



PECE – POLI – USP
MBA – Tecnologia de Software

Aula 03
Melhoria de Processos de Software

Prof. Dr. Rogério Rossi
2021

Roteiro

- Standards and Models concepts
- SPI Program Implementation
- SPI Program Institutionalization
- Frameworks for SPI
 - Framework for Software Process Improvement
 - Pragmatic Model for Implementing a Program for Software Process Improvement
 - Strategic Drivers for Implementing a Software Process Improvement Program
- IDEAL Model
- SPI Model - CMMI
- Process Measurement Program

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Standards and Models concepts

Standards and Models for SPI

Standards define the minimum to be achieved

- A standard measure compass in “pass” or “fail”
- In general, standards are owned and maintained by the National or International Standards Organizations
- Conformance is inspected by external organization (by trained and registered auditors)
- ISO/IEC 15.504 associated to ISO/IEC 12.207 are examples of standards for software process.

Standards and Models for SPI

Models are flexible and can be customized by the organizations

- Depending on the scope and focus they are owned and maintained by an industry consortium or by a specialized institution
- CMMI is the most notable example of model for software process
- Brazil also have the MPSBR Program for SPI
- Bootstrap Process Model and Trillium Model are examples of models maintained by an industry consortium

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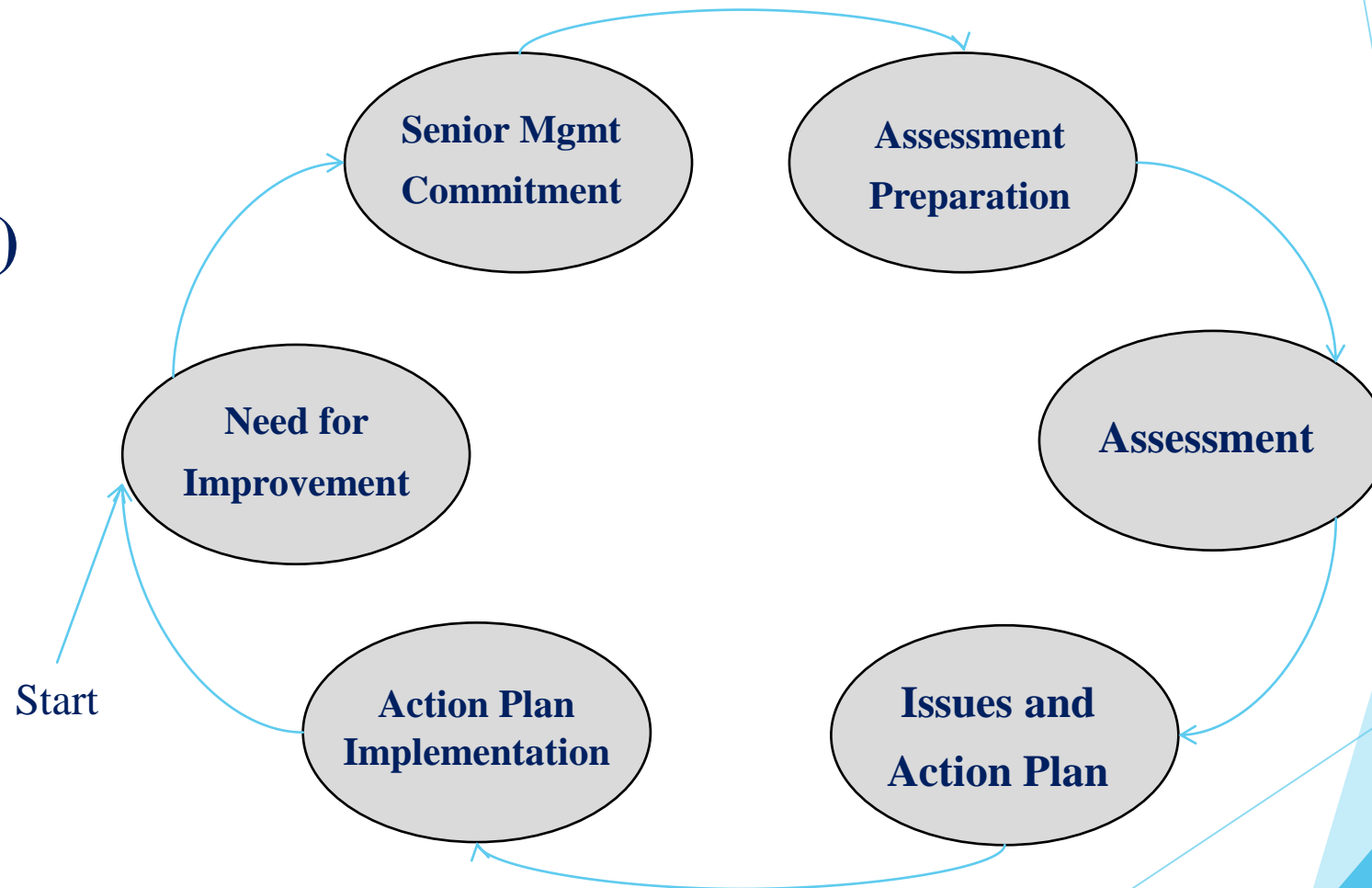
SPI Program Implementation

SPI Program Implementation

- **SPI – Software Process Improvement**
- **Process** should be always **improved to not deteriorate**
- **SPI Program** or just **SPI** is not a destination, it is a journey
- **SPI** should be a continuous effort practiced by the overall organization
- **Organization structure** should be established to sustain the process improvement effort

SPI Program Implementation

SPI (Software Process Improvement) LifeCycle



(Zahran, 1998)

SPI Program Implementation

Principles of an SPI Program Implementation

- **Creating** an SPI Action Plan
- **Allocating** Responsibilities for SPI
- **Implementing** SPI actions
- **Institutionalizing** the SPI Program

