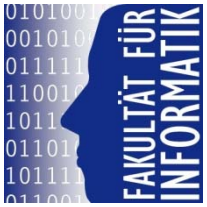

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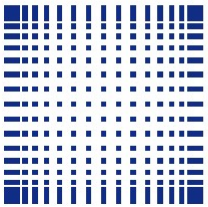

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Software-Qualitätsmanagement

SWQ – SS2019 – 2IM

Kapitel 4.2: Geschäftsausrichtung (Teil 2)

Dr. Adam Trendowicz
Fraunhofer Institut für Experimentelles Software Engineering

Inhalt

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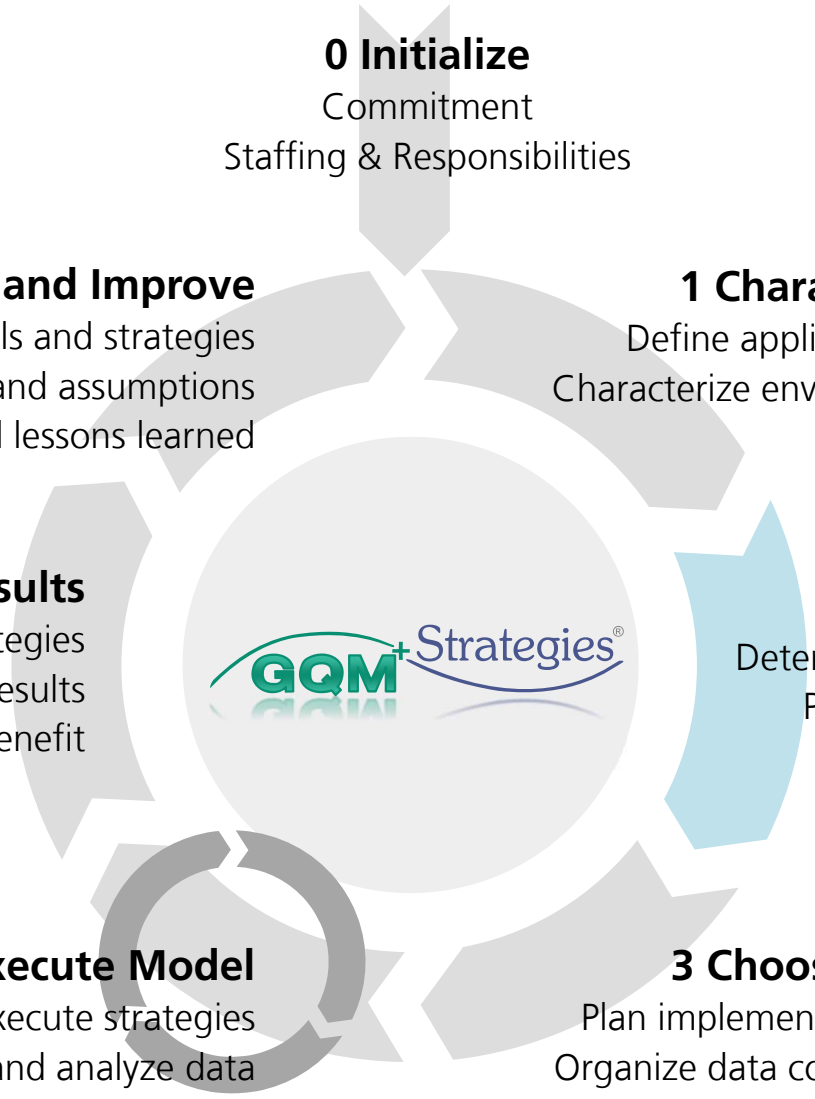
GQM+Strategies® Process



0 Initialize
Commitment
Staffing & Responsibilities

1 Characterize
Define application scope
Characterize environment/context

2 Set Goals
Determine organizational structures
Perform status quo analysis
Prioritize goals
Build up grid

3 Choose Process
Plan implementation of strategies
Organize data collection and analysis
Define feedback mechanisms

4 Execute Model
4.1 Execute strategies
4.2 Collect and analyze data
4.3 Provide feedback

5 Analyze Results
Analyze data and revise strategies
Review and communicate results
Analyze cost/benefit

6 Package and Improve
Adapt and improve goals and strategies
Revise context and assumptions
Record lessons learned

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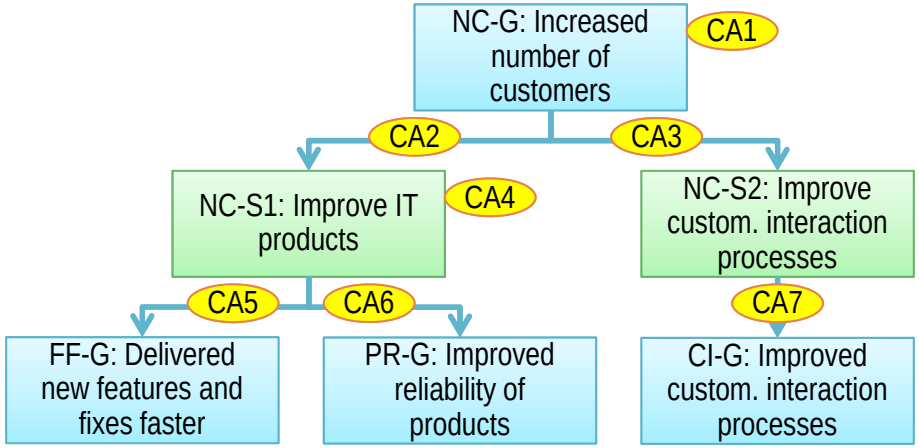
EXAMPLE

2 Set Goals: Define Interpretation Model

- Identify relationships between this interpretation model and the one for your higher-level goal



NC-G	FF-G	PR-G	CI-G	Check
0	0	0	0	Enforce strategies
0	1	1	1	Strategies not sufficient or not effective Assumptions wrong
1	0	0	0	Check magnitudes (less was sufficient) Check root causes for achieving NC-G
…	…	…	…	…

0 = not achieved

1 = achieved

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EXAMPLE

2 Set Goals: Define Interpretation Model

- Alternative text representation of the whole interpretation model:
  - IF (NC-G, FF-G, PR-G, CI-G) are not achieved THEN
    - Enforce strategies
  - ELSE IF NC-G is not achieved AND (FF-G, PR-G, CI-G) are achieved THEN
    - Strategies not sufficient or not effective (check)
    - Assumptions wrong (check)
  - ELSE IF NC-G is achieved AND (FF-G, PR-G, CI-G) are not achieved THEN
    - Check magnitudes (less was sufficient)
    - Check root causes for achieving NC-G

NC-G	FF-G	PR-G	CI-G	Check
0	0	0	0	Enforce strategies
0	1	1	1	Strategies not sufficient or not effective Assumptions wrong
1	0	0	0	Check magnitudes (less was sufficient) Check root causes for achieving NC-G
…	…	…	…	…

0 = not achieved

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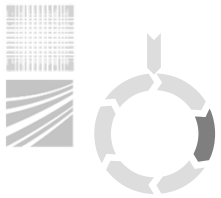

EXAMPLE

2 Set Goals: Make Strategy Decisions

- Document context and assumptions
  - Assumption CA8: The delay of existing projects is mainly responsible for not being able to deliver new features and bug fixes faster.
  - Context CA9: Customers complain about inconsistent and incomplete information during their interaction with company X.
- Brainstorm potential strategies
  - Strategy FF-S: Increase productivity of development projects
  - Strategy PR-S: Improve QA activities
  - Strategy CI-S: Provide more complete and consistent information
- Decide on a strategy
  - Company X decides to follow all three strategies and to do not define more than one strategy per goal

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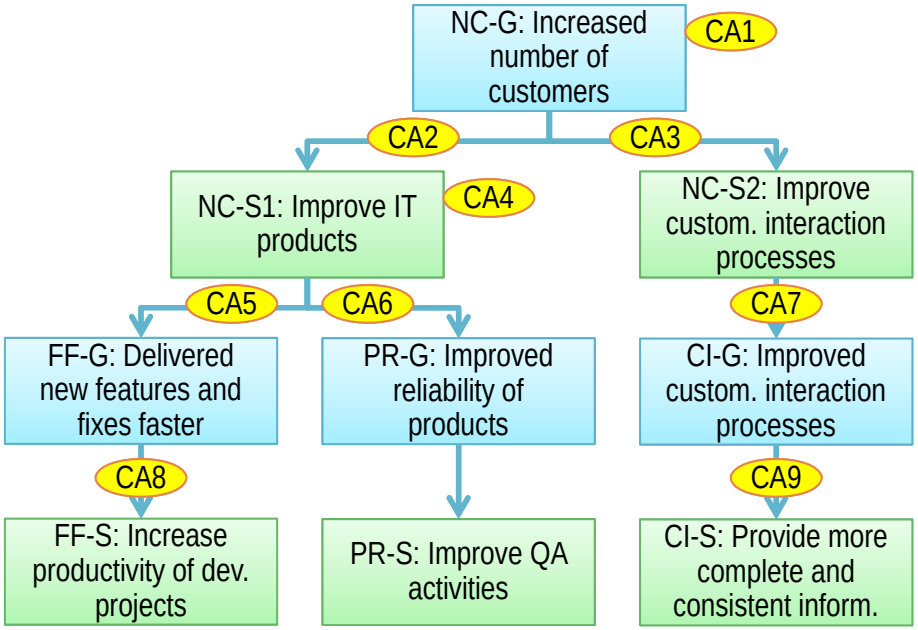
EXAMPLE

2 Set Goals: GQM+Strategies Grid



- CA1: Company X provides banking and insurance services to their customers. X directly sells services via the internet without local sales agents. X has a lot of customers in the banking area, but only few in the insurance area.
- CA2: For getting more customers in the insurance area, the quality of the IT products has to be improved.
- CA3: For getting more customers in the insurance area, the quality of the customer interaction processes has to be improved.
- CA4: The services of X are build upon an Enterprise information system (IS) that is composed out of different software components (from which 60% were developed in-house by the IT department).
- CA5: Customers complain that it takes too long to deliver new features (react to the market) and to fix existing bugs.
- CA6: Customers complain that the IT products they have to deal with are not reliable.
- CA7: Customers complain about many issues related to the customer interaction process.
- CA8: The delay of existing projects is mainly responsible for not being able to deliver new features and bug fixes faster.
- CA9: Customers complain about inconsistent and incomplete information during their interaction with company X.

