QUESTIONNAIRE FOR VALIDATION BY INDUSTRY EXPERTS

The proposed conceptual framework targets the evaluation of Software Process Improvement (SPI) initiatives and validation by industry experts is needed to assess its usefulness and usability. The questionnaire is divided into four parts:

(A) Industry Expert Background Information
The section contains some short questions to create the profile of the industry expert.

(B) Introduction to the Conceptual Framework
The two-page flyer in this section describes the aims of the framework and gives an overview of the framework as a whole.

(C) Key Concepts Validation Questions
This is the main part of the questionnaire that presents the key concepts of the framework together with the questions that require input from the expert.

(D) General Validation Questions
This is the final part of the questionnaire that presents questions to validate the framework as a whole.

(A) Industry Expert Background Information

The following questions are aimed to create the profile of the expert whose opinions are gathered in our questionnaires. The objective of the profile is to make a summary of the sample population used in our framework validation. Information of the individual industry expert will be kept **anonymous**.

(A1) Personal Information

Full name:	
Years of industry experience:	
Company:	
Location:	

(A2) Company Information

1. What is the size of your company (i.e. number of employees)? ***[Fill with X]***

   [ ] Small = 1-49 **[ ] Medium = 50-249** **[ ] Large = 250 and above**

2. What is the core business / domain of your company?

3. What business unit / department are you currently working in?

(A3) Software Process Improvement (SPI) Involvement Information

Definition of terms:

SPI initiative: *Any kind of software process improvement activities ranging from framework (e.g. CMMI, Six-Sigma, SPICE or other frameworks), practices (e.g. software inspection, software reuse) or tools (e.g. software development tool, debugging tool, etc).*

Role in SPI initiative: *Involvement in SPI initiative either by participating (as a developer, tester etc.), coordinating (as a process lead, team lead, manager etc.) or other relevant roles.*

Have you ever been involved with any SPI initiative? If yes, please answer the following questions. ***[Fill with X]***

[ ] Yes **[ ] No**

1. How long were you involved in software process improvement?

2. Please state your role / responsibility in the initiative?

3. Please specify what SPI initiative you have been involved in?

4. Do you have any experience in SPI formal assessments (e.g. CBA-IPI, SCAMPI, etc.)? ***[Fill with X]***

[ ] Yes **[ ] No**

5. Do you have any experience in the evaluation of software process improvement initiatives, in terms of assessing their actual benefits (e.g. Improved product quality, reduced time-to-market, increased ROI, etc)? ***[Fill with X]***

[ ] Yes **[ ] No**

(B) Introduction to the Conceptual Framework

The two-page flyer in the following pages describes the aims of the framework and gives an overview of the framework as a whole.

Software Process Improvement Measurement And Evaluation Framework (SPI-MEF)

Today's Challenges in SPI Evaluations

With the increasing importance of software in industry and as well as in our everyday's life, the process of developing software has also gained significant importance. Many companies are investing large sums of money in improving their software processes through different Software Process Improvement (SPI) initiatives.

SPI initiatives are all software engineering methods or activities which are intended to improve the performance of the software process and these can be categorized into frameworks (e.g. CMM, CMMI, SPICE, QIP, Six Sigma, etc.), software engineering practices (e.g. inspections, test-driven development, etc.) or tools that support software engineering practices. After the undertaking of such SPI initiatives, it is of major interest for organizations to evaluate whether the investment for the improvement pays off.

The evaluation of SPI initiatives is a complex undertaking because there are various aspects that need to be taken into consideration.

Firstly, there is no common understanding on what needs to be measured for evaluating different success indicators (e.g. productivity, product quality, etc.) of improvement.

Secondly, the success of improvement initiatives is often primarily based on the evaluation of project outcomes without considering farther reaching ramifications. Consequently, the evaluation of improvement initiatives is too narrow and doesn't provide enough insight to validate their efficiency and effectiveness.

Thirdly, it is important to provide appropriate visibility of the evaluation results and evidence of improvement to the participating stakeholders of the initiative.

Need For SPI Evaluations

The evaluation of SPI through formal assessments like CBA-IPI, SCAMPI or other well-known assessments are concerned about determining the capability level of the organizational process by means of investigating its adherence to certain standards and identifying strengths and weakness in the process for suggesting areas for improvement.

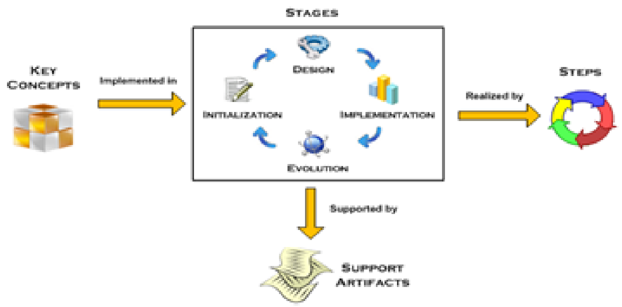
The evaluation we are concerned about is different from these assessments. The concepts proposed in SPI-MEF promote an evaluation which considers the improvement from different perspectives and, in sum, increases the visibility, and consequentially alleviates the assessment of the achieved benefits.

