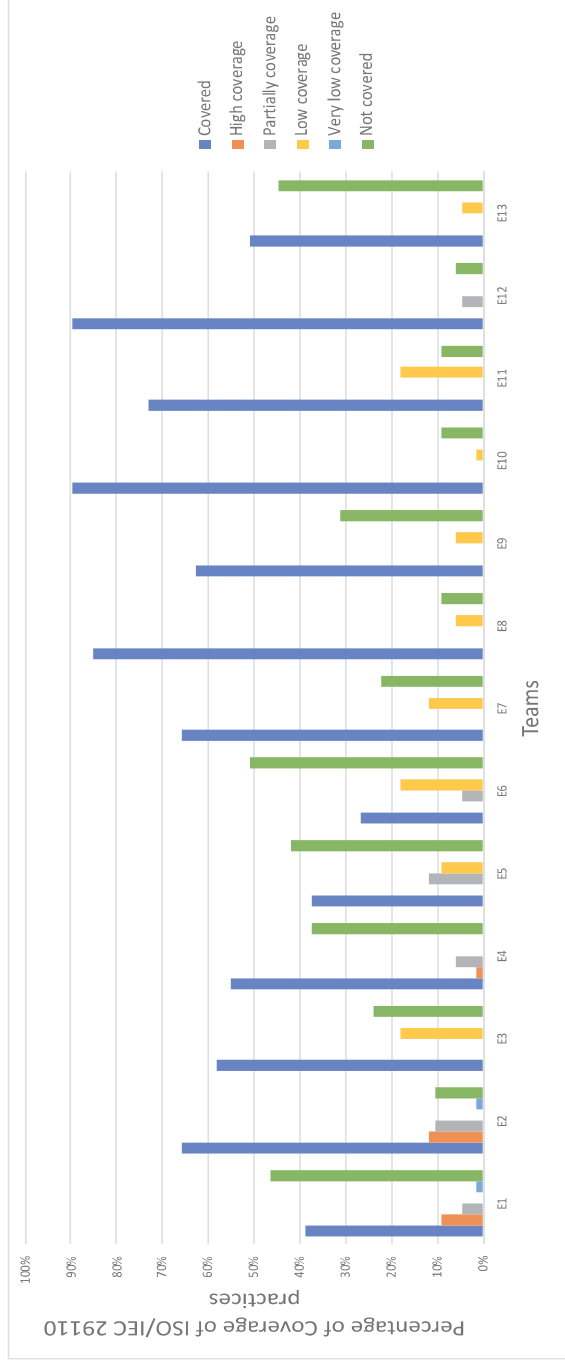


Team ID	Methodology
E1	None, but using some agile practices
E2	Hybrid: TSP-Scrum
E3	Scrum
E4	Scrum
E5	Scrum
E6	Scrum
E7	Hybrid: CMMI®-Scrum
E8	Waterfall
E9	TSP
E10	Waterfall
E11	Hybrid: CMMI®-Scrum
E12	Methodology based on CMMI® model
E13	TSP

	not covered practices (#)	Covered Process (%)
Highest	EMP7	PM: EMP1, EMP7, EMP11, EMP12 IS: EMP7, EMP10, EMP11
Lowest	EMP5, EMP6, EMP8, EMP13	PM: EMP2, EMP3, EMP4, EMP10 IS: EMP12, EMP9