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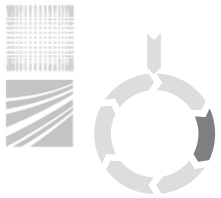

EXAMPLE

2 Set Goals: Define Goals

- Elicit the implications of the chosen strategy (e.g. to sub-units of the considered organizational unit or to other organizational units)
  - More detailed goals can directly be derived from strategies
- Identify potential goals
  - (Strategy FF-S: Increase productivity of development projects)
    - Goal PP-G: Increased productivity of dev. projects
  - (Strategy PR-S: Improve QA activities)
    - Goal DS-G: Decreased defects slipped
  - (Strategy CI-S: Provide more complete and consistent information)
    - Goal IQ-G: Improved information quality of IS
- Select the most promising goal considering feasibility, cost, and benefit
  - Company X decides to take all three goals
- Formalize selected goals

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EXAMPLE

2 Set Goals: Formalize Goal: "PP-G: Increase productivity of development projects"

Focus	productivity of
Object	SW maintenance and new development projects
Magnitude	10% increase (in terms of FP/PH)
Timeframe	by the middle of next fiscal year
Organizational Scope	management of software group
Constraints	while maintaining quality and functionality
Relations	supported by "DS-G: Decrease defects slipped" (less slippage → less rework effort → more effort of work → higher productivity)

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EXAMPLE

2 Set Goals: Define GQM Graph: “GQM-PP-G: Evaluate increase of productivity of dev. projects”

Object	Purpose	Quality Focus	Viewpoint	Context
SW maintenance and new development projects	Evaluate	Productivity	Management of software group	C&A

Quality Focus	Variation Factors
■ **Per development project** ■ PP-G-Q1: What is the productivity of a project? ■ FP: Number of IPUG function points ■ PH: Effort in person hours of direct project effort ■ P = FP / PH ■ **Across all development projects** ■ PP-G-Q2: What is the productivity across projects finished in time span T (e.g., half a year)? ■ P_Min(T): Minimum of P values for projects in T ■ P_Max(T): Maximum of P values for projects in T ■ P_Q1(T): Lower quartile of P values for projects in T ■ P_Q2(T): Median of P values for projects in T ■ P_Q3(T): Upper quartile of P values for projects in T	■ **Per development project** ■ PP-G-VF2: Project type (New development, maintenance, integration) ■ PP-G-VF3: Implementation language (C#, Java, PHP, others) ■ PP-G-VF4: Development approach (Plan-based, Agile) ■ PP-G-VF5: How old is the application? (#years)

Baseline Hypotheses	Impact of Variation Factors
P_Q2(2019H2) = 0.25, whereas 2019H2 is second half 2019	Not defined yet

Interpretation Model
PP-G-I: P_Q2(2020H1)/P_Q2(2019H2) >= 1.1, whereas 2020H1 is the first half of fiscal year 2020 and 2019H2 is the second half of fiscal year 2019

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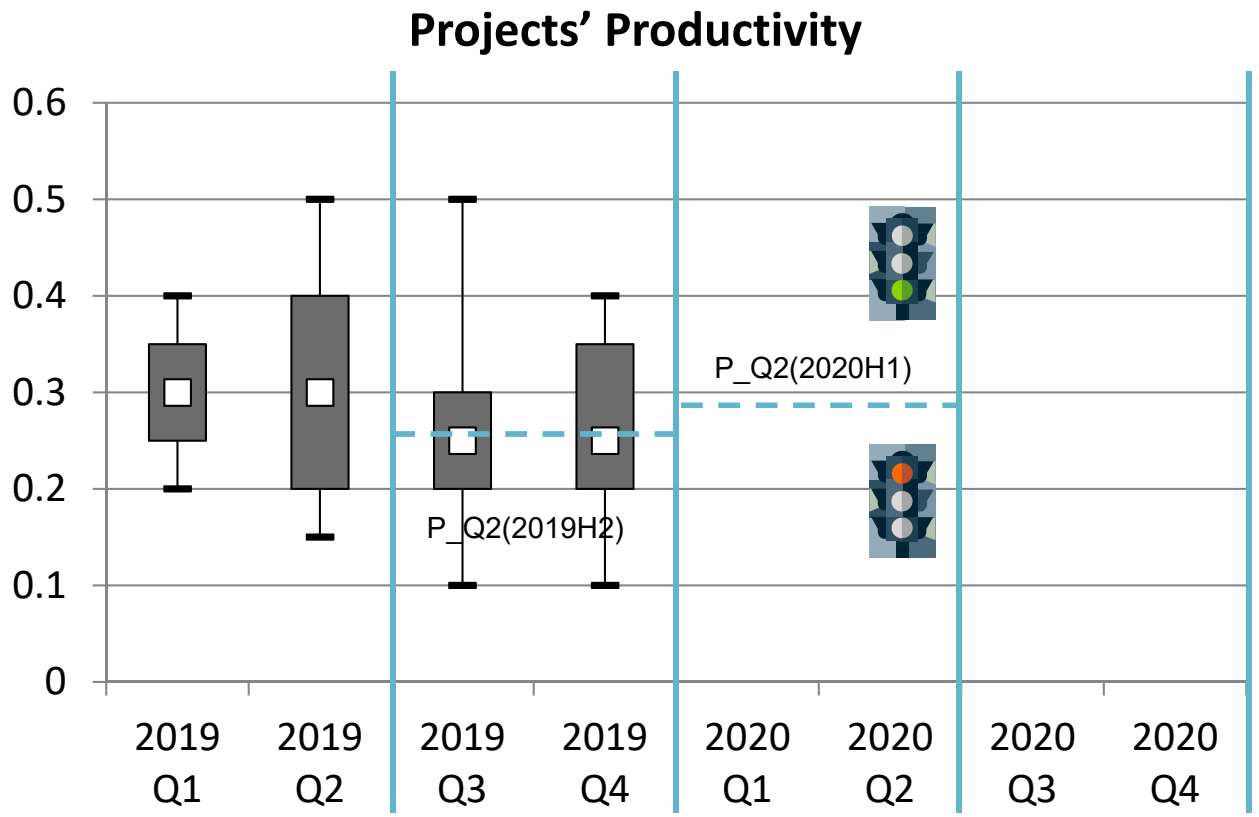
EXAMPLE

2 Set Goals: Visualization: “GQM-PP-G: Evaluate increase of productivity of dev. projects”



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EXAMPLE

2 Set Goals: Formalize Goal: "DS-G: Decreased defects slipped"

Focus	amount of defects slipped through
Object	QA activities (V&V)
Magnitude	10% less over all QA stages
Timeframe	by the middle of next fiscal year
Organizational Scope	management of software group
Constraints	-
Relations	supports goal "PP-G: Increase productivity of dev. Projects" (less slippage → less rework effort → more effort of work → higher productivity)

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EXAMPLE

2 Set Goals: Define GQM Graph: “GQM-DS-G: Evaluate decrease of defects slipped”

Object	Purpose	Quality Focus	Viewpoint	Context
QA activities (V&V)	Evaluate	Amount of defects slipped	Software group	C&A

Quality Focus	Variation Factors
■ **Per development project** ■ DS-G-Q1: What percentage of defects have been slipped in phase P (having one major output artifact A_P)? ■ DD(A, P): # defects detected in artifact A during QA in P ■ DI(A_P): # defects injected in artifact A_P (of phase P) = Sum of DD(A, P) for all phases P ■ DSR(P) = DD(P, A_P) / DI(A_P) ■ DS-G-Q2: What is the average slippage across all phases? ■ DSR_AVG = Average of DSR(P) for all phases P ■ **Across all development projects** ■ DS-G-Q3: What is the average slippage across projects? ■ DSR_AVG(T): Average slippage for all projects finished in time span T (e.g., half a year)	■ **Per development project** ■ DS-G-VF1: Project type (New development, maintenance, integration) ■ DS-G-VF2: Development approach (Plan-based, Agile) ■ DS-G-VF3: How old is the application? (#years)

Baseline Hypotheses	Impact of Variation Factors
DSR_AVG(2019H2) = 60%, whereas 2019H2 is the second half of year 2019	Not defined yet

Interpretation Model
DS-G-I: DSR_AVG(2020H1)/DSR_AVG(2019H2) <= 0.9, whereas 2020H1 is the first half of fiscal year 2020 and 2019H2 is the second half of fiscal year 2019

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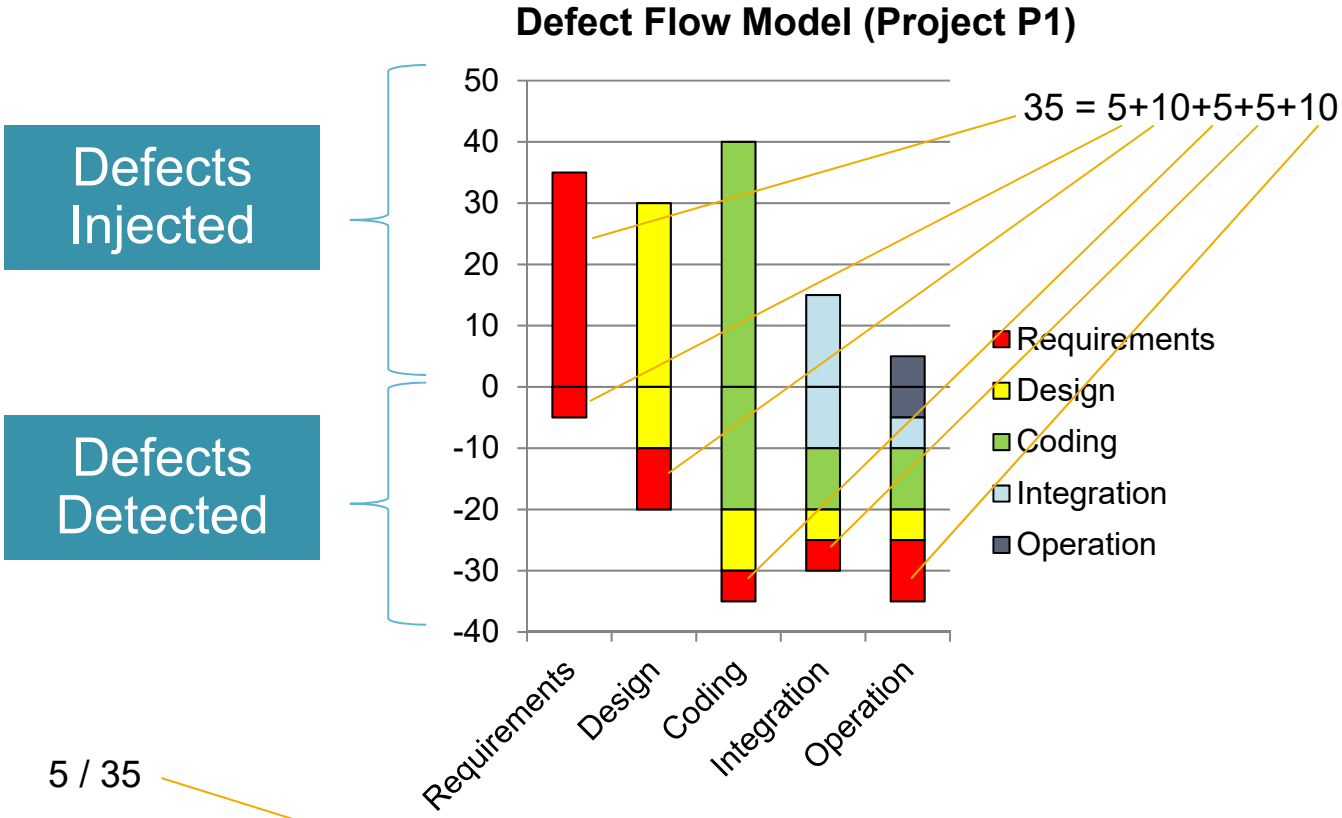
EXAMPLE

2 Set Goals: Visualization: “GQM-DS-G: Evaluate decrease of defects slipped”



5 / 35

DSR	86%	67%	50%	33%

DSR_AVG = (86%+67%+50%+33%)/4 = 59%

CA
SG
M
S
G
M
S
G
M
S

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EXAMPLE

2 Set Goals: Formalize Goal: "IQ-G: Improved information quality of Enterprise IS"

Focus	information quality of
Object	Enterprise IS
Magnitude	providing 20% more complete and 10% more consistent information
Timeframe	by the middle of next fiscal year
Organizational Scope	management of software group
Constraints	-
Relations	-

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EXAMPLE

2 Set Goals: Define GQM Graph: "GQM-IQ-G: Evaluate improvement of IQ of Enterprise IS"

Object	Purpose	Quality Focus	Viewpoint	Context
Enterprise IS	Evaluate	Information quality	Management of software group	C&A