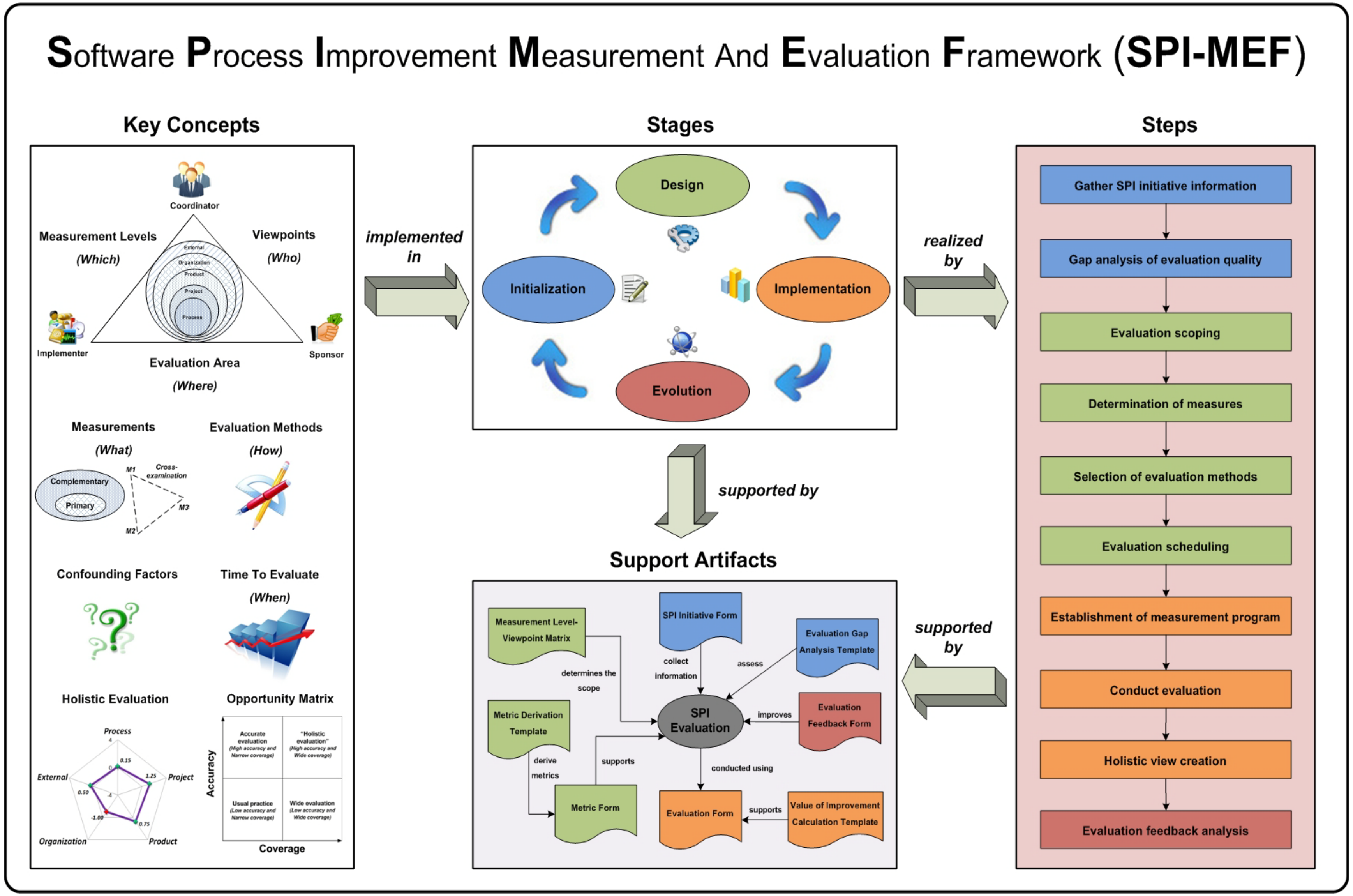
Since the evaluation of the outcome of SPI initiative is complex but also crucial to the organization, there is a need for a measurement and evaluation framework to evaluate the outcome of SPI initiatives. In the current state-of-the-art, there is no framework specifically designed to carry out the evaluation of SPI initiatives' outcome. SPI-MEF tries to address this gap.

SPI-MEF Approach

- Enable organization to justify the investment on SPI by providing a measurement and evaluation framework for the systematic assessment of SPI initiatives.
- Provide a balanced view of the impact of SPI initiatives for a holistic evaluation by considering the five measurable entities in a software organization (Process, Project, Product, Organization and External).
- Increase the visibility of the results of the improvement for all stakeholders according to their specific needs.
- Reuse of same generic framework in evaluating a broad spectrum of SPI initiative since the framework is independent of specific SPI initiative.
- Provide an evolutionary path (basic to advanced) for an organization to do evaluation of SPI.
- Create awareness for taking into consideration confounding factors that might affect the accuracy and validity of the evaluation.

SPI-MEF Overview





Software Process Improvement Measurement And Evaluation Framework (SPI-MEF)
Key Concepts
Coordinator
Measurement Levels
(Which)
Viewpoints
(Who)
Implementer
Sponsor
Evaluation Area
(Where)
Measurements
(What)
Complementary
Primary
Cross-examination
Evaluation Methods
(How)
Confounding Factors
Time To Evaluate
(When)
Holistic Evaluation
Process
Project
Product
Organization
External
Opportunity Matrix
Accuracy
Coverage
implemented in
Stages
Design
Initialization
Implementation
Evolution
supported by
Support Artifacts
Measurement Level-Viewpoint Matrix
SPI Initiative Form
Evaluation Gap Analysis Template
determines the scope
collect information
assess
Metric Derivation Template
SPI Evaluation
Evaluation Feedback Form
improves
derive metrics
supports
conducted using
Metric Form
Evaluation Form
supports
Value of Improvement Calculation Template
realized by
supported by
Steps
Gather SPI initiative information
Gap analysis of evaluation quality
Evaluation scoping
Determination of measures
Selection of evaluation methods
Evaluation scheduling
Establishment of measurement program
Conduct evaluation
Holistic view creation
Evaluation feedback analysis

(C) Key Concepts Validation Questions

This section presents the key concepts of the framework. Validation questions are attached in the end of each key concept.