SPI Program Implementation

Principles of an SPI Program Implementation

- **Creating** an SPI Action Plan
 - Recommendations based on internal or external assessments
 - Process behavior has to be embedded into the organization (organization process focus)
 - Dedicated resources should be allocated
 - Management sponsorship and staff commitment are vital

SPI Program Implementation

Principles of an SPI Program Implementation

- **Allocating** Responsibilities for SPI
 - Roles and Responsibilities should be well allocated for the implementation of the SPI Program
 - Management and technical staff should be encouraged to participate in the implementation

SPI Program Implementation

Principles of an SPI Program Implementation

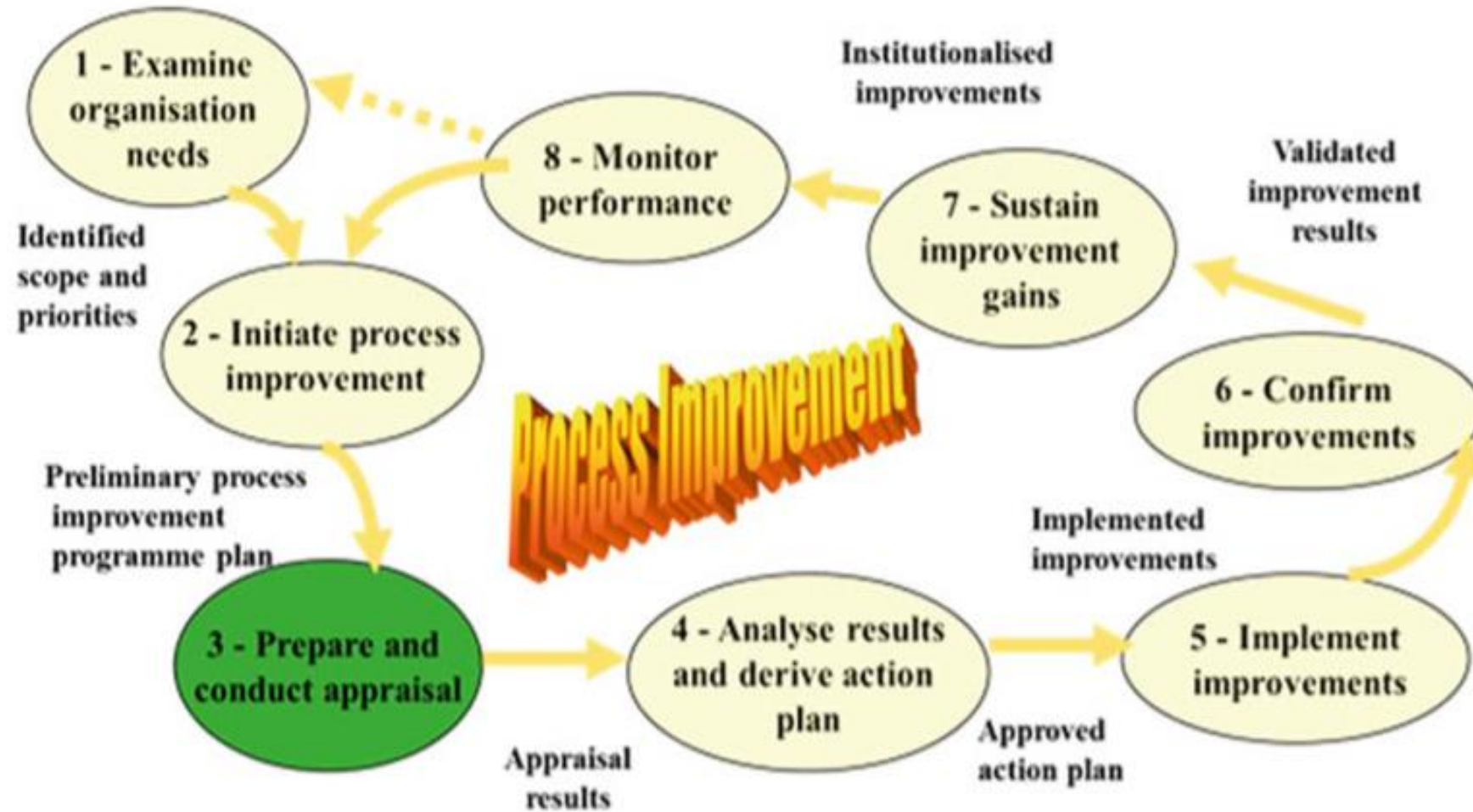
- **Implementing SPI actions**
 - Process should be mapped, designed (or redesigned), defined and implemented
 - Measuring should be defined

SPI Program Implementation

Principles of an SPI Program Implementation

- **Institutionalizing** the SPI Program
 - Process thinking and process discipline should be institutionalized
 - Managers and technical staff should use and propose improvement to the process