# COMPARISON IN THE IMPLEMENTATION OF THE BASIC PROFILE OF ISO/IEC 29110

## Middle diagnostic comparison



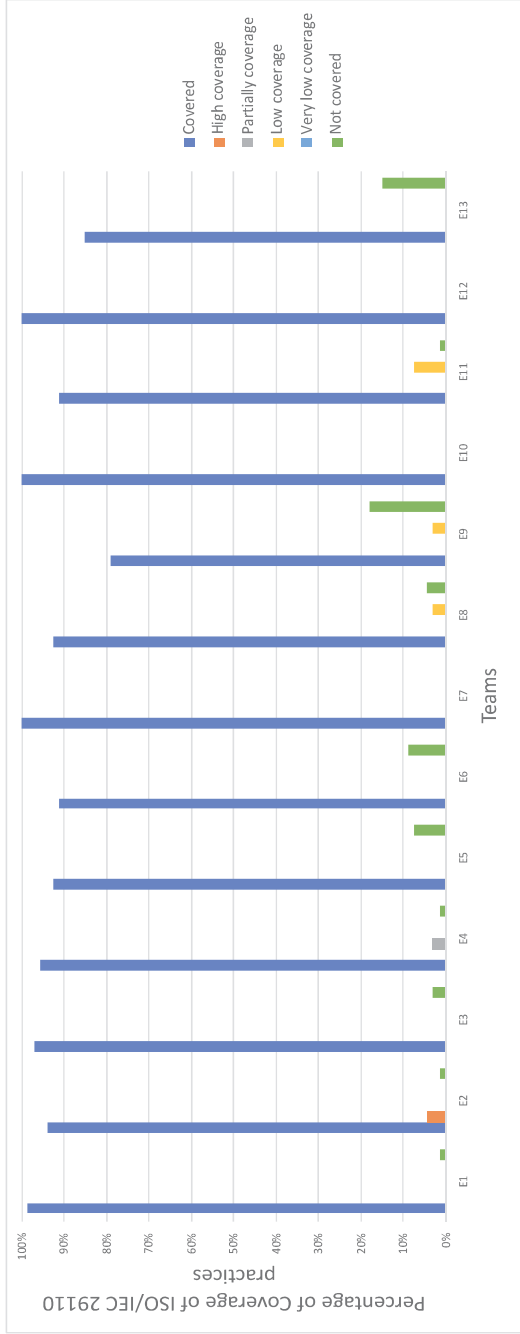
Team ID	Methodology
E1	None, but using some agile practices
E2	Hybrid: TSP-Serum
E3	Serum
E4	Serum
E5	Serum
E6	Serum
E7	Hybrid: CMMI®-Serum
E8	Waterfall
E9	TSP
E10	Waterfall
E11	Hybrid: CMMI®-Serum
E12	Methodology based on CMMI® model
E13	TSP

	not covered practices (#)	Covered Process (%)
Highest	EMP12, EMP11, EMP10, EMP8	PM: EMP1, EMP12, EMP2, EMP10, EMP9 IS: EMP8, EMP12, EMP10, EMP2
Lowest	EMP6	PM: EMP4, EMP3, EMP5, EMP13, EMP7, EMP6 IS: EMP7



# COMPARISON IN THE IMPLEMENTATION OF THE BASIC PROFILE OF ISO/IEC 29110

## Final diagnostic comparison



Team ID	Methodology
E1	None, but using some agile practices
E2	Hybrid: TSP-Scrum
E3	Scrum
E4	Scrum
E5	Scrum
E6	Scrum
E7	Hybrid: CMMI®-Scrum
E8	Waterfall
E9	TSP
E10	Waterfall
E11	Hybrid: CMMI®-Scrum
E12	Methodology based on CMMI® model
E13	TSP

	not covered practices (#)	Covered Process (%)
Highest	EMP7, EMP10, EMP12, EMP1	PM & IS: EMP7, EMP10, EMP12 PM: EMP1, EMP5, EMP2, EMP3, EMP4, EMP13 IS: EMP2, EMP4, EMP12, EPM1, EPM3, EPM8
Lowest	EMP9, EMP13	PM: EMP6, EMP9, EMP11

# COMPARISON IN THE IMPLEMENTATION OF THE BASIC PROFILE OF ISO/IEC 29110



At milestone 2, all teams had an important improvement in the covered practices of both processes comparing with milestone 1. Team E2, which used a hybrid approach, i.e. CMMI-TSP, is the team that had the highest improvement of both processes: in project management process from 35% of coverage in the first analysis to 88% of coverage of coverage in the middle analysis; and in the software implementation process from 29% to 88%.