(C1) Measurement Levels and Viewpoints (Evaluation Area)

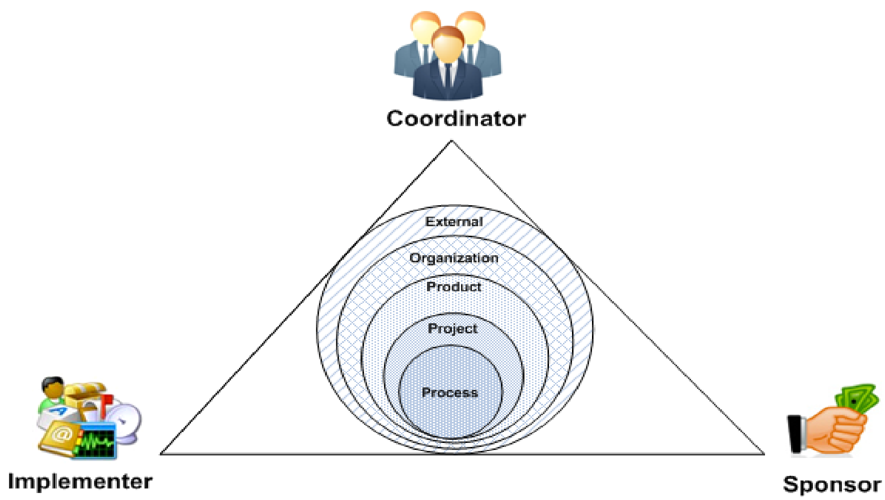
Aim: To define the scope of evaluation by characterizing areas where data can be collected and by identifying the stakeholders who are interested to see the evaluation of the improvement.

The measurement levels (Process, Project, Product, Organization, and External) represent the measurable entities that can be assessed to evaluate the software process improvement. The following list shows **examples of metrics** for each measurement level:

i. **Process:** Defect removal efficiency (Defects found in code inspection activity per time unit)
ii. **Project:** Developer productivity (Lines of code per time unit)
iii. **Product:** Quality (Number of customer reported defects per product size unit)
iv. **Organization:** Return on investment (% ROI = (Benefits of improvement / Costs of improvement) x 100)
v. **External:** Externalities of the improvement (Customer business growth)

SPI-MEF defines **three generic viewpoints** that represent the stakeholders who are interested to see the results of the improvement:

i. The **Implementer** viewpoint represents all the roles that are dedicated to put the software development in general and the process improvement in particular into practice.
ii. The **Coordinator** viewpoint subsumes the roles which generally participate in software development and in a software process improvement initiative as coordination and control entities.
iii. The **Sponsor** viewpoint represents those roles that fund and motivate the improvement initiative and, in parallel, those who are interested in evaluating the improvement according to its costs and benefits.



The scope of the evaluation (evaluation area) is defined by considering both the measurement levels and viewpoints, which serves as a driver for determining the appropriate measures.

Table 1: Example instance of an evaluation area

Measurement Levels	**Viewpoints**		
	Implementer	***Coordinator***	***Sponsor***
Process	Development team	SPI Coordinators, Process Managers	---
Project	Development team	Project Managers	---
Product	Project Managers	Product Managers	Head of Division
Organization	---	Board of Directors, SPI Steering Committee	Corporate SPI Sponsor, Shareholders
External	---	---	Corporate SPI Sponsor, Shareholders

Q1: To what extent do you agree that the above schema (evaluation area) represents clearly WHO is interested in the evaluation and WHICH measurable entities need to be considered? ***[Fill with X]***

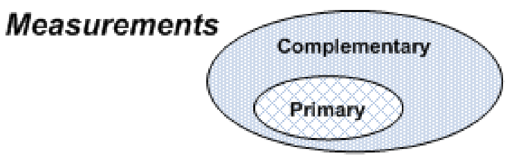
[ ] Strongly agree
[ ] Agree
[ ] Neither agree nor disagree
[ ] Disagree
[ ] Strongly disagree

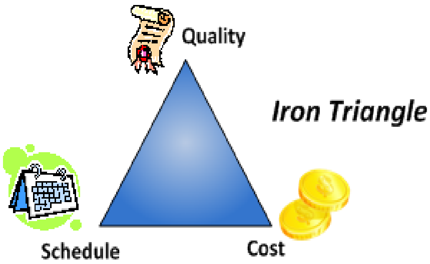
Please give a short rationale for your opinion.

<u>**(C2) Primary and Complementary Measures**</u>

Aim: To create a mindset that supports the elicitation of appropriate measures to evaluate the improvement.

- **Primary measurements** are the set of measurements that are used to assess if the improvement goal has been reached.
- **Complementary measurements** capture the effects of the process improvement that cannot be directly related to the improvement goal. They assess the potential side-effects caused by the improvement initiative.





Example:

SPI initiative:	Code inspection		
Improvement goal:	Improve product quality		
Measures:	**Primary**	**Complementary**	
Success indicator:	Defects (Quality)	Cost	Schedule
Metric:	Defect density	Effort in man-hours	Project cycle time

The **"Iron Triangle"** metaphor is used to illustrate the relationship between primary and complementary measurements and helps to derive the needed measures. In project management, the iron triangle is used to visualize the challenge to optimize the three major attributes **cost**, **quality** and **schedule** contemporaneously.

"For example, one can try to optimize schedule and cost, but most probably quality will then be negatively affected. The same idea is applied to the example shown in the above table. Defect density is the primary measure since it is directly related to the improvement goal (increase product quality). Effort in man-hours and project cycle time are complementary measures which need to be monitored in order to make the improvement an overall success."