SPI Program Implementation

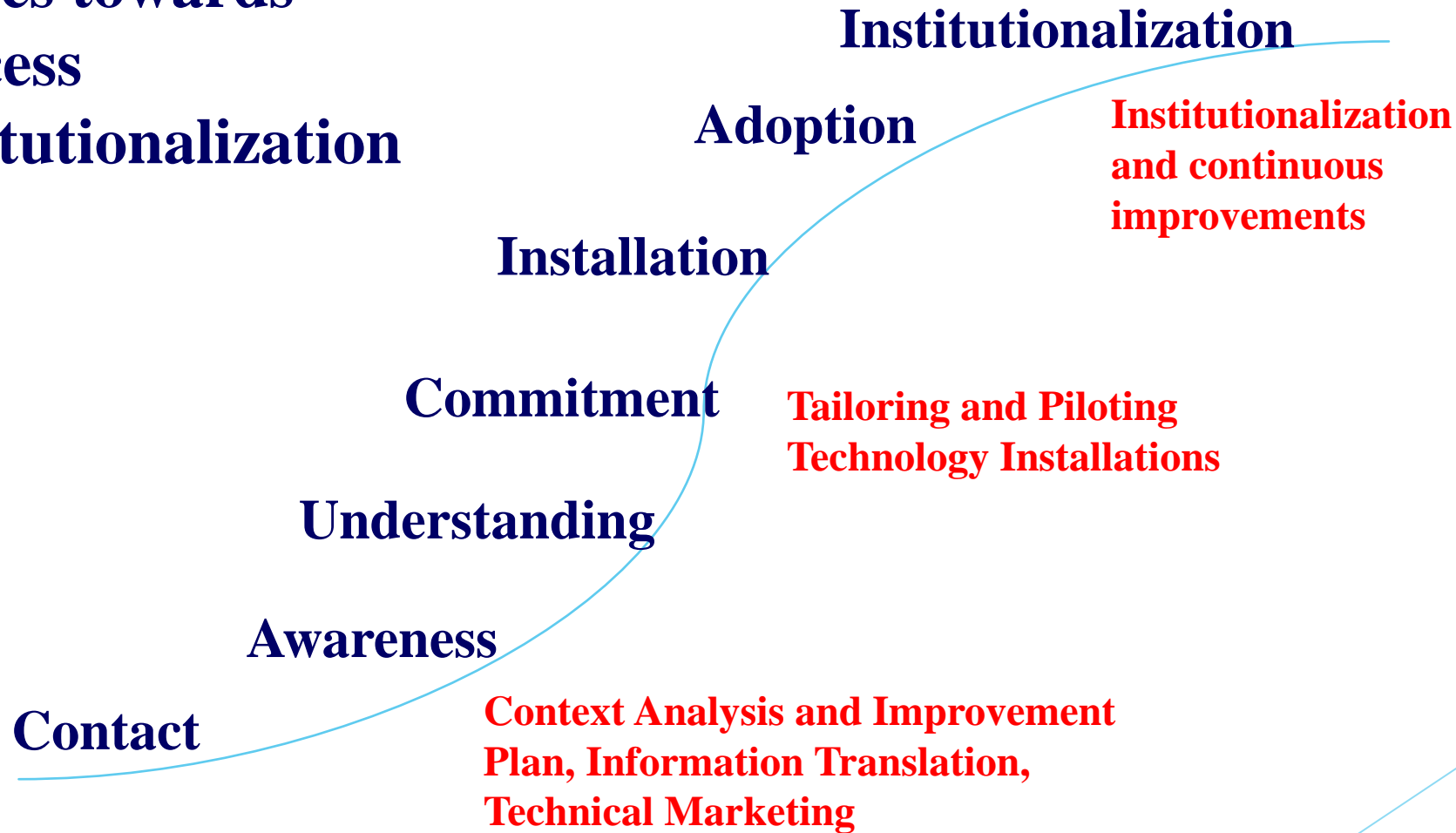


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SPI Program Institutionalization

SPI Program Institutionalization

**Stages towards
process
institutionalization**



(Zahran, 1998)