Quality Focus	Variation Factors
■ IQ-G-Q1: What is the completeness of information in the Enterprise IS? ■ IQI_Comp(T): Information quality index (IQI) for completeness in time span T (e.g., half a year) ■ IQ-G-Q2: What is the consistency of information in the Enterprise IS? ■ IQI_Cons(T): Information quality index (IQI) for consistency in time span T (e.g., half a year)	■ IQ-G-V1: % of information units in Enterprise IS classified by the IQI ■ IQ-G-V2: Overall number of information units in Enterprise IS
Baseline Hypotheses	**Impact of Variation Factors**
IQI_Comp(2019H2) = 70% AND IQI_Cons(2019H2) = 80%, whereas 2019H2 is the second half of fiscal year 2019	Not defined yet
Interpretation Model	
IQ-G-I: IQI_Comp(2020H1)/IQI_Comp(2019H2) >= 1.2 AND IQI_Cons(2020H1)/IQI_Cons(2019H2) >= 1.1, whereas 2020H1 is the first half of fiscal year 2020 and 2019H2 is the second half of fiscal year 2019	

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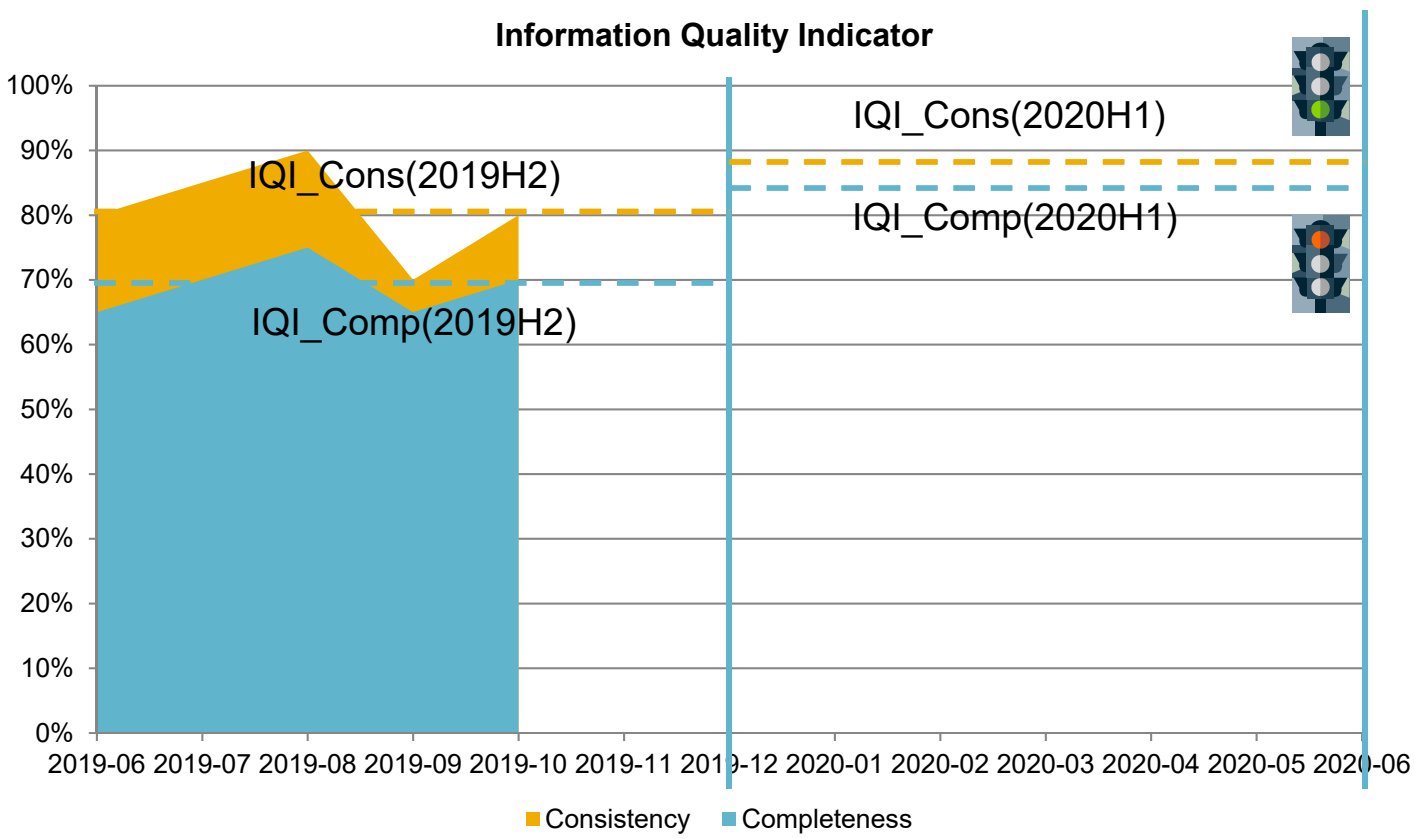
EXAMPLE

2 Set Goals: Visualization: “GQM-IQ-G: Evaluate improvement of IQ of Enterprise IS”



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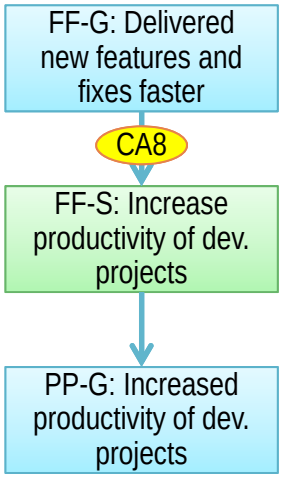
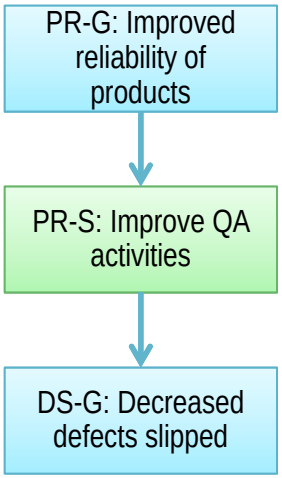
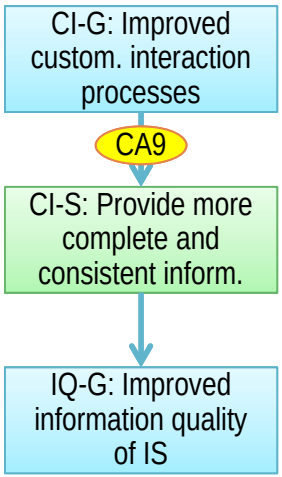
EXAMPLE

2 Set Goals: Define Interpretation Models

- Identify relationships between this interpretation model and the one for your higher-level goal







FF-G	PP-G	Check
0	0	Enforce strategy
0	1	CA8 wrong Strategy insufficient
1	0	Check magnitudes (less was sufficient)
1	1	OK

PR-G	DS-G	Check
0	0	Enforce strategy
0	1	Strategy insufficient
1	0	Check magnitudes (less was sufficient)
1	1	OK

CI-G	IQ-G	Check
0	0	Enforce strategy
0	1	CA9 wrong Strategy insufficient
1	0	Check magnitudes (less was sufficient)
1	1	OK

0 = not achieved

1 = achieved

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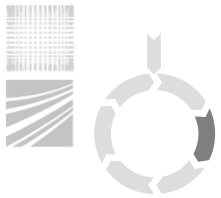

EXAMPLE

2 Set Goals: Make Strategy Decisions

- Document context and assumptions
  - Context CA10: According to the experience from the recently run pilot project, agile development principles will be able to speed up software development.
  - Context CA11: According to the analysis of the defect data, too many defects slip from the requirements stage to the coding and system testing phases.
  - Context CA12: Not all services of X are completely IT supported; some have to be provided manually, which decreases information quality.
- Brainstorm potential strategies
  - Strategy PP-S: Introduce agile development (extend its use)
  - Strategy DS-S: Introduce inspections after req. specification
  - Strategy IQ-S: Increase IT support of customer processes
- Decide on a strategy
  - Company X decides to follow all three strategies and to do not define more than one strategy per goal

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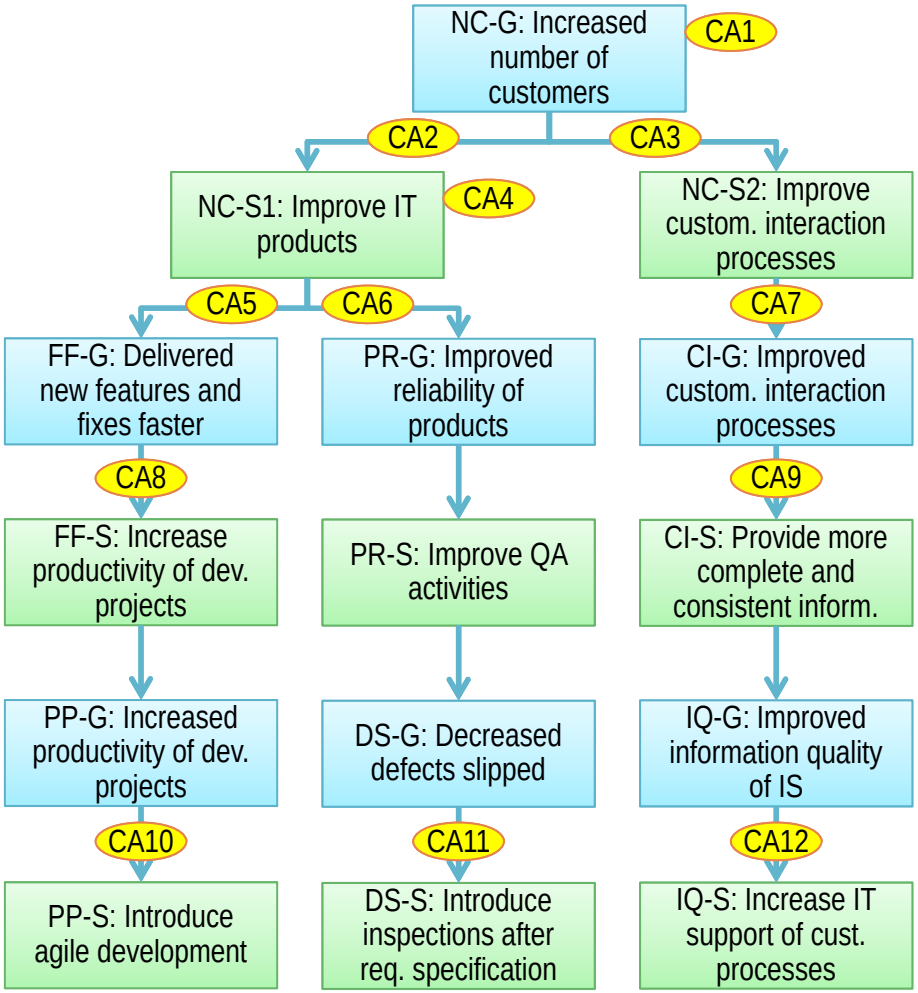
EXAMPLE

2 Set Goals: GQM+Strategies Grid



- CA1: Company X provides banking and insurance services to their customers. X directly sells services via the internet without local sales agents. X has a lot of customers in the banking area, but only few in the insurance area.
- CA2: For getting more customers in the insurance area, the quality of the IT products has to be improved.
- CA3: For getting more customers in the insurance area, the quality of the customer interaction processes has to be improved.
- CA4: The services of X are build upon an Enterprise information system (IS) that is composed out of different software components (from which 60% were developed in-house by the IT department).
- CA5: Customers complain that it takes too long to deliver new features (react to the market) and to fix existing bugs.
- CA6: Customers complain that the IT products they have to deal with are not reliable.
- CA7: Customers complain about many issues related to the customer interaction process.
- CA8: The delay of existing projects is mainly responsible for not being able to deliver new features and bug fixes faster.
- CA9: Customers complain about inconsistent and incomplete information during their interaction with company X.
- CA10: According to the experience from the recently run pilot project, agile development principles will be able to speed up software development.
- CA11: According to the analysis of the defect data, too many defects slip from the requirements stage to the coding and system testing phases.
- CA12: Not all services of X are completely IT supported; some have to be provided manually, which decreases information quality.