The example is based on the project measurement level, but the principle can be applied on every measurement level.

Q2: To what extent do you agree that the consideration of primary and complementary measures provides a more complete view on how you look at the effects of the SPI initiative? ***[Fill with X]***

[ ] Strongly agree
[ ] Agree
[ ] Neither agree nor disagree
[ ] Disagree
[ ] Strongly disagree

Please give a short rationale for your opinion.

Q3: To what extent do you agree that the derivation of complementary measures (based on the principle of the iron triangle) clarifies what should be measured and why it should be measured? ***[Fill with X]***

[ ] Strongly agree
[ ] Agree
[ ] Neither agree nor disagree
[ ] Disagree
[ ] Strongly disagree

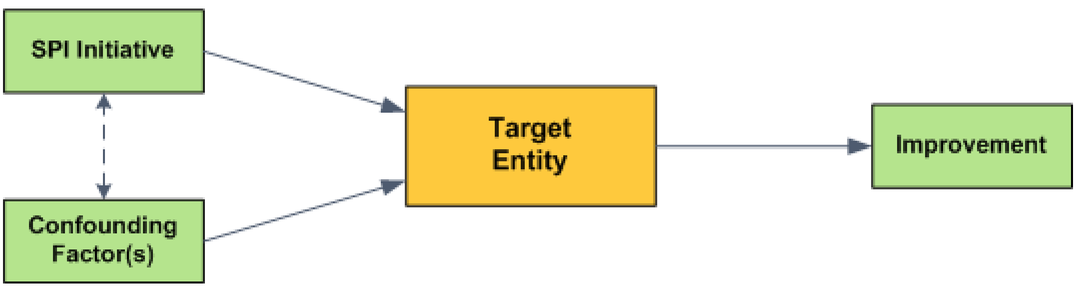
Please give a short rationale for your opinion.

(C3) Confounding Factors

Aim: To increase the confidence in the validity of the improvement evaluation.

Confounding factors represent a fundamental threat for the evaluation of a process improvement initiative if any kind of comparison is used to assess its effects. A comparison is said to be confounded if the observed difference between two values (the effect of a treatment) is not solely caused by the treatment alone but can be partially attributed to an external factor. The challenge in evaluating SPI initiatives is therefore to identify and possibly control confounding factors in order to achieve valid results. In this initial stage, SPI-MEF's aim is to **create awareness** of the **potential threats** caused by confounding factors and, since they are dependent on the context in which the improvement initiative is carried out, exemplify those which are most commonly encountered, e.g.:

- Project nature (new development, enhancement/maintenance)
- Development model (Waterfall, Iterative models, etc.)
- Product size, complexity and domain
- Employee factors (experience level, staff turnover)
- Technology related factors (programming language, tool support, etc.)



An often encountered scenario may be as follows:

"Code inspection is introduced as an improvement initiative in a project. The aim is to decrease the number of defects as early as possible in the development life-cycle and

therefore to decrease the effort in testing and to decrease the number of delivered defects. Assuming that code inspection is used for the first time in the project, one way to assess its effectiveness could be to compare the test effort with another project which was completed without code inspections. It is crucial to select for comparison a project with similar characteristics as the one where the code inspection was introduced: the selected project should be similar in terms of its complexity (e.g. implemented features, work products and size) and in the experience level of the test staff. Furthermore, one has to consider that the introduction of a new practice like code inspections may adhere with a learning curve of the employees who conduct the inspections. Therefore, the effectiveness of the practice should be assessed only with trained employees."

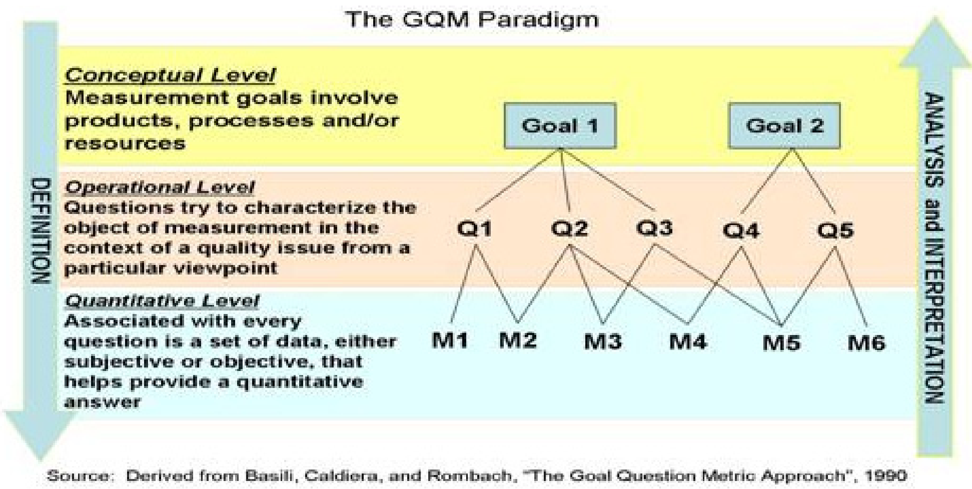
Q4: To what extent do you agree that confounding factors can affect the validity of the evaluation results? ***[Fill with X]***

[ ] Strongly agree
[ ] Agree
[ ] Neither agree nor disagree
[ ] Disagree
[ ] Strongly disagree