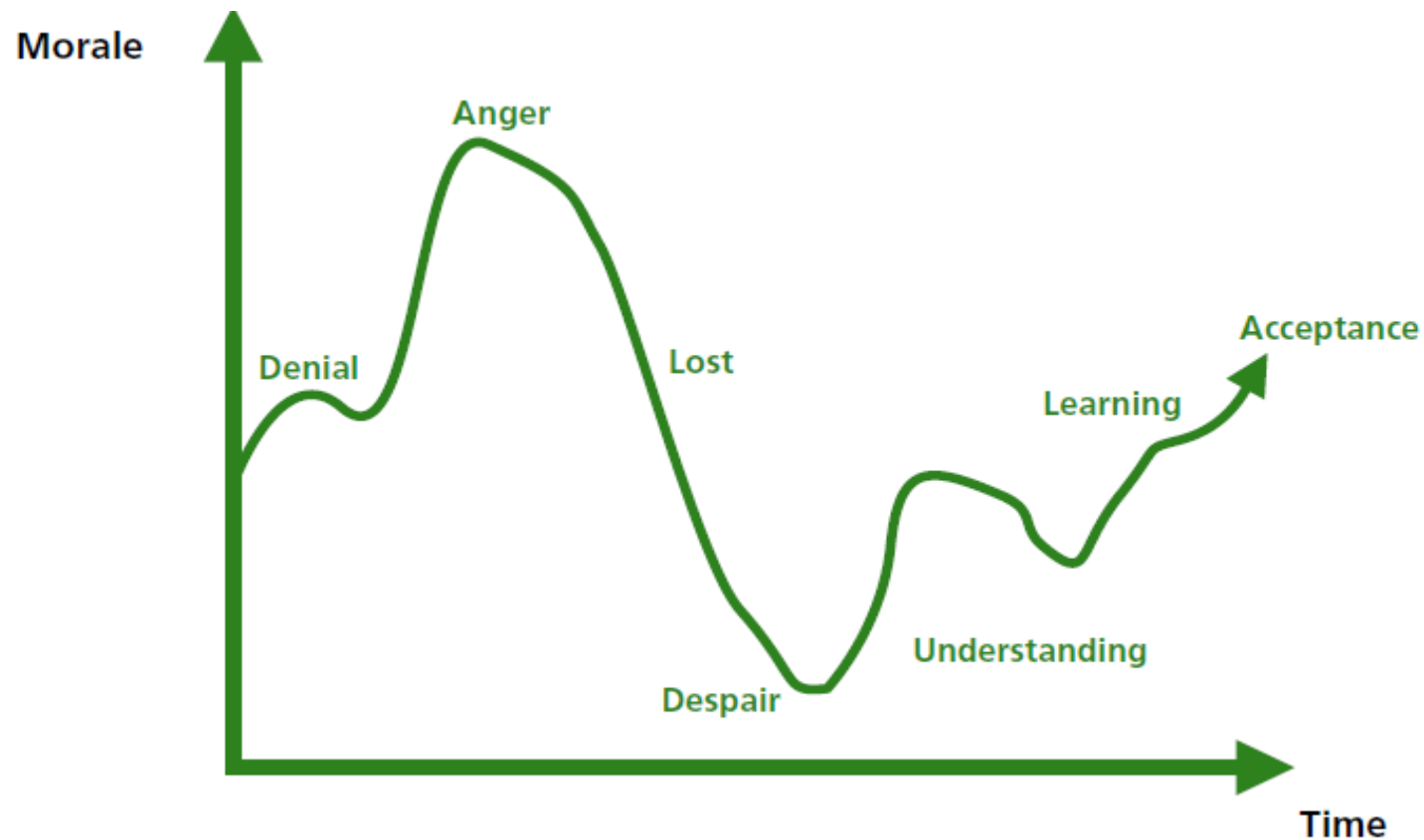
SPI Program Institutionalization

Managing the change

- Cultural changes – change the culture is a trivial matter
- Behavioral changes – involving people who will have to change
- Organizational changes – being aligned from the organization
- Technological changes
- Environmental changes

SPI Program Institutionalization

Human Response to change



(Kubler-Ross)

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Frameworks for SPI

Frameworks for SPI

Frameworks for SPI – Software Process Improvement

1. **Framework for Software Process Improvement** (Zahran, 1998)
2. **Pragmatic Model for Implementing a Program for Software Process Improvement** (Moitra, 2005)
3. **Strategic Drivers for Implementing a Software Process Improvement Program** (Godbole, 2005)

Frameworks for SPI

Framework for Software Process Improvement [Zahran (1998)]

- **Infrastructure for Software Process Improvement**
- **Roadmap for Software Process Improvement**
- **Evaluation methods for software process**
- **Plan for Software Process Improvement**

Frameworks for SPI

Framework for Software Process Improvement [Zahran (1998)]

Infrastructure for Software Process Improvement

basically considering two infrastructures to support the software process; the first one organizational and managerial, the second, technical

Frameworks for SPI

Framework for Software Process Improvement [Zahran (1998)]

Roadmap for Software Process Improvement

a logical approach with identified steps should be defined to provide effective implementation of software processes. In this case, models and standards can be adopted as the CMMI or ISO / IEC 15.504 or adopting customized versions to meet the needs of the organization

Frameworks for SPI

Framework for Software Process Improvement [Zahran (1998)]

Evaluation methods for software process

this evaluation method must be applied to assess the current situation of software processes used by the organization. Perhaps this assessment is performed according to what is prescribed in the roadmap adopted (item 2). Improvement actions should gradually satisfy what is established by the roadmap (model and / or standard adopted by the organization)

Frameworks for SPI

Framework for Software Process Improvement [Zahran (1998)]

Plan for Software Process Improvement

this plan involves the transformations identified during the evaluation phase (item 3). Actions must be understood and specified so that they are effectively applied to the processes to effectively achieve the desired improvements

Frameworks for SPI

Pragmatic Model for Implementing a Program for Software Process Improvement [Moitra (2005)]

- **Preparação**
- **Planejamento**
- **Implementação**
- **Institucionalização**

Frameworks for SPI

Pragmatic Model for Implementing a Program for Software Process Improvement [Moitra (2005)]

Preparação

uma visão sobre as mudanças desejadas deve pautar-se nos processos que necessitam de melhorias, porquê necessitam de melhorias, bem como definir-se uma ordem de prioridades para realização das melhorias.

Frameworks for SPI

Pragmatic Model for Implementing a Program for Software Process Improvement [Moitra (2005)]

Planejamento

inclui a formulação de objetivos mensuráveis para se realizar as melhorias e a projeção dos esforços a serem realizados para se alcançar tais melhorias. Isto envolve a definição de atividades atendendo-se a restrições de tempo e a definição de papéis e responsabilidades para se realizar as mudanças sugeridas na preparação.

Frameworks for SPI

Pragmatic Model for Implementing a Program for Software Process Improvement [Moitra (2005)]

Implementação

nesta fase deve se operacionalizar o plano e realizar os objetivos de melhoria de processos de software conforme definidos em tempo de planejamento. Deve se comunicar os benefícios das melhorias alcançadas para perpetuar a visão de melhoria contínua dos processos.

Frameworks for SPI

Pragmatic Model for Implementing a Program for Software Process Improvement [Moitra (2005)]

Institucionalização

deve se verificar que a mudança (melhoria) é permanente na organização. É tornar claro que o processo foi definitivamente melhorado, deixando de ser utilizado somente em projetos pilotos, mas sendo utilizado por todos os colaboradores para que os benefícios que foram intencionados para sejam alcançados

Frameworks for SPI

Strategic Drivers for Implementing a Software Process Improvement Program [Godbole (2005)]

- **Developing Proposals for Process Improvement**
- **Evaluating Developed Proposals**
- **Defining Project for the Program**
- **Defining a Schedule for Implementing Defined Proposals**
- **Obtaining Management Commitment**

Frameworks for SPI

Strategic Drivers for Implementing a Software Process Improvement Program [Godbole (2005)]

For Godbole (2005) strong attention should be given to the following actions that favor the success of the implementation of a **SPI Program**

- **Strong relation** with the organization's business processes;
- **Selection and involvement of the right people** to implement this plan;
- **Productive communication and sharing of ideas** among those involved in the program; and
- Approach that provides an **objective view on the proposed actions.**