At milestone 3 (see Figure 4), all teams had a high level of coverage of the practices of the software Basic profile of ISO/IEC 29110 for both processes. Teams using predictive and hybrid methodologies achieved 100% of coverage (hybrid CMMI-Scrum, Waterfall and CMMI)



Teams using adaptive methodologies implemented more practices related to validation and verification, project monitoring and control, change requests, configuration management and delivery instructions for the project management process and requirements, design, test and traceability for the software implementation process



Teams using predictive methodologies implemented more practices related to validation, risk management, change requests and delivery instructions for the project management process and design, test and traceability for the software implementation process.

# DISCUSSION

The following 3 values of the SPI Manifesto were used when planning and executing the ISO/IEC 29110 improvement activities:



People (*"Must Involve people actively and affect their daily activities"*): our method kept the people involved and motivated right from the beginning and throughout all the phases. Besides, our method starts by understanding the culture and the needs of a VSE. Also, all teams collaborated to the selection of ISO/IEC 29110 practices that give value to their processes.



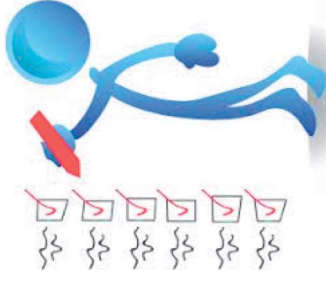
Business (*"What one does to make business successful"*): our method motivated VSEs to implement ISO/IEC 29110 activities and tasks by keeping in mind the vision and the business objectives of the VSE. Moreover, the ISO/IEC 29110 is an adaptable standard that can be implemented by VSEs using either the adaptive or the predictive life cycles.



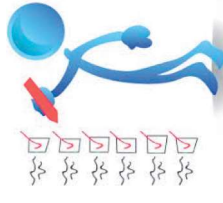
Change (*"Process improvement is inherently linked with change"*): our method facilitated the management organizational changes by having each team understanding the ISO/IEC 29110 practices and having them to think about how they will implement the practices to their current processes while they were conducting their software development activities.