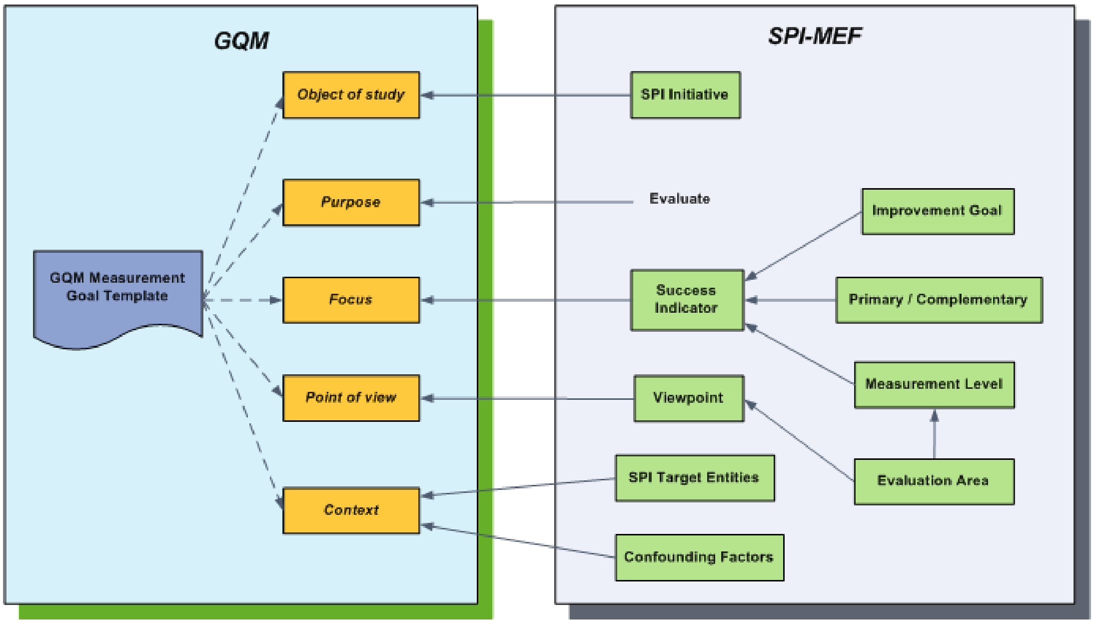
Please give a short rationale for your opinion.

(C4) Derivation of measures for improvement evaluation

Aim: To provide a guideline for the elicitation of the appropriate measures for improvement evaluation.



The previously introduced concepts provide additional information that facilitates the usage of the **Goal-Question-Metric (GQM)** paradigm. The GQM approach is a systematic way to tailor and integrate an organization's objectives into measurement goals and refine them into measurable values. It provides template for defining measurement goals and guidelines on top-down refinement of measurement goals into questions and then into metrics, and a bottom-up analysis and interpretation of the collected data. SPI-MEF provides an interface with the conceptual level of GQM to define the appropriate measurement goals for improvement evaluation.



By using the input from SPI-MEF, it is possible to define very specific measurement goals which facilitate the elicitation of the appropriate questions and right metrics to answer those questions.

The following simple example shows how the concepts proposed by SPI-MEF interface with the GQM approach.

1. <u>Information provided by SPI-MEF</u>

Improvement Goal	Increase product quality
SPI Initiative	Code inspections
Target Entities	Project and Product

Measurement Level	**Viewpoints**		
	Implementer	*Coordinator*	*Sponsor*
Process	---	Project Manager, SPI Process Coordinator	---
Project	Inspection Team	Project Manager, SPI Process Coordinator	---
Product	Project Manager	Product Manager, QA Manager	Head of Division
Organization	---	---	---
External	---	---	---

2. Interfaces between SPI-MEF and GQM

Business Goal	Increase product quality
Object of Study	Code inspection process
Purpose	Evaluate

Table 2: Example of interfaces between SPI-MEF and GQM

Measurement Levels		**Focus**	**Point of View**	**Context**
Process	*MG1*	Effectiveness	SPI Process Coordinator	Project
	*MG2**	Efficiency	Project Manager	Project
	*MG3**	Process conformance	SPI Process Coordinator	Project
Project	*MG4*	Work product defects	Project Manager	Project
	MG5	Work product defects	Inspection Team	Project
	*MG6**	Schedule	Project Manager	Project
	*MG7**	Effort	Project Manager	Project
Product	*MG8*	Pre-release defects	Project Manager	Product
	MG9	Post-release defects	Product Manager	Product
	*MG10**	Time-to-Market	Product Manager	Product
	*MG11**	Cost	Product Manager	Product
	*MG12**	Sales revenue	Product Manager	Product
	MG13	Sales revenue	Head of Division	Product
	*MG14**	Cost	Head of Division	Product

Note: Measurement Goals (MG) with ***** are used to elicit complementary measurements.

3. Elaboration of Measurement Goals and Questions

In the following paragraphs a subset of the measurement goals presented in Table 2 are elaborated in more detail.

MG1: Primary Measurement Goal
Evaluate the process of code inspection with respect to its effectiveness on pre-test defect detection in Project from the viewpoint of the SPI Process Coordinator.

Question 1: What is the effectiveness of the used code inspection method?
Metrics:

1. **Percentage of defects found by inspection** = The number of defects found during inspection, divided by the total of defects found in inspection, unit test, integration test, system test and acceptance test.
   Example: 240 defects are found during inspection and the total number of defects found in the project is 370. The inspection effectiveness is therefore 65%.

2. The previous metric does not take into account the severity of the detected defects during inspection. The severity level of a defect indicates the potential business impact for the end user (business impact = effect on the end user * frequency of occurrence). Severity levels are commonly defined as critical, serious, medium and low. **A histogram of the number of the defects found by code inspection** shows the effectiveness of the inspections process in terms of defect severity.