Frameworks for SPI

Author	Proposed Framework
Zahran (1998)	Framework for Software Process Improvement <ol style="list-style-type: none">1) Infrastructure for Software Process Improvement2) Roadmap for Software Process Improvement3) Evaluation methods for software process4) Plan for Software Process Improvement
Moitra (2005)	Pragmatic Model for Implementing a Program for Software Process Improvement <ol style="list-style-type: none">1) Preparation2) Planning3) Implementation4) Institucionalization
Godbole (2005)	Strategic Drivers for Implementing a Software Process Improvement Program <ol style="list-style-type: none">1) Developing proposals for process improvement2) Evaluating developed proposals3) Defining project for the program4) Defining a schedule for implementing defined proposals5) Obtaining management commitment

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IDEAL Model

IDEAL Model

Cenário:

Imagine-se como um Consultor de Processos de Software - você e sua equipe foram acionados pela empresa FGC Produtos de Software, pois a mesma busca

1. ser orientada a processos (*process driven-oriented*)
2. entender a situação atual de seus processos de software (como a empresa encontra-se neste momento)
3. viabilizar um plano estratégico de como implementar um programa de melhoria de processos de software.

Portanto, vocês necessitariam de algumas reuniões com equipes diretivas da organização, equipes gerenciais, equipes de projetos e equipes técnicas.

O modelo IDEAL poderia ser uma excelente ferramenta para suas atividades!

IDEAL Model

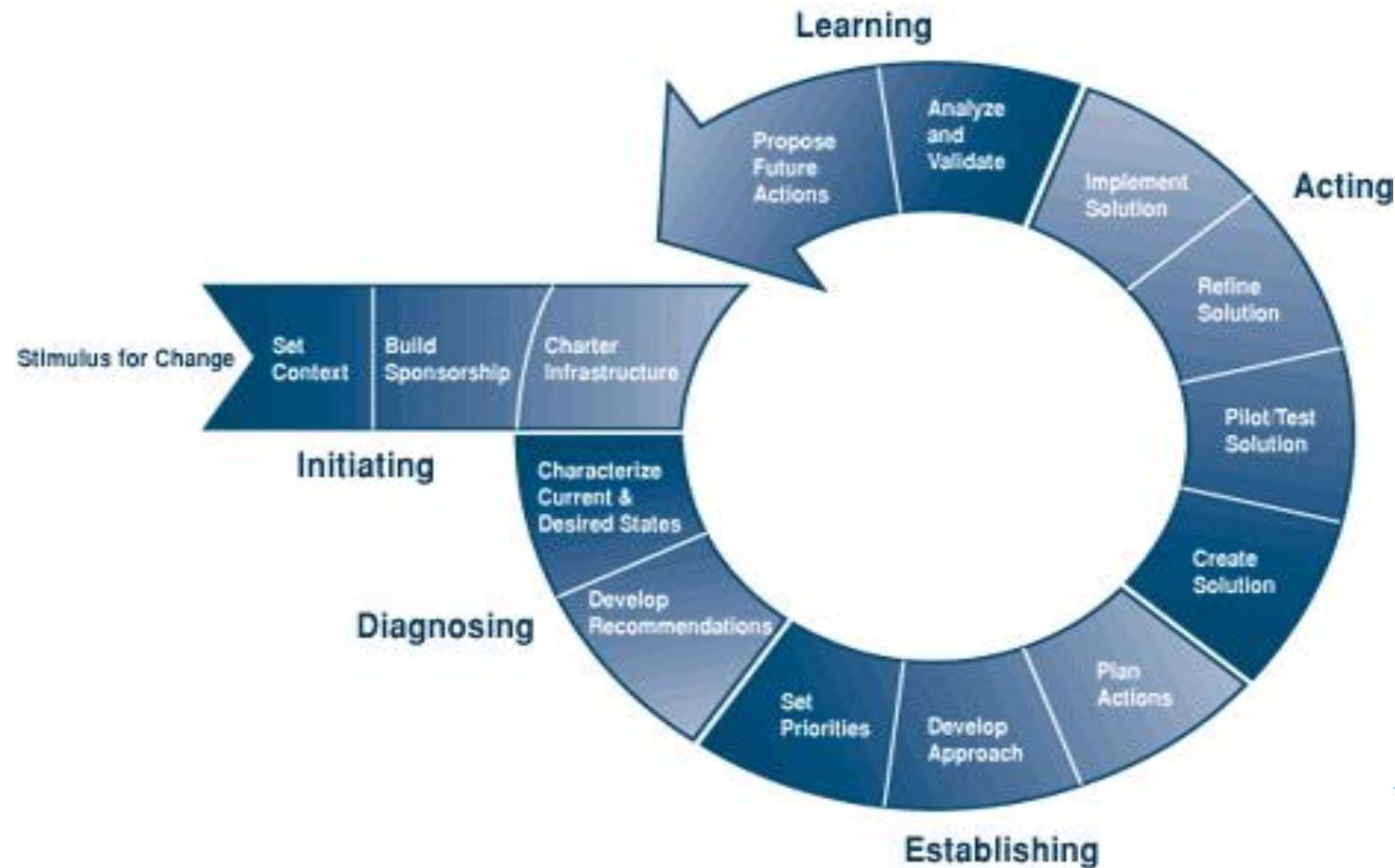
IDEAL - example of an SPI Implementation Model

O **IDEAL Model**, numa abordagem cíclica, propõe **cinco fases** que definem o caminho para a implementação de um Programa de Melhoria de Processo de Software (*SPI Program*)

“If you don’t know where you are, a map won’t help”
(Watts Humphrey)

IDEAL Model

IDEAL - example of an SPI Implementation Model



(SEI, 1997)

IDEAL Model

IDEAL - example of an SPI Implementation Model

Initiating (Iniciar)

- Se estabelece a infraestrutura para a mudança
- Os papéis e responsabilidades são definidos e os recursos são assinalados
- O *SPI Plan* é criado, é aprovado e os compromissos para implementá-lo devem ser estabelecidos.