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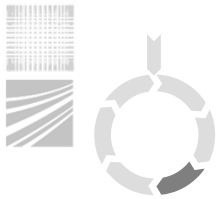

3 Choose Process: Develop Mechanisms for Data Collection and Analysis

- Identify existing means for measurement and identify need for change
- Create measurement plan
  - *Who*: assign responsibilities
  - *What*: provide metrics definitions to responsible persons
  - *When*: schedule measurement activities within the project
  - *How*: specify measurement instruments (data collection and storage, etc.)
- Prepare data collection and analysis
  - Create measurement repository (spreadsheet, database, etc.)
  - Design data collection forms (if applicable)
- Select and prepare tool support
  - Measurement (e.g., forms, questionnaires, automatic tools)
  - Analysis tools (e.g., statistical and machine learning)
  - Visualization tools (e.g., dashboards)
- Train people

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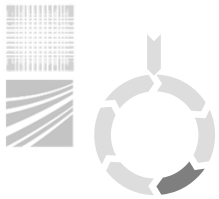

EXAMPLE

3 Choose Process: Data Collection and Analysis

- Schiller (Company Expert on GQM+Strategies®) sets up data collection and analysis mechanisms for the measurement goals defined

Measurement Goal	Short Description
GQM-NC-G	Evaluate increase of number of customers
GQM-FF-G	Evaluate faster delivery of new features and fixes
GQM-CI-G	Evaluate improvement of customer interaction processes
GQM-PR-G	Evaluate improvement of reliability of products
GQM-PP-G	Evaluate increase of productivity of development projects
GQM-IQ-G	Evaluate improvement of information quality of Enterprise IS
GQM-DS-G	Evaluate decrease of defects slipped

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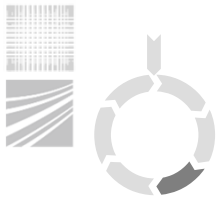

EXAMPLE

3 Choose Process: Data Collection and Analysis: Measurement Plan

ID	Metric	Range	Scale Type	Unit	Scope	Collection Time	Data Source	Collection Resource
Cus(Y)	Number of new customers in year Y (e.g., next fiscal year)	N0	Rational	Customers	Management	Quarterly	Customer Relationship Management	Sales
F_Rel(T)	Number of feature releases in time span T (e.g., half a year)	N0	Rational	Releases	Business Unit	End of project	Configuration Management	Product Manager
BF_Rel(T)	Number of bug fix releases in time span T (e.g., half a year)	N0	Rational	Releases	Business Unit	End of project	Configuration Management	Product Manager
CC_IP(T)	Number of complaints about the interaction processes in time span T (e.g., half a year)	N0	Rational	Complaints	Business Unit	Monthly	Service Desk	Service Desk Operator
CC_PR(T)	Number of complaints about product reliability in time span T (e.g., half a year)	N0	Rational	Complaints	Business Unit	Monthly	Service Desk	Service Desk Operator
P_AVG(T)	Average Function Points per person hours of project effort in time span T (e.g., half a year)	R	Rational	FP/PH	Software Group	End of project	Questionnaire	Project Manager
IQI_Comp(T)	Information quality index (IQI) for completeness in time span T (e.g., half a year)	0-100	Rational	%	Software Group	Monthly	Questionnaire	Project Manager
IQI_Cons(T)	Information quality index (IQI) for consistency in time span T (e.g., half a year)	0-100	Rational	%	Software Group	Monthly	Questionnaire	Project Manager
DSR_AVG(T)	Average ratio of defects slipped per overall defects introduced over all development phases (e.g., coding) for all releases in time span T (e.g., half a year)	R	Rational	%	Software Group	Quarterly	Bug Tracking	QA People
DT(P, R)	# defects detected in phase P for release R	N0	Rational	Defects	Software Group	End of project	Bug Tracking	QA People
DS(P, R)	# defects slipped from P to P+1 for release R	N0	Rational	Defects	Software Group	End of project	Bug Tracking	QA People
DSR(P, R)	DT(P, R) / (DT(P, R) + DS(P, R))	R	Rational	%	Software Group	End of project	Bug Tracking	QA People

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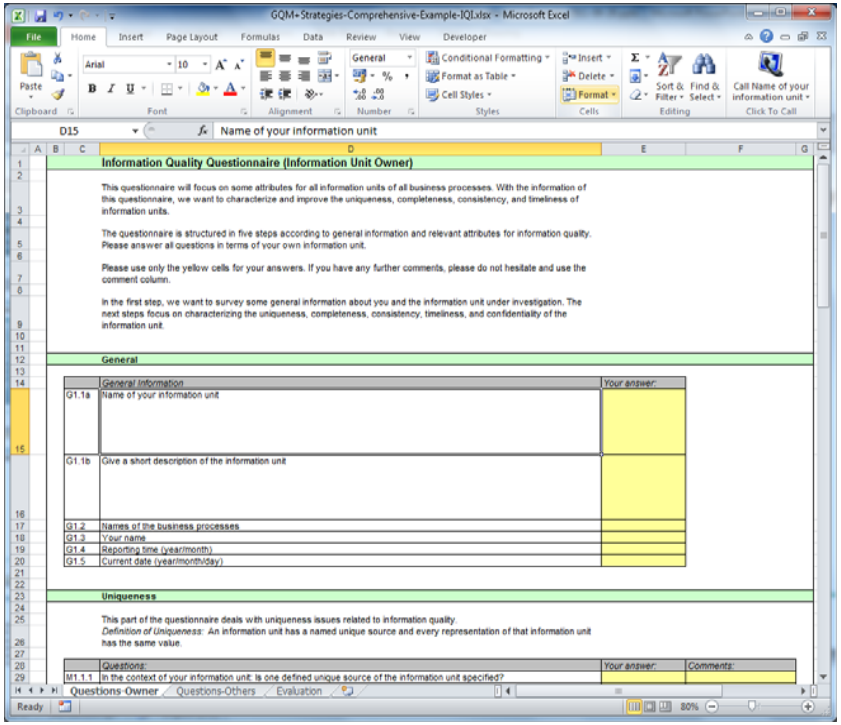
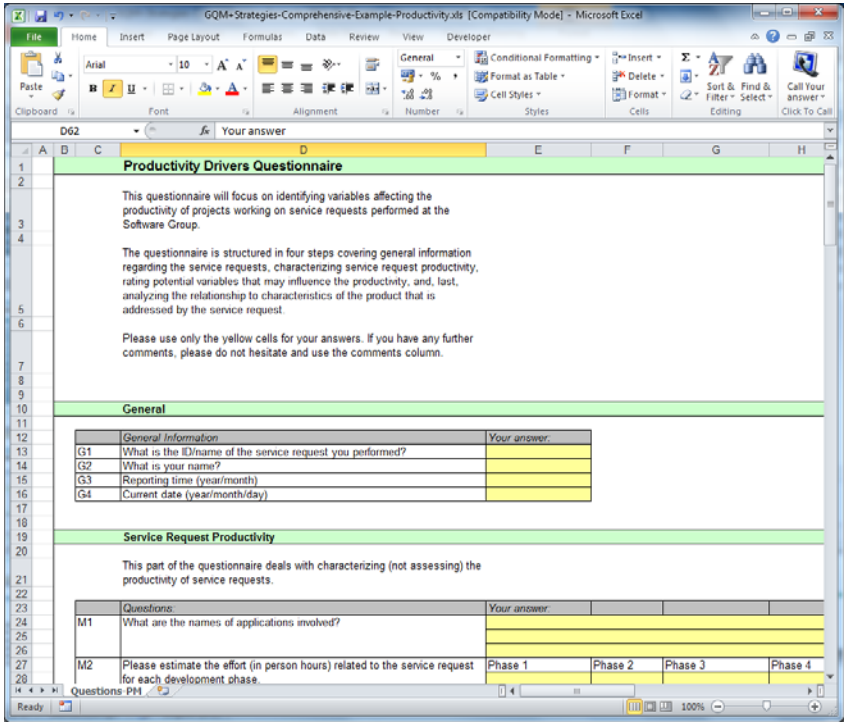
EXAMPLE

3 Choose Process: Data Collection and Analysis: Data Collection Questionnaires

Information Quality Indicator



Project's Productivity



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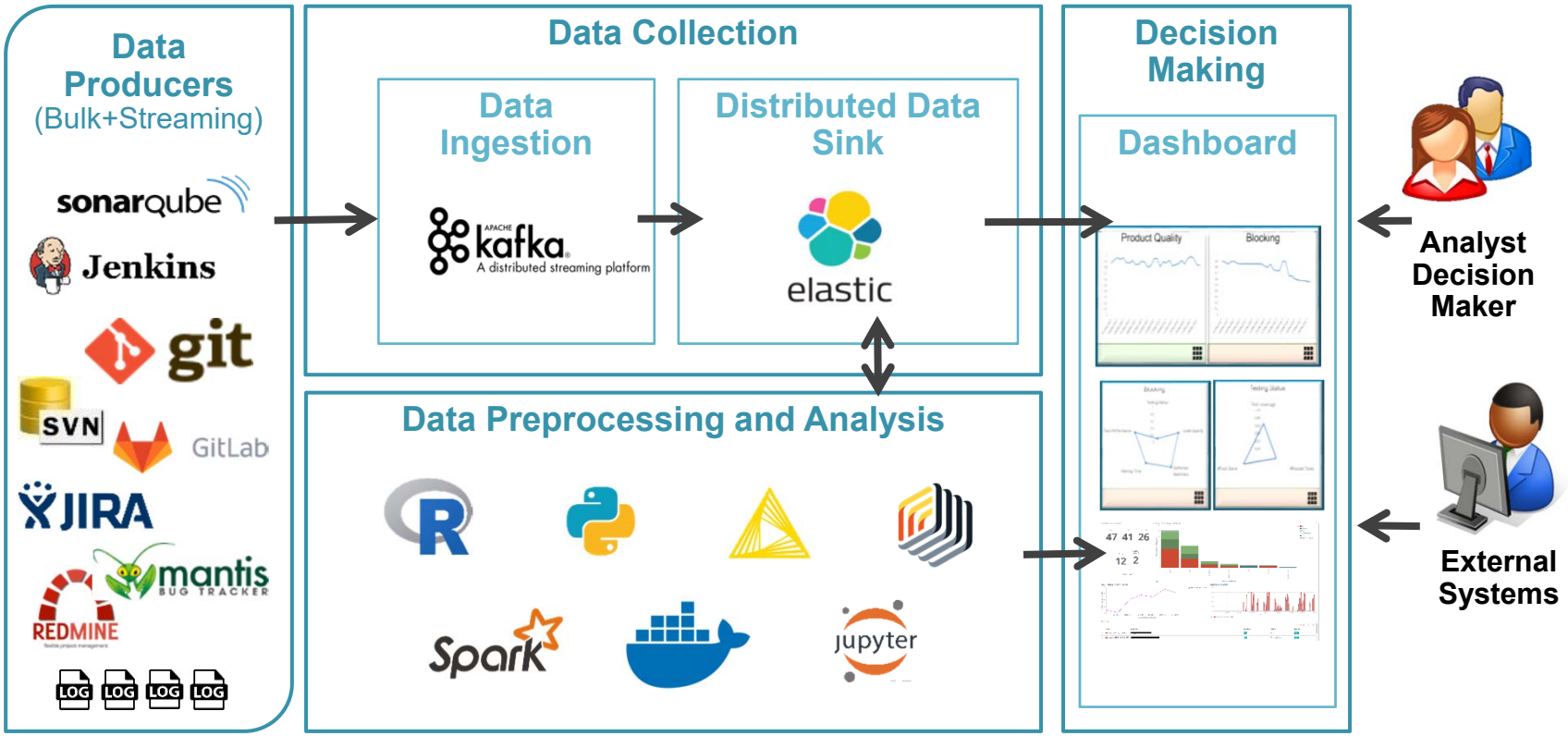
EXAMPLE