MG2: Complementary Measurement Goal
Evaluate the process of code inspection with respect to its efficiency in Project from the viewpoint of the Project Manager.

Question 1: How many defects are found during the inspection activity?
Metrics:
1. The **defect finding rate** is the number of defects found during one inspection hour. If 12 defects are found in a meeting which lasts 1.65 hours, the defect finding rate is 12/1.65 = 7.3. The average defect finding rate can be calculated by taking the arithmetic mean of the defect finding rate of all meetings in a project.

Question 2: What is the time invested in inspection meetings?
Metrics:
1. The **inspection rate** is the amount of code inspected in one hour of inspection time.
   Example: 450 lines of code are inspected in one meeting that lasts 1.65 hours. Inspection rate = 450/1.65 = 273 lines of code per hour. The average inspection rate can be calculated by taking the arithmetic mean of the inspection rate of all meetings in a project.
2. The **inspection effort** is the amount of time required to inspect 1000 lines of code. If the inspection rate is 273 lines of code per hour, the inspection effort is 1000/273 = 3.6 hours. The average inspection effort is 1000 divided by the average inspection rate.
3. The **defect finding effort** is the number of defects found per 1000 lines of code. If the defect finding rate is 7.3 defects per hour and the inspection rate is 273 lines of code per hour, the defect finding effort is 7.3 * 1000/273 = 26.7 defects per 1000 lines of code. The average defect finding effort can be calculated by taking the arithmetic mean of the defect finding effort of all meetings in a project.
4. Often inspections require a preceding preparation. The **preparation rate** can be calculated analogously to the inspection rate, using the preparation time of each inspector.

MG3: Complementary Measurement Goal
Evaluate the process of code inspection with respect to its conformance to the specified standard process in Project from the viewpoint of the SPI Process Coordinator.

Question 1: Were the code inspections conducted according to the schedule (planned vs. conducted)?

Metrics:

1. The **conducted inspection rate** is the number of inspection meetings which were held according to the schedule.
   Example: 8 code inspections were planned for the project, but only 6 were conducted. The conducted inspection rate is therefore 6/8*100 = 75%.

Question 2: Were all the allocated participants present during the inspections (planned vs. actual participants)?

Metrics:

1. The **participation rate** is the number of inspectors which were actually present in the meetings.
   Example: 3 participants were planned and 2 participants conducted the inspection. The participation rate is therefore 2/3*100 = 66%. The average participation rate can be calculated by taking the arithmetic mean of the participation rate of all meetings.

Q5: To what extent do you agree that the proposed approach provides a clear and systematic method for the elicitation of measures of improvement evaluation? ***[Fill with X]***

[ ] Strongly agree
[ ] Agree
[ ] Neither agree nor disagree
[ ] Disagree
[ ] Strongly disagree

Please give a short rationale for your opinion.

Q6: To what extent do you agree that the proposed approach is useful in practice? ***[Fill with X]***

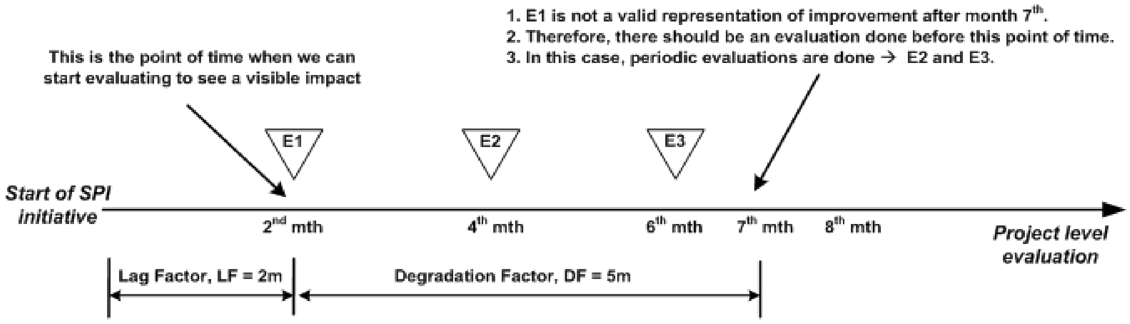
[ ] Strongly agree
[ ] Agree
[ ] Neither agree nor disagree
[ ] Disagree
[ ] Strongly disagree

Please give a short rationale for your opinion.

(C5) Time to evaluate

Aim: To propose an approach that helps to identify the time bounds for improvement evaluation.