IDEAL Model

IDEAL - example of an SPI Implementation Model

Diagnosing (Diagnosticar)

- Inicia-se as atividades com o objetivo de se identificar os processos organizacionais num formato “*as-is*”
- Se define uma *baseline* do processo atual

IDEAL Model

IDEAL - example of an SPI Implementation Model

Establishing (Estabelecer)

- Priorizam-se as ações que direcionam as atividades de mudanças
- Define-se uma visão organizacional dos processos num formato “*should be*”
- Definem-se os *gaps* (lacuna) entre o formato atual e o proposto para se delinear as mudanças

IDEAL Model

IDEAL - example of an SPI Implementation Model

Acting (Agir)

- São mapeados, definidos e implementados os novos processos
- As mudanças são verificadas por meios de projetos “pilotos”
- As mudanças são institucionalizadas no âmbito organizacional

IDEAL Model

IDEAL - example of an SPI Implementation Model

Learning (Aprender)

- Registram-se as lições aprendidas conforme as ações realizadas
- Realiza-se as medições quanto as melhorias identificadas
- Os dados são coletados e os resultados são divulgados.

IDEAL Model

Cenário:

Após ter atuado juntos às equipes e líderes da FGC Produtos de Software, aplicando o modelo IDEAL para fornecer um resultado e direcionamentos para um plano estratégico que oriente a FGC a utilizar processos, você e sua equipe poderiam, dentre outros pontos, destacar o seguinte:

1. Atualmente a FGC tem **poucos processos** formalizados e aplicados de forma sistemática por suas equipes
2. A FGC poderia definir uma equipe especialista para modelar os processos e implementá-los, iniciando por pequenos projetos e seguir numa abordagem de melhoria contínua.
3. A FGC poderia se basear em modelos de melhoria de processos de software como o CMMI ou o MPSBR para orientar suas ações, utilizando os mesmos de forma total ou parcial, conforme suas estratégias.

Most popular process models used in SPI include as follows:

- Capability Maturity Model Integration (CMMI)
 - CMMI for Development (CMMI-DEV)
 - CMMI for Services (CMMI-SVC)
 - CMMI for Acquisition (CMMI-ACQ)
- ISO 9.001 Standard
- ISO 15.504
- PSP and TSP
- Six sigma
- Root cause analysis (RCA)
- Balanced Score Card (BSC)

SPI Model - CMMI

SPI Model- CMMI

CMMI: Introdução – considerações sobre o modelo

O CMMI é uma estrutura que descreve os principais elementos de um processo de software efetivo, ou seja, de um processo que pode ser caracterizado como praticado, formalizado, indispensável, medido e passível de melhorias.

SPI Model- CMMI

CMMI: Introdução – considerações sobre o modelo

- O CMMI propõe um caminho gradual que direciona as organizações a se aprimorarem continuamente na busca da sua própria solução dos problemas inerentes a melhoria de processos
- O CMMI focaliza a capacitação da gerência de processo, na qual a qualidade do produto, é determinada principalmente pelos processos utilizados.

SPI Model- CMMI

CMMI: Introdução – considerações sobre o modelo

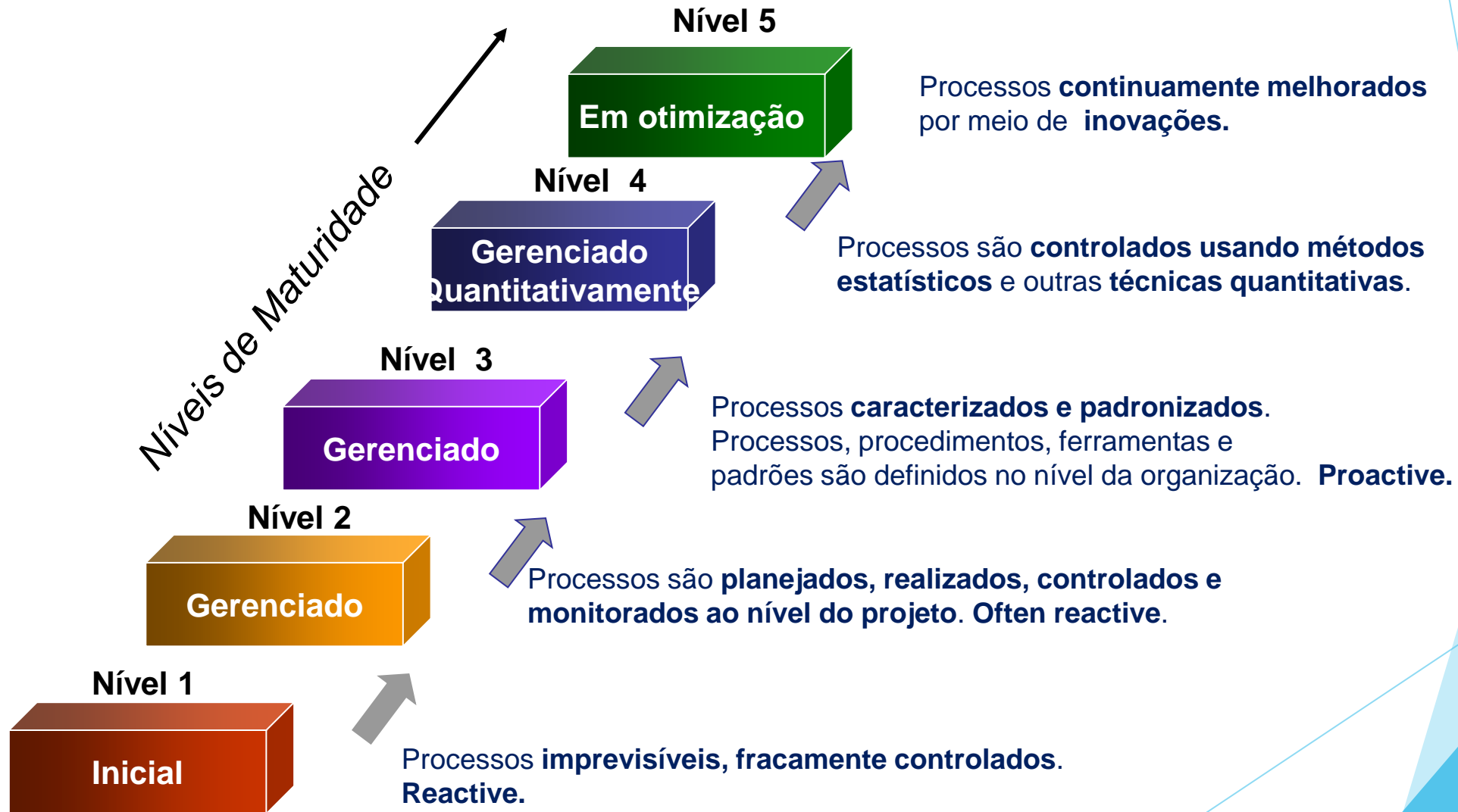
- O CMMI considera práticas para Planejar, Desenvolver, Gerenciar, e Manter processos de Engenharia de Software.
- Quando essas práticas são seguidas rotineiramente, as organizações estão habilitadas a aprimorar o controle de custo, cronograma, produtividade e qualidade.