# CONCLUSIONS

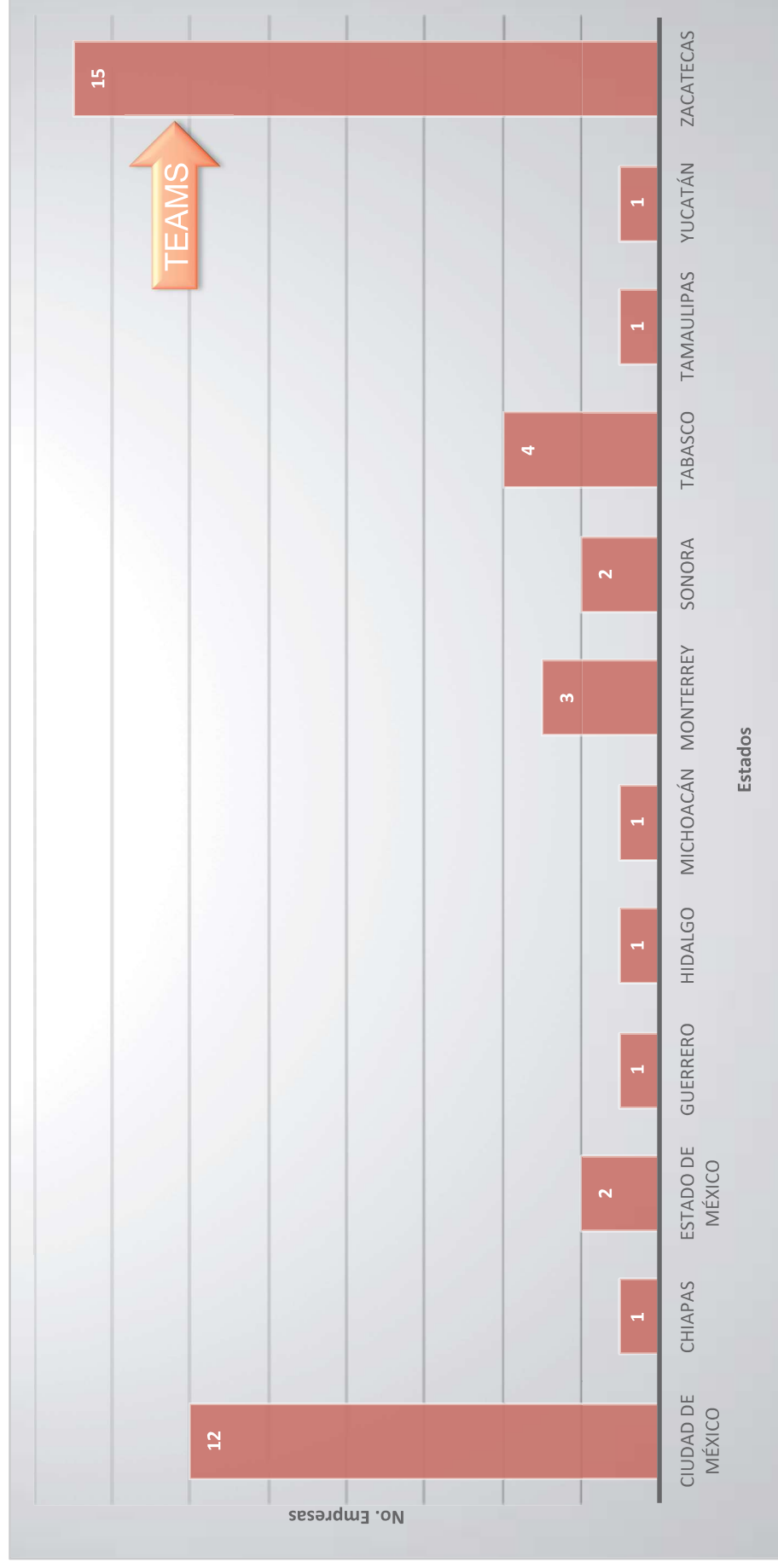
- Each VSE had to invest a minimum effort:
  - ✓ Training sessions (30 horas).
  - ✓ Work meetings (each work meeting took 4 hours)
  - ✓ milestone meetings (each milestone meeting took 6 hours).
- The meetings held, the effort required by each team to implement the ISO/IEC 29110 varied due to the specific characteristics of each VSE, such as culture, team size, size and type of project, among others.
- The ISO/IEC 29110 implementation speed in each VSE was adjusted to meet their needs.
  - ✓ The calendar time, between the beginning of the implementation until they were certified, was no longer than 4 months.
- we identified that each team had a different level of control and maturity regarding the methodology used to develop software.
- with the execution of the steps 1 to 4, it is possible to obtain the commitment of the teams, because they understood the need for improving their processes.
- The method can be used for both predictive and adaptive methodologies, with hybrid methodologies and even with teams which just followed a set of agile practices.



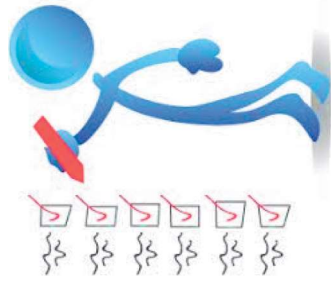
## CONCLUSIONS



# VSEs Certified



## CONCLUSIONS







## A comparative analysis of the implementation of the Software Basic profile of ISO/IEC 29110 in thirteen teams that used predictive versus adaptive life cycles

**Mirna Muñoz**, Adriana Peña, Jezreel Mejía, Gloria Piedad Gasca-Hurtado, María Clara Gómez-Alvarez and Claude Y. Laporte

[mirna.munoz@cimat.mx](mailto:mirna.munoz@cimat.mx), [adriana.pena@cucei.udg.mx](mailto:adriana.pena@cucei.udg.mx), [jmejia@cimat.mx](mailto:jmejia@cimat.mx), [gpgasca@udem.edu.co](mailto:gpgasca@udem.edu.co), [mcgomez@udem.edu.co](mailto:mcgomez@udem.edu.co), [Claude.Laporte@etsmtl.ca](mailto:Claude.Laporte@etsmtl.ca)



**Universidad  
de Medellín**  
Ciencia y Libertad