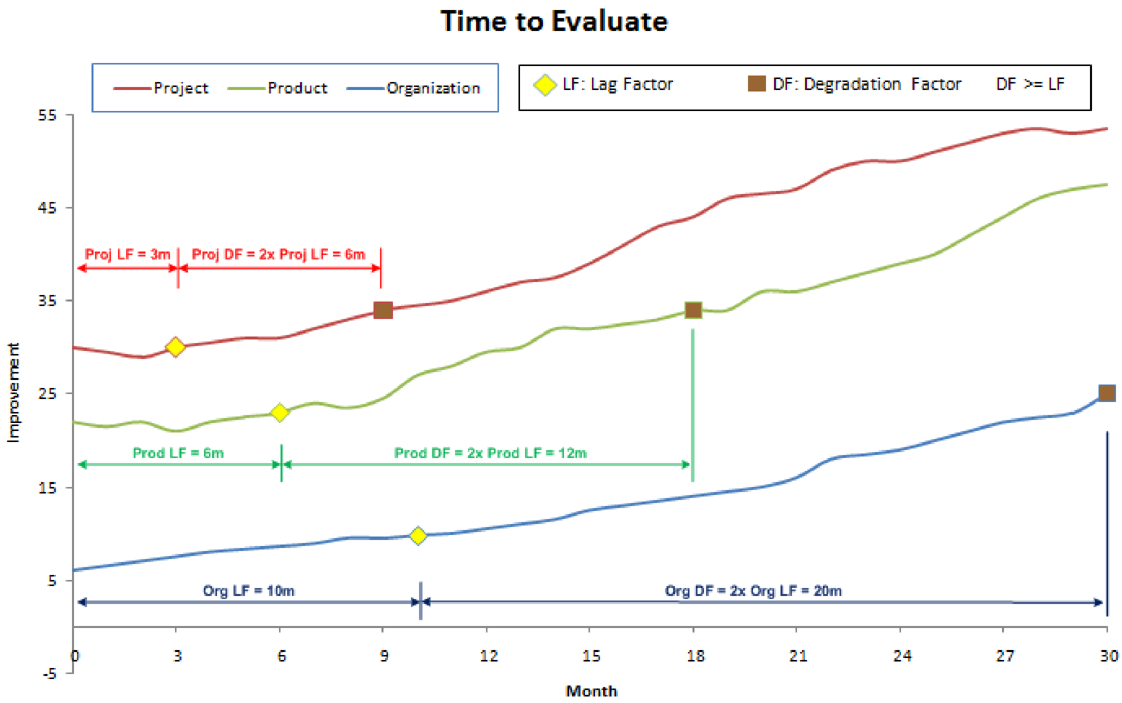
The determination of the appropriate time to evaluate the improvement is important; however it is difficult to suggest a general rule which is universally applicable. Therefore SPI-MEF introduces the concepts of **Lag Factor** and **Degradation Factor** which support the practitioner to determine the time bounds for an improvement evaluation. The Lag Factor is the minimum time required for the improvement initiative to propagate a visible impact on the measurable entities (measurement levels). The Degradation Factor, on the other hand, is the maximum time for which an evaluation result can be considered as valid, or, more specifically, can be considered as representing the actual status of the improvement.



The value of Lag Factor and Degradation Factor is defined by organization based on the type of SPI initiative taken and organizational context.

"The illustration above shows the concept of Lag Factor and Degradation Factor where the Lag Factor and Degradation Factor are defined as 2 months and 5 months respectively for a certain SPI initiative at Project level. E1 is the evaluation at first point of time (2 months after the introduction of SPI initiative) when the impact of SPI initiative is visible at Project level. As the degradation factor is 5 months, the evaluation E1 is no longer a valid representation of improvement anymore after the 7th month (five months after E1 is conducted). That is why organization needs to do evaluation periodically to get the current representation of improvement and also to see the trend of impact of SPI initiative. In this illustration, two periodic evaluations are conducted after E1, and they are shown as E2 (4^{th} month) and E3 (6^{th} month)."

The evaluation should be conducted within the interval range defined by the Lag Factor and Degradation Factor. The figure below exemplifies the concept on the Project, Product and Organization measurement levels.



"In the figure above, it is illustrated that the minimum time to propagate the visible impact of improvement (i.e. Lag Factor) is higher at the Organization level (LF = 10 months) than Product level (LF = 6 months), and it is higher at Product level than Project level (LF = 3 months). The same relation applies for Degradation Factor."

The only heuristic currently provided by SPI-MEF to determine the Lag Factor and Degradation Factor is that their values increase with the measurement levels, that is, **"**$\mathbf{LF_{Prc} < LF_{Prj} < LF_{Prd} < LF_{Org} < LF_{Ext}}$**"** and **"**$\mathbf{DF_{Prc} < DF_{Prj} < DF_{Prd} < DF_{Org} < DF_{Ext}}$**"**. Driven by these two factors, SPI-MEF proposes a periodic improvement evaluation, that is, an evaluation indexed by time to see the trend of the improvement.

Q7: Do you think that it is feasible for an organization to determine the value for the Lag Factor and Degradation Factor using their historical data and experience?

Q8: To what extent do you agree that the concept of Lag Factor and Degradation Factor can be used to determine the appropriate time to evaluate the outcome of SPI initiative? ***[Fill with X]***

[ ] Strongly agree
[ ] Agree
[ ] Neither agree nor disagree
[ ] Disagree
[ ] Strongly disagree

Please give a short rationale for your opinion.

Q9: To what extent do you agree that periodic evaluation (to see the trend over time) is an effective way to gauge the outcome of SPI initiatives? ***[Fill with X]***

[ ] Strongly agree
[ ] Agree
[ ] Neither agree nor disagree
[ ] Disagree
[ ] Strongly disagree

Please give a short rationale for your opinion.

(C6) Holistic View

Aim: To provide a “one-view” representation of the overall improvement evaluation results.

The **Holistic View** combines the evaluation results of different measurement levels and viewpoints. The construction of Holistic View is an iterative process. The improvement initiative propagates its visible impact to Process level first then to Project in which the process is applied and eventually to the Products emerging from various projects and then to Organization and External measurement level. Therefore, the Holistic View creation starts from the Process level and then evaluation is done periodically in each level to incrementally create the Holistic View.

The following components are used to construct the model:

- **GL (Gain/Loss):** To normalize the different measurements, their actual values are mapped to Gain (+1), Neutral (0) and Loss (-1), relative to previous evaluations.
- **IR (Impact Rating):** Each viewpoint (that is, each stakeholder of the improvement initiative) rates the impact of the improvement initiative on the respective measurement according to the following scale:

Impact assessment scale	Value
Low impact	1
Considerably low impact	2
Moderate impact	3
Considerably high impact	4
High impact	5

- **SW (Subjective Weight):** Each viewpoint gives a weight of subjective importance to every measurement. The weights sum up to 1.