SPI Model- CMMI

CMMI: Introdução – considerações sobre o modelo

- **O CMMI não é um método**, pois não estabelece ações operacionais específicas. É um Modelo que **necessita ser estudado, compreendido e adaptado às características de cada organização.**
- **Cada organização deve determinar como desenvolver e manter software** de modo que as práticas do CMMI sejam satisfeitos

SPI Model- CMMI



SPI Model- CMMI

Maternity Level	Project Managment	Engineering	Process Management	Support
5 Optimizing			Organizational Innovation & Deployment	Causal Analysis & Resolution
4 Quantitatively Managed	Quantitative Project Mngt		Organizational Process Performance	
3 Defined	Integrated Project Mngt Risk Management	Requirements Development Technical Solution Product Integration Verification Validation	Organizational Process Focus Organizational Process Definition Organizational Training	Decision Analysis & Resolution
2 Managed	Project Planning Project Monitoring & Control Supplier Agreement Mngt	Requirements Mngt		Measurement & Analysis Process & Product Quality Assurance Configuration Mngt
1 Initial				

SPI Model- CMMI

Level: 2

Process Area: Requirements Management

Relação de Metas e Práticas Específicas

SG 1 Gerenciar Requisitos

SP 1.1 Obter Entendimento dos Requisitos

SP 1.2 Obter Comprometimento com os Requisitos

SP 1.3 Gerenciar Mudanças nos Requisitos

**SP 1.4 Manter Rastreabilidade Bidirecional dos
Requisitos**

**SP 1.5 Identificar Inconsistências entre Produtos de
Trabalho, Planos de Projeto e Requisitos**



CMMI® for Development, Version 1.3

CMMI-DEV, V1.3

CMMI Product Team

Improving processes for developing better products and services

November 2010

TECHNICAL REPORT

CMU/SEI-2010-TR-033
ESC-TR-2010-033

Software Engineering Process Management Program
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<http://www.sei.cmu.edu>

Ativar o Windows
Acesse Configurações para ativar o Windows.

SPI Model- CMMI

Cenário:

Se a equipe diretiva da FGC Produtos de Software decidir basear-se no modelo **CMMI**, ela poderá adotar uma das representações do Modelo, como a **representação por estágio** (o Modelo também apresenta a **representação contínua**).

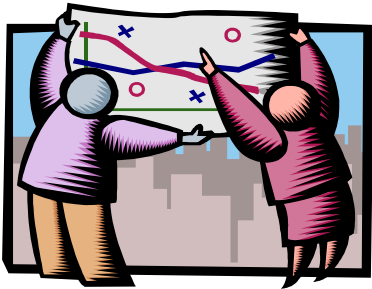
Desta forma, a FGC poderá formar uma equipe especializada e doutrinar suas equipes para a institucionalização dos processos para alcançar o nível 2 de maturidade proposto pelo **CMMI**

A FGC poderá buscar a certificação quando possuir processos mais consistentes e maduros, seguidos sistematicamente por suas equipes, mesmo este não sendo um ponto estratégico definido inicialmente pela empresa.

SPI Model- CMMI

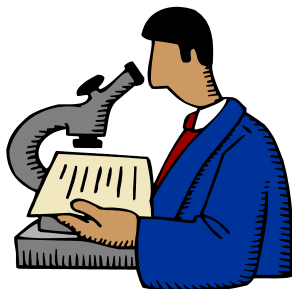
1

Entender os processos da organização



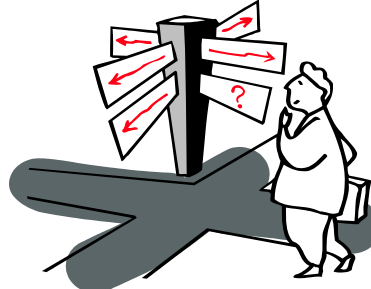
2

Verificar o modelo CMMISM para melhorias



3

Verificar padrões para definição de processos



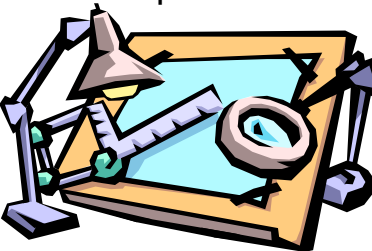
4

Verificar demais padrões para detalhar os processos



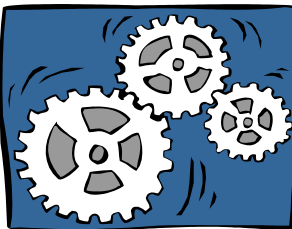
5

Construir ou revisar a arquitetura de processos



6

Realizar segundo os processos estabelecidos



7

Medir os resultados – modificar os processos



8

Confirmar o resultado com avaliação independente



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Process Measurement Program

Process Measurement Program

- Measurement Program is part of an SPI Program
- Measurement roles and responsibilities should be allocated
- Measurement should cover process, project and product
- Define clear objective of the Measurement Program