3 Choose Process: Data Collection and Analysis: Example Architecture



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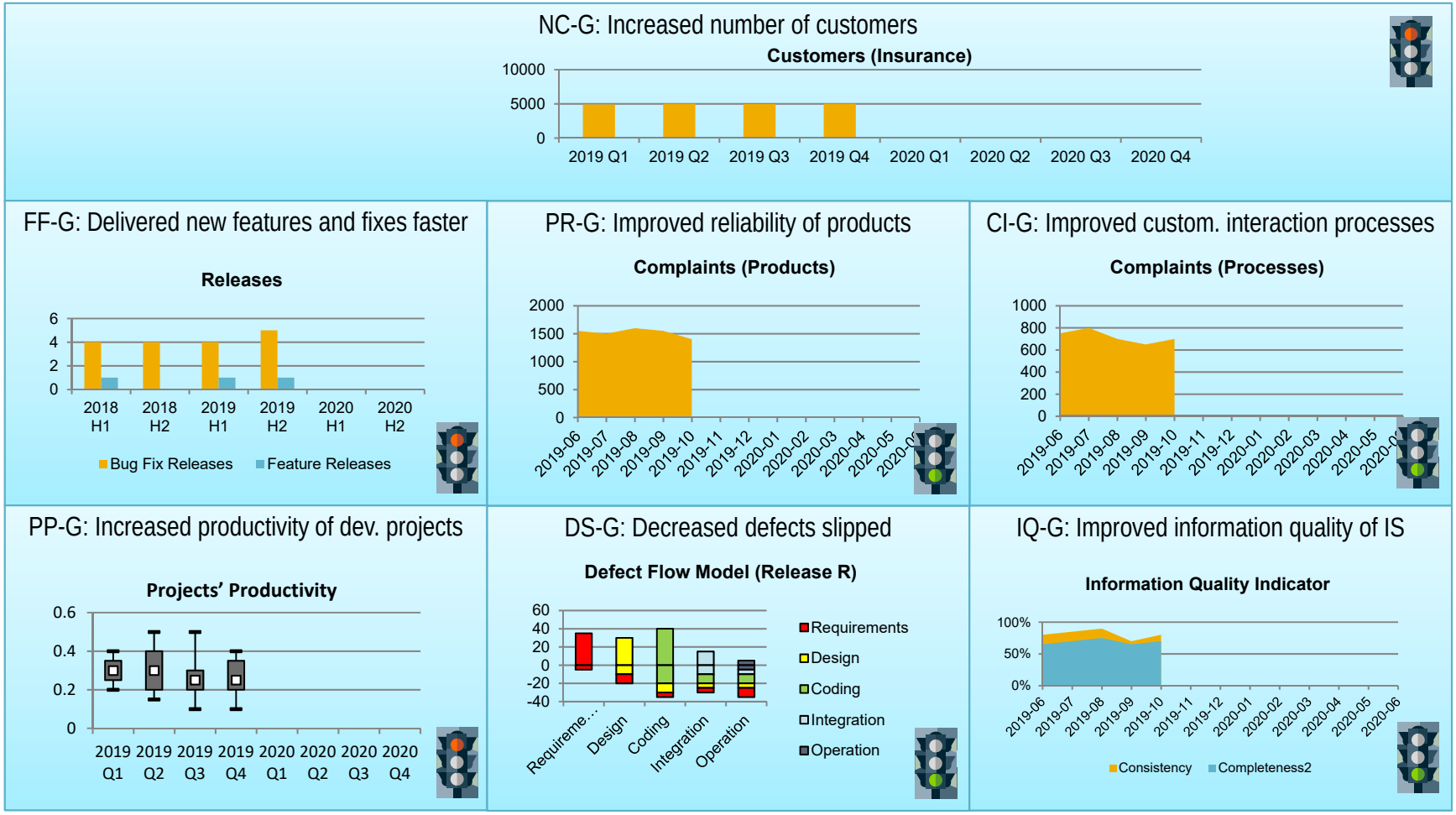
EXAMPLE

3 Choose Process: Data Collection and Analysis: Dashboard Layout



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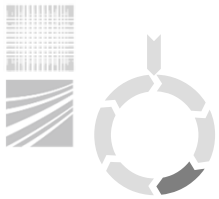

EXAMPLE

3 Choose Process: Data Collection and Analysis: Provide Data Collection Training

- Schiller (Company Expert on GQM+Strategies®) conducts training
  - of people that need to provide the data (collection resource)
  - of all stakeholders of the data (Müller, Meyer, Schmidt)

- Training includes
  - Data collection and analysis tools
  - Measurement plan (Who, What, When)
  - Interpreting the GQM+Strategies® grid for decision-making

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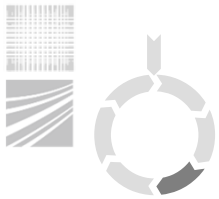

3 Choose Process: Generate Plans for Application of Strategies

- Analyze the impact of strategies
  - Which processes/practices should be newly introduced?
  - Which of existing processes/practices need to be changed?
- Specify appropriate changes
  - Adjust current processes/practices according to defined strategies
  - Validate resulting changes by getting feedback from their users
- Plan changes
  - Assign responsibilities, schedule activities, allocate resources such as budget, personnel, infrastructure, software tools, etc.
- Communicate future changes
  - Inform all affected personnel about the changes
  - Support them in adjusting to the changes, e.g., by conducting information events, writing manuals, conducting trainings, proving a help desk, etc.

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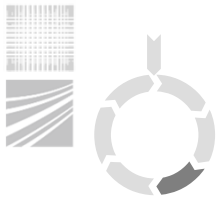

EXAMPLE

3 Choose Process: Generate Plans for Application of Strategies

- The responsible managers of company X take care to carry out the strategies as defined in the grid as part of strategic projects
  - Müller (CEO)
    - Strategy NC-S1: Improve IT products
    - Strategy NC-S2: Improve processes
  - Meyer (Division Manager of Insurance Business Unit)
    - Strategy FF-S: Increase productivity of dev. projects
    - Strategy PR-S: Improve QA activities
    - Strategy CI-S: Provide more complete and consistent information
  - Schmidt (Department Head of Software Group)
    - Strategy PP-S: Introduce agile development
    - Strategy DS-S: Introduce inspections after req. specification
    - Strategy IQ-S: Increase IT support of customer processes

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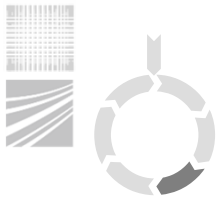

EXAMPLE

3 Choose Process: Plan Strategies (as Part of Strategy Implementation Projects)

- Strategy NC-S1: Improve IT products
  - Strategy FF-S: Increase productivity of dev. projects
    - Strategy PP-S: Introduce agile development
      - Company X evaluates different agile development approaches
      - Company X selects Scrum as most appropriate one (based on existing experience)
  - Strategy PR-S: Improve QA activities
    - Strategy DS-S: Introduce inspections after req. specification
      - Company X evaluates different techniques for inspections
      - Company X selects Checklist-based Reading (CBR) of req. specification as most appropriate one
- Strategy NC-S2: Improve processes
  - Strategy CI-S: Provide more complete and consistent informatio
    - Strategy IQ-S: Increase IT support of customer processes
      - Company X analyzes customer reports regarding greatest issues in information quality
      - Company X decides to develop a new interface for their employees to their CRM system

Strategy Implementation Projects1

Strategy Implementation Projects2

Strategy Implementation Projects3

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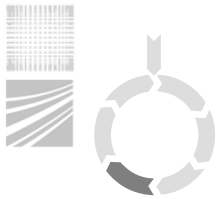

4 Execute: Implement and Monitor Process Changes

- 4.1 Execute Strategies
  - Follow project plan
- 4.2 Collect and Analyze Data
  - Collect measurement data
    - Process & product measures
    - Follow measurement plan
  - Validate measurement data
    - Consistency
    - Completeness
  - Re-assess changed processes
    - Determine effects of improvement efforts
- 4.3 Provide Feedback
  - Perform feedback sessions for communicating and resolving issues

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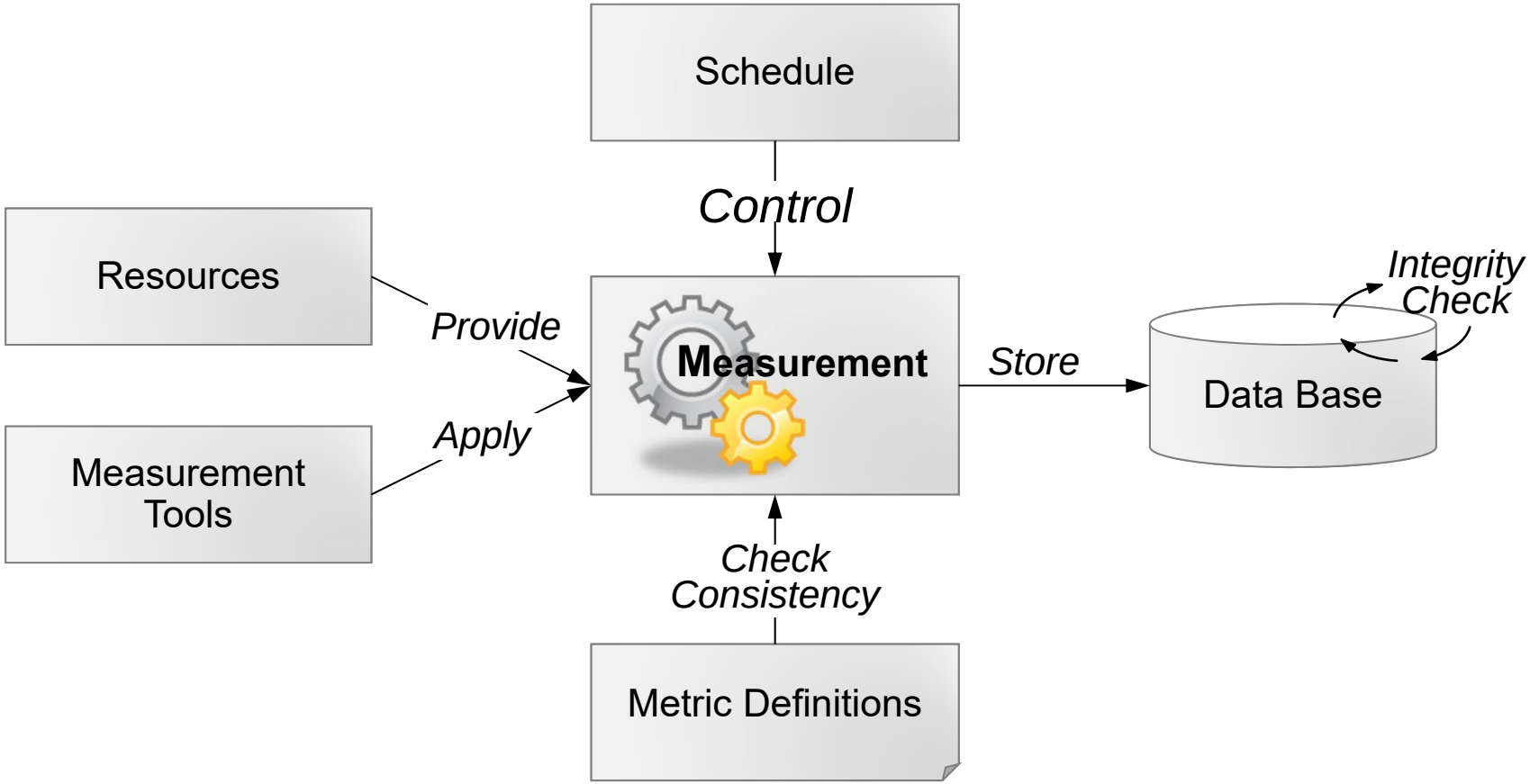
4 Execute: Data Collection and Validation



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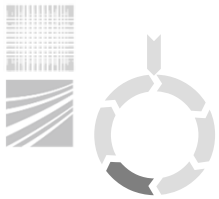

4 Execute: Data Validation Guidelines

- Abnormal (incorrect) data
  - Does data include points that fall out the main body of data?
  - What are causes of outlier data? Should they be adjusted or excluded?
- Internal consistency
  - Are the data points in a meaningful relation to each other?
  - Do data point in a similar direction, or are they seemingly random?
- External consistency
  - Are the data points in a meaningful relation to the external world?
  - Does the data indicate good performance, while indicators from outside the project suggest bad performance?
- Completeness
  - Were all the data collected as planned?
  - Are there “holes” in the collected data points?
  - Can the desired information be extracted from the data available?

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EXAMPLE

4 Execute: Overview of Strategy Implementation Projects and Governance Activities

- Perform governance activities
  - A1: Monitor management goals (Müller, CEO)
  - A2: Monitor insurance business unit goals (Meyer, Unit Head)
  - A3: Monitor software group goals (Schmidt, Group Head)
- Execute strategy implementation projects
  - P1: Introduce Scrum (Bauer, IT Project Manager)
  - P2: Introduce CBR (Wiese, IT Quality Manager)
  - P3: Develop new CRM interface (Baum, IT Project Manager)

- For each strategy implementation project:

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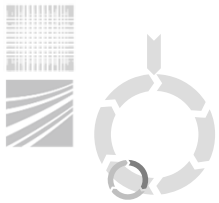

EXAMPLE

4.1 Execute Strategies: Follow Project Plan

- Strategic projects
  - P1: Introduce Scrum
    - Determine development project types that should make use of Scrum
    - Fully customize Scrum according to the needs of organization X
    - Scrum is trained, piloted, and rolled out
  - P2: Introduce CBR
    - CBR is integrated into development process
    - CBR is trained, piloted, and rolled out
  - P3: Develop new CRM interface
    - Design and implement new CRM interface
    - New interface is trained, piloted, and rolled out
- Governance activities
  - Establish regular meetings for analyzing and interpreting data related to organizational goals
  - Decision about leaving project cycle

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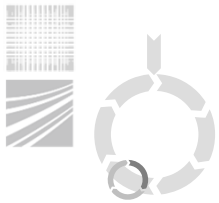

EXAMPLE

4.2 Collect and Analyze Data: Provide Data and Check Quality

- Data collection resources provide data
  - Sales provides customer data from CRM system
  - Product Manager provides data about feature and bug fix releases
  - Service Desk Operators provide data about customer complaints
  - Project Manager provide data regarding the functional size of projects in terms of Function Points and the effort needed (in terms of person hours)
  - Project and Product Manager provide information regarding the Information quality index of the Enterprise IS
  - QA People provide data regarding the defects slipped from the Bug Tracking system
- Schiller (Company Expert on GQM+Strategies®) checks data quality and gives feedback to data collection resources

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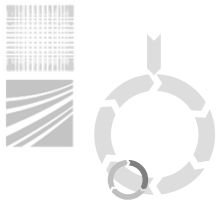

EXAMPLE

4.2 Collect and Analyze Data: Identify Issues

- Based on governance activities
  - A1: Monitor management goals (Müller, CEO)
    - None
  - A2: Monitor insurance business unit goals (Meyer, Unit Head)
    - None
  - A3: Monitor software group goals (Schmidt, Group Head)
    - During data analysis, it was revealed that the baseline data for information quality was wrong
- Based on performance of strategic projects
  - P1: Introduce Scrum (Bauer, IT Project Manager)
    - None
  - P2: Introduce CBR (Wiese, IT Quality Manager)
    - During piloting it was revealed that CBR was not sufficient for decreasing the number of slipped defects from the requirements document
  - P3: Develop new CRM interface (Baum, IT Project Manager)
    - None

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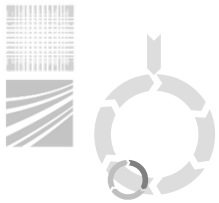

EXAMPLE

4.3 Provide Feedback: Communicate and Resolve Issues

- A3: Monitor software group goals (Schmidt, Group Head)
  - New baseline data is set:
    - Completeness of information is currently at 75%
    - Consistency of information is currently at 75%
  - Schmidt decides that target values can still be obtained
  - Issue was resolved locally, so no changes to the grid needed
- P2: Introduce CBR (Wiese, IT Quality Manager)
  - Wiese talked to Schmidt about actions
  - Schmidt decides to cancel strategic project P2 and setup a new project P4 for introducing an alternative technique called Perspective-based reading
  - New project is planned and set up with Wiese as project lead
  - Issue was resolved locally, so no changes to the grid needed

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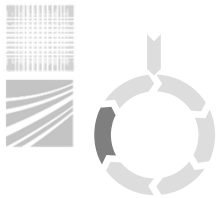

5 Analyze: Prepare and Analyze Data

- Pre-process measurement data
  - Redundancy: data representing the same concept, irrelevant data
  - Incompleteness: missing relevant attributes, missing measurements
  - Inconsistency: data outliers, inconsistent coding of the same measures
- Analyze data and evaluate results (e.g., as part of a workshop)
  - Create descriptive statistics
  - Compute derived measures
  - Visualize base and derived measurements
  - Explain results using defined interpretation models and baselines
- Identify improvement potentials
  - Evaluate achievement of goals and success of strategies
  - Evaluate hypothesized strategy-goal relationships
  - Evaluate applicability of used measures and interpretation models

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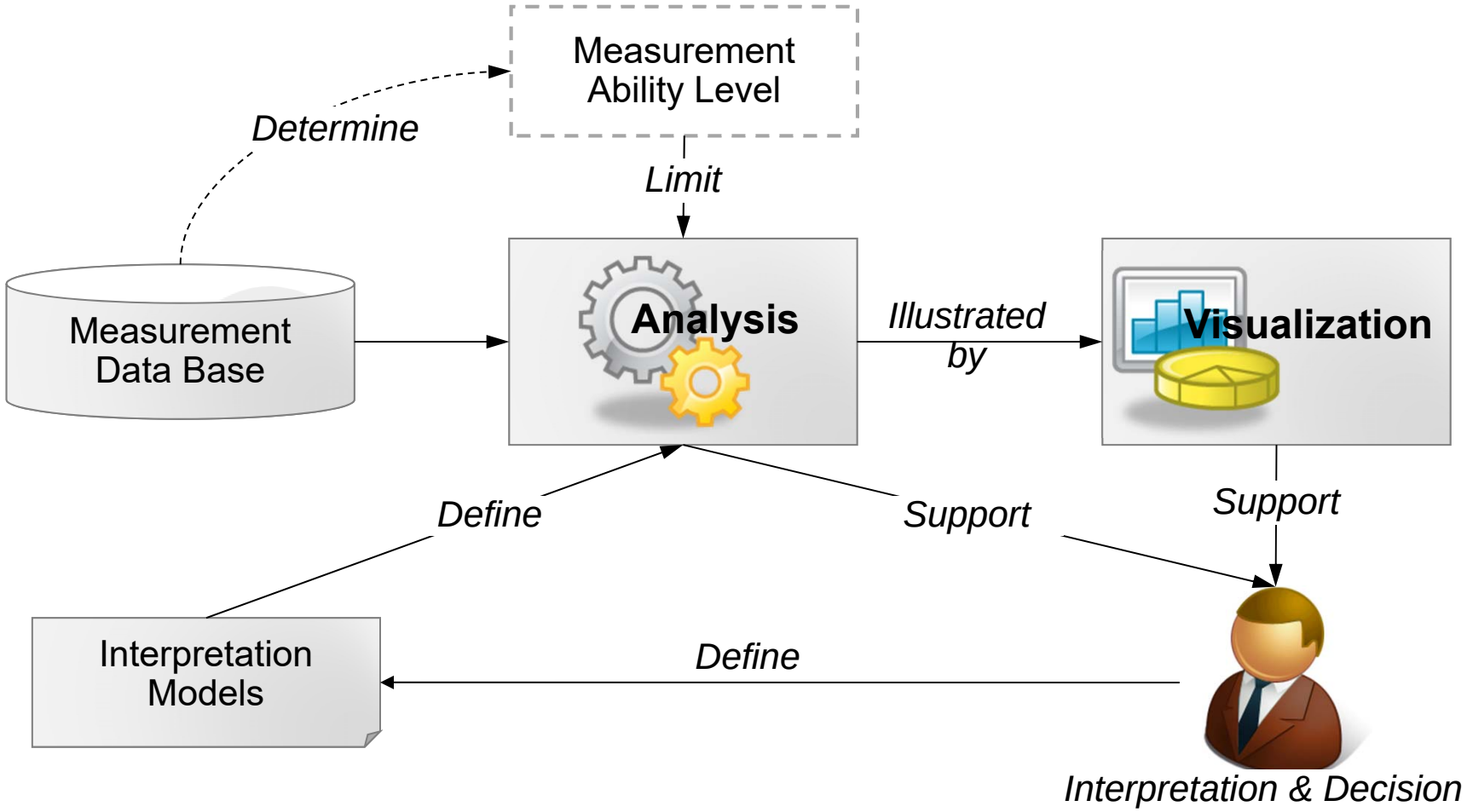
5 Analyze: Data Analysis, Visualization and Interpretation



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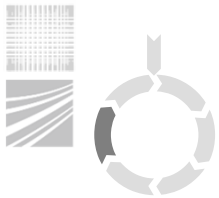
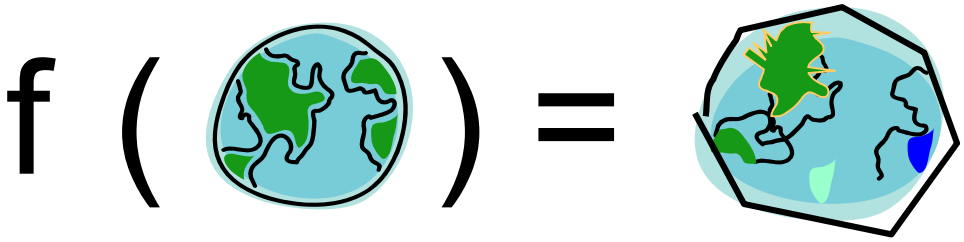


5 Analyze: Interpretation

- All models are wrong but some are useful



  - Modeling the real world is always incomplete
  - There will always be factors not represented in the model
  - Data is not 100% correct or complete

- Goal of interpretation models
  - Provide sufficient accuracy (e.g., explain 70% of the variance in data)
  - Cover the most important effects
  - Identify the most relevant influencing factors while reducing measurement effort

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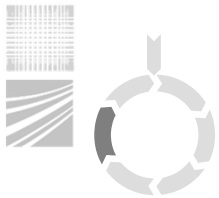

EXAMPLE

5 Analyze: Initiate Strategic Analysis Workshop

- After 6 months, Müller (CEO) decides to reevaluate the overall grid
- For this purpose, the governance activities provide the current data and a joint workshop for analyzing and interpreting the data is performed:
  - A1: Monitor management goals (Müller, CEO)
    - GQM-NC-G: Evaluate increase of number of customers
  - A2: Monitor insurance business unit goals (Meyer, Unit Head)
    - GQM-FF-G: Evaluate faster delivery of new features and fixes
    - GQM-PR-G: Evaluate improvement of reliability of products
    - GQM-CI-G: Evaluate improvement of customer interaction processes
  - A3: Monitor software group goals (Schmidt, Group Head)
    - GQM-PP-G: Evaluate increase of productivity of dev. projects
    - GQM-DS-G: Evaluate decrease of defects slipped
    - GQM-IQ-G: Evaluate improvement of IQ of Enterprise IS

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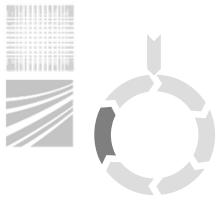
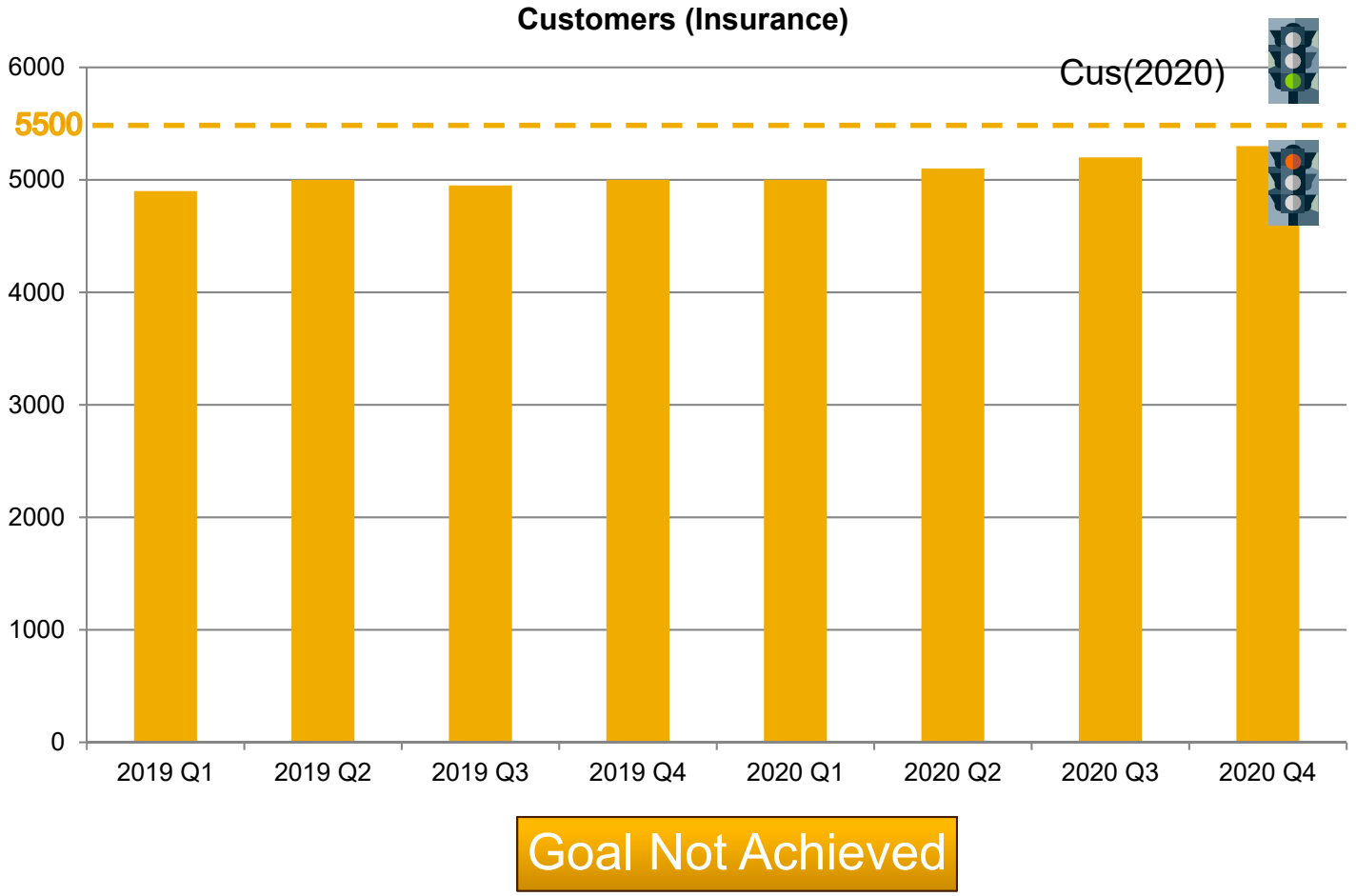


EXAMPLE

5 Analyze: Analyze and Interpret: “GQM-NC-G: Evaluate increase of number of customers”



Goal Not Achieved

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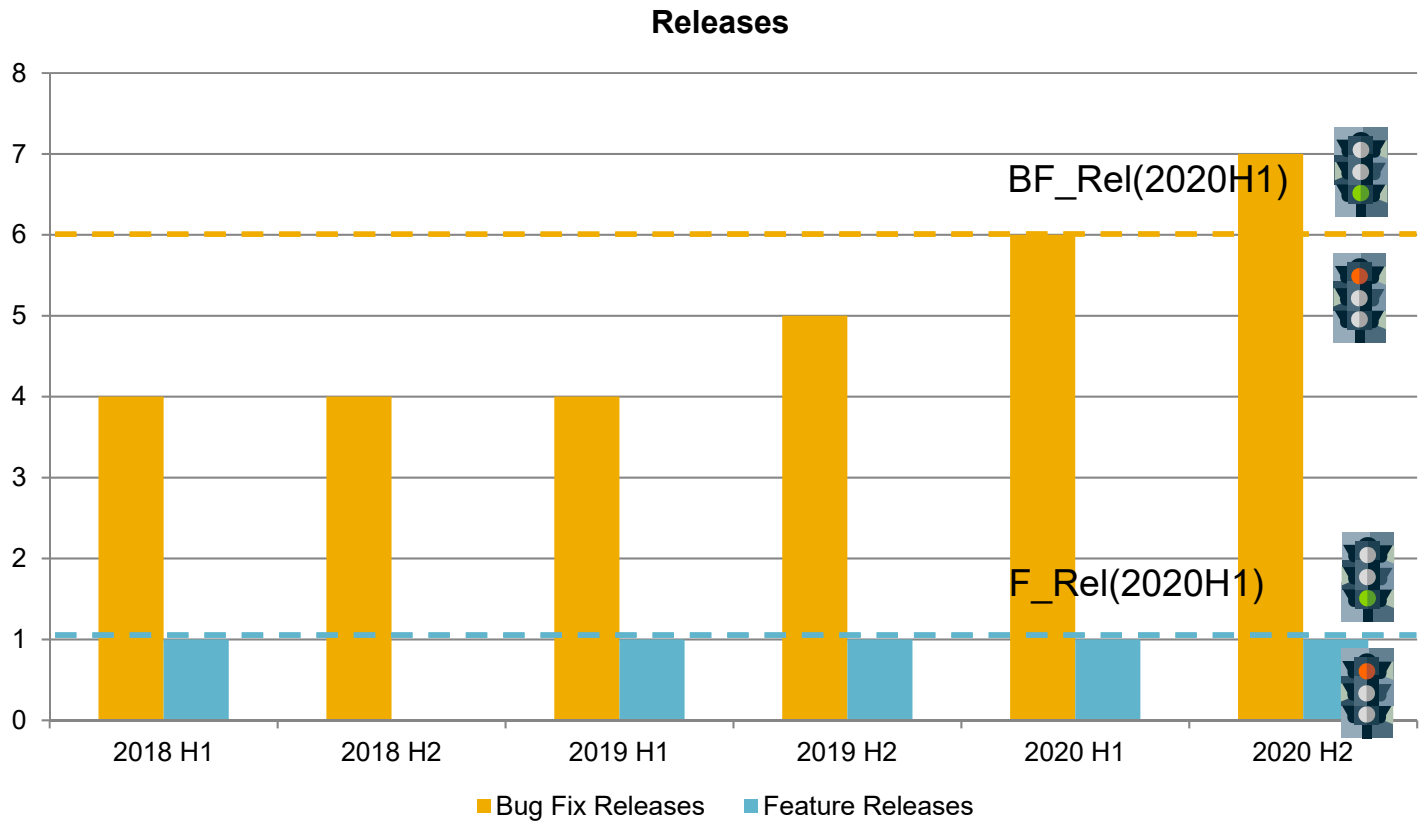
EXAMPLE

5 Analyze: Analyze and Interpret: “GQM-FF-G: Evaluate faster delivery of new features and fixes”



Goal Achieved

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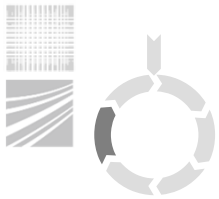
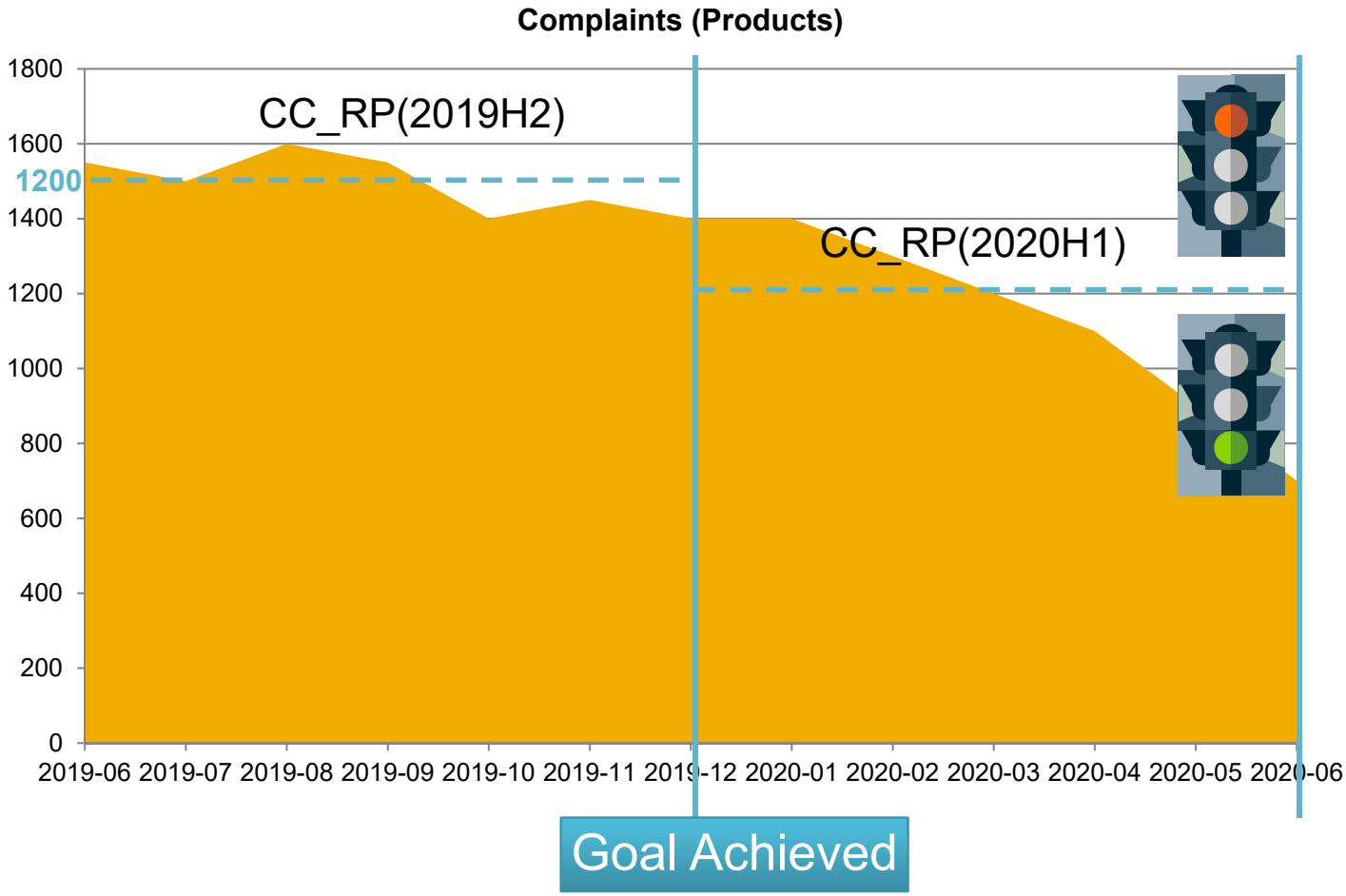


EXAMPLE

5 Analyze: Analyze and Interpret: “GQM-PR-G: Evaluate improvement of reliability of products”



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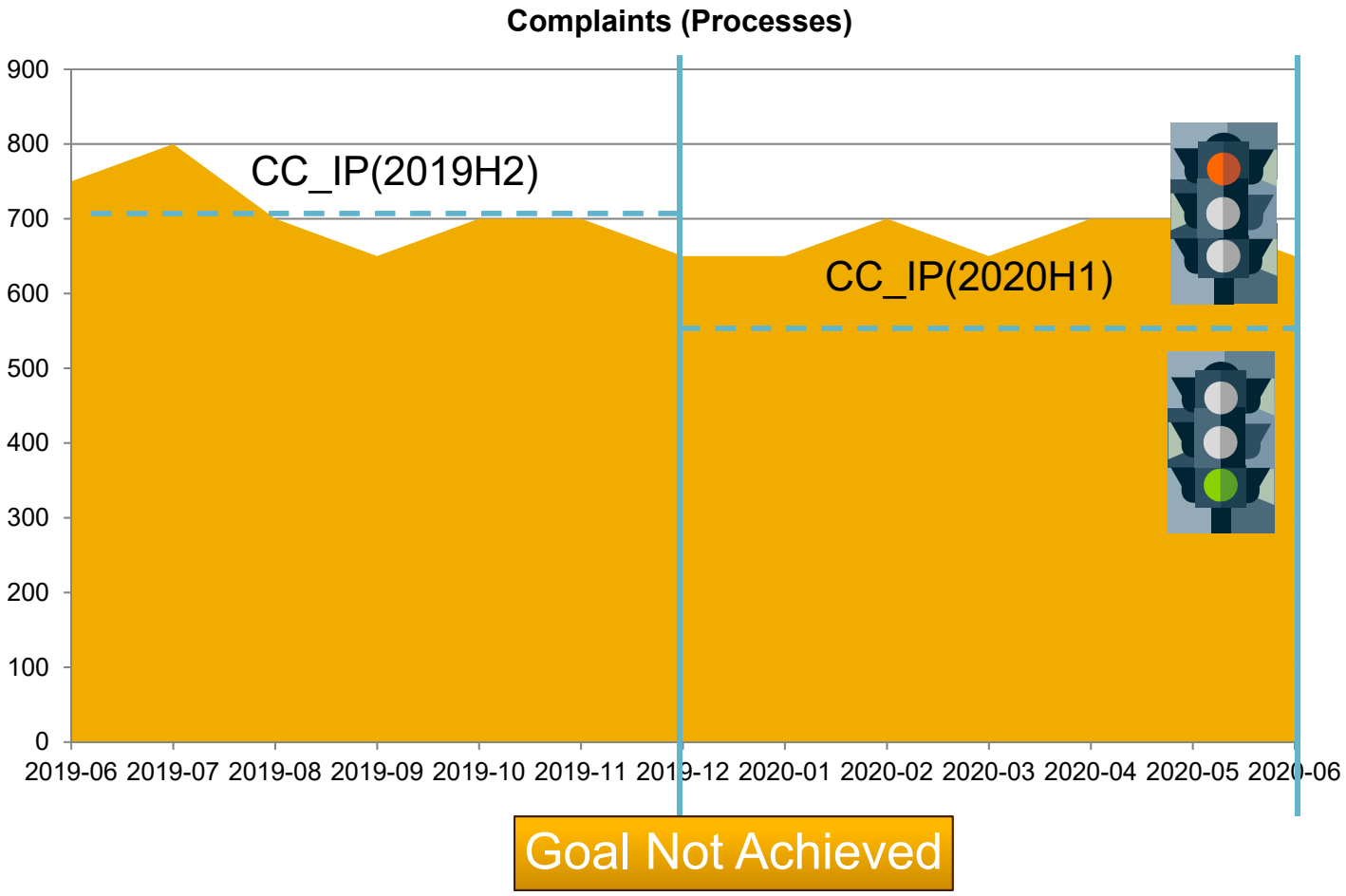
EXAMPLE

5 Analyze: Analyze and Interpret: “GQM-CI-G: Evaluate improvement of customer interaction processes”



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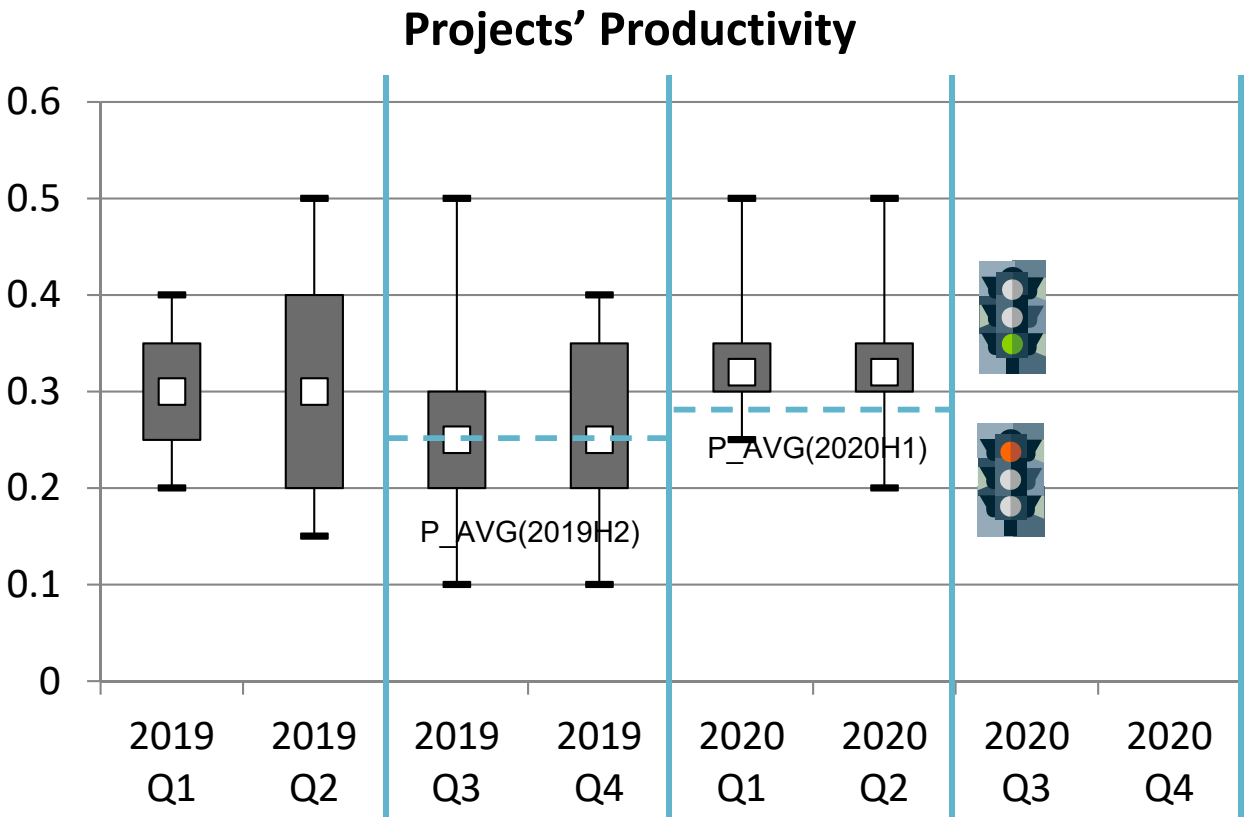
EXAMPLE

5 Analyze: Analyze and Interpret: “GQM-PP-G: Evaluate increase of productivity of dev. projects”



Goal Achieved

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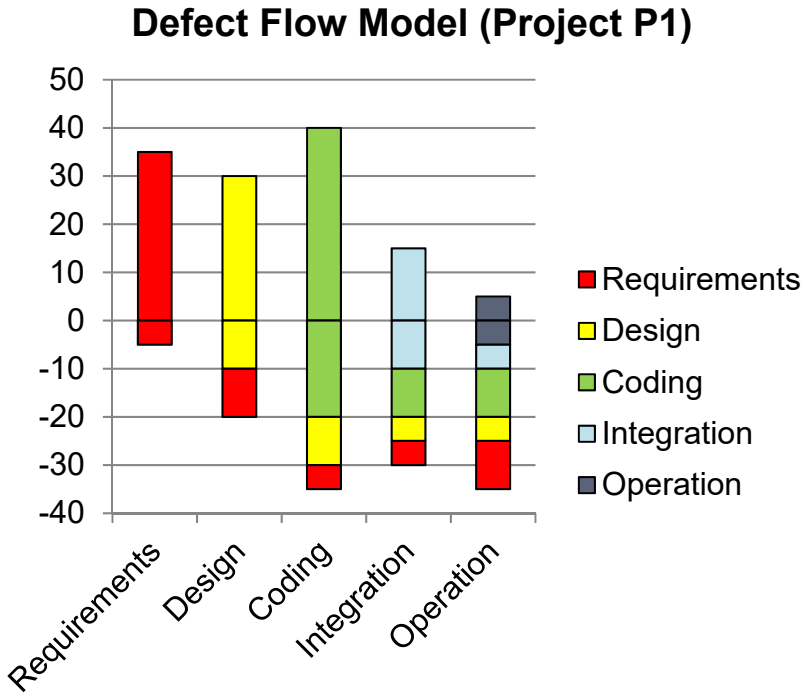