From these components, the **Subjective Value of Improvement (SVI)** for each viewpoint is calculated as follows:

$$SVI_{vw} = \Sigma\,(GL_i * SW_i * IR_i) / n$$

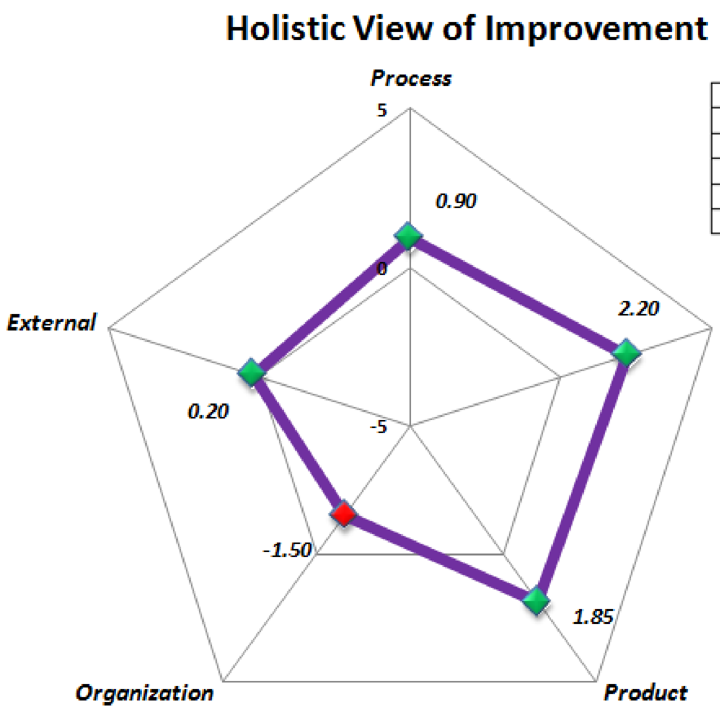
vw: *Sponsor / Coordinator / Implementer*
i: *Metric 1, Metric 2, ….. , Metric n*
n: *Total number of metrics*

The table below shows an example on how SVI is calculated for measurements at the process level. The **Average Value of Improvement (AVI)** is the arithmetic mean of SVI.

Table 3: Example of SVI calculation at the process level

Viewpoint	*Metrics*	*Gain / Loss* ^{GL}	*Subjective Weight* ^{SW}	*Impact Rating* ^{IR}	*Subjective Value of Improvement* ^{SVI}
Sponsor	M1	1	0.4	3	[(1)(0.4)(3) + (-1)(0.6)(4)] / 2 = -0.60
	M2	-1	0.6	4	
Coordinator	M2	-1	0.3	5	[(-1)(0.3)(5) + (1)(0.2)(5) + (1)(0.5)(4)] / 3 = 0.50
	M3	1	0.2	5	
	M4	1	0.5	4	
Implementer	M3	1	0.5	4	[(1)(0.5)(4) + (-1)(0.5)(0)] / 2 = 1.00
	M5	-1	0.5	0	
Average Value of Improvement ^{AVI}**:**					(-0.50 + 0.20 + 0.75) / 3 = **0.90**

By calculating the AVI for each evaluated measurement level, the overall improvement can be represented in a radar (Kiviat) diagram as shown in the below figure.



Measurement level	AVI
Process	**0.90**
Project	2.20
Product	1.85
Organization	-1.50
External	0.20

Impact assessment scale	Value
High gain	5.0
Considerably high gain	4.0
Moderate gain	3.0
Considerably low gain	2.0
Low gain	1.0
No impact	0.0
Low loss	-1.0
Considerably low loss	-2.0
Moderate loss	-3.0
Considerably high loss	-4.0
High loss	-5.0

Q10: To what extent do you agree with our approach to construct the holistic view? ***[Fill with X]***

[ ] Strongly agree
[ ] Agree
[ ] Neither agree nor disagree
[ ] Disagree
[ ] Strongly disagree

Please give a short rationale for your opinion.

Q11: To what extent do you agree that consolidating the evaluation results into "one picture" (holistic view) gives benefits to the organization? ***[Fill with X]***

[ ] Strongly agree
[ ] Agree
[ ] Neither agree nor disagree
[ ] Disagree
[ ] Strongly disagree

Please give a short rationale for your opinion.

(D) General Validation Questions

The general validation questions are divided into applicability and suggestions for improvement.

(D1) Applicability

Q1: To what extent do you agree that SPI-MEF is usable in practice? ***[Fill with X]***

[ ] Strongly agree
[ ] Agree
[ ] Neither agree nor disagree
[ ] Disagree
[ ] Strongly disagree

Please give a short rationale for your opinion.

Q2: To what extent do you agree that SPI-MEF is useful (giving benefits) in practice? ***[Fill with X]***

[ ] Strongly agree
[ ] Agree
[ ] Neither agree nor disagree
[ ] Disagree
[ ] Strongly disagree

Please give a short rationale for your opinion.

Q3: To what extent do you agree that SPI-MEF is adaptable and customizable to different company settings (size, core business, culture)? ***[Fill with X]***

[ ] Strongly agree
[ ] Agree
[ ] Neither agree nor disagree
[ ] Disagree
[ ] Strongly disagree

Please give a short rationale for your opinion.

<u>(D2) Suggestions</u>

Q4: Can you name and explain briefly any deficiency you have observed in the framework?

Q5: Can you name and explain the major benefits you have observed in the framework?

Q6: Do you have any suggestions to improve SPI-MEF? If yes, please state them.