Process Measurement Program

- Measuring benefits of an SPI Program
 - You can't measure chaos
 - A measurement process must be supported by Senior Management
 - Measurements take time, effort, and investments

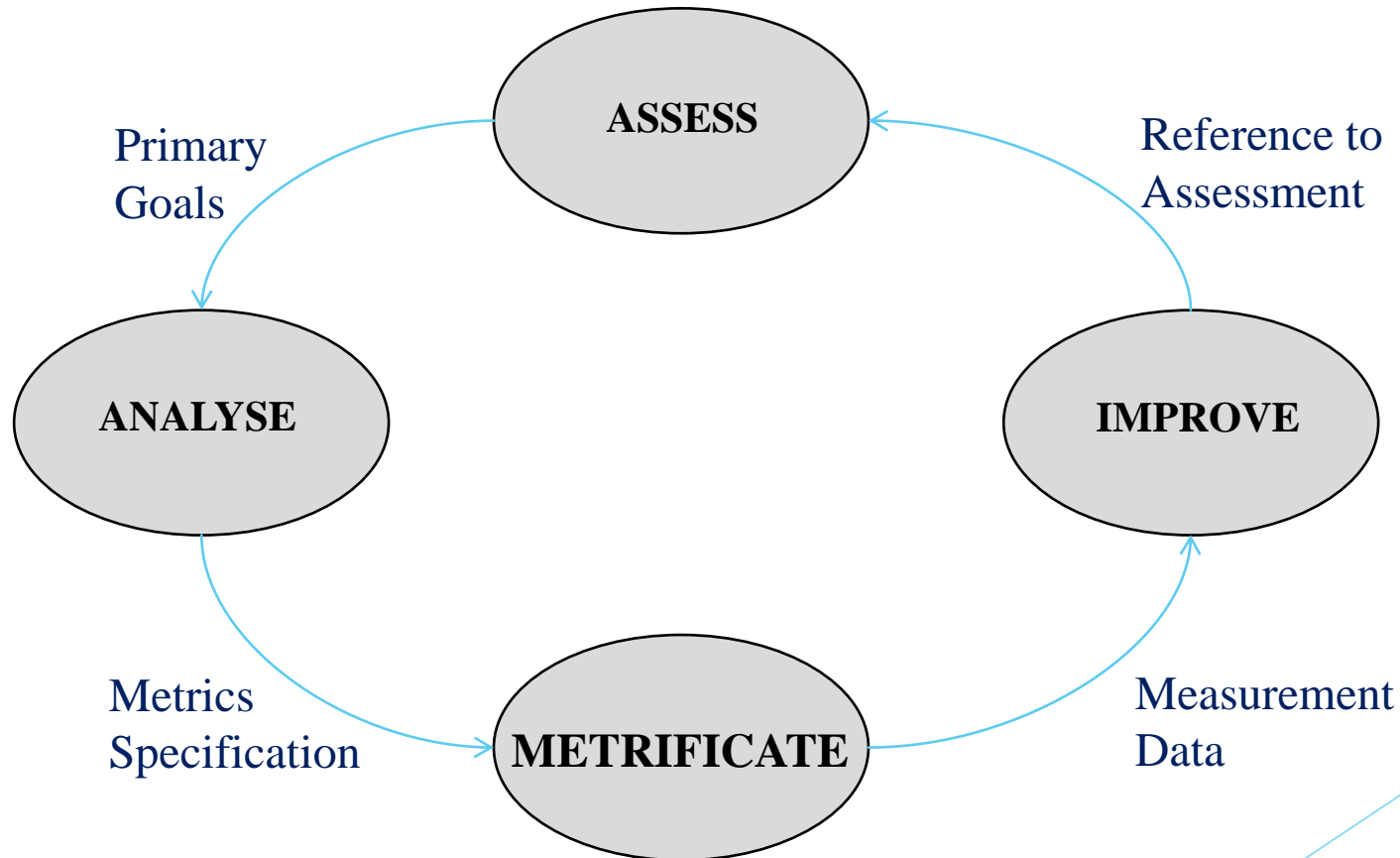
Process Measurement Program

- The goals of measurement process
 - Parameters for managing the process
 - Key Indicators for measuring process performance
 - A Measure Process should be **SMART**
(**S**pecific, **M**easurable, **A**ttainable, **R**elevant, **T**raceable)

Process Measurement Program

ami Method - activities for process measurement

ami Method (Application of Metrics in Industry) was developed by a consortium of European companies



Process Measurement Program

ami Method - activities for process measurement

- **ASSESS**

- Assess the environment
- Define primary goals
- Check the goals against the assessment

- **ANALYSE**

- Break down management goals into sub-goals
- Check consistency
- Identify metrics for each sub-goal

Process Measurement Program

ami Method - activities for process measurement

- **METRIFICATE**

- Write and validate measurement plan
- Collect primary data
- Verify primary data

- **IMPROVE**

- Distribute, analyse and review
- Validate the metrics
- Relate the data to goals and implementation actions.

Process Measurement Program

Major issues in measuring the results of SPI

- **Quantitative business benefits**
 - Increased productivity
 - Early error detection and correction
 - Improved maintainability (process and product)
 - Process simplification

Process Measurement Program

Major issues in measuring the results of SPI

- **Qualitative benefits**
 - Employee morale
 - Motivation
 - Staff turnover
 - Disciplined culture
 - Improved communication

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Referências

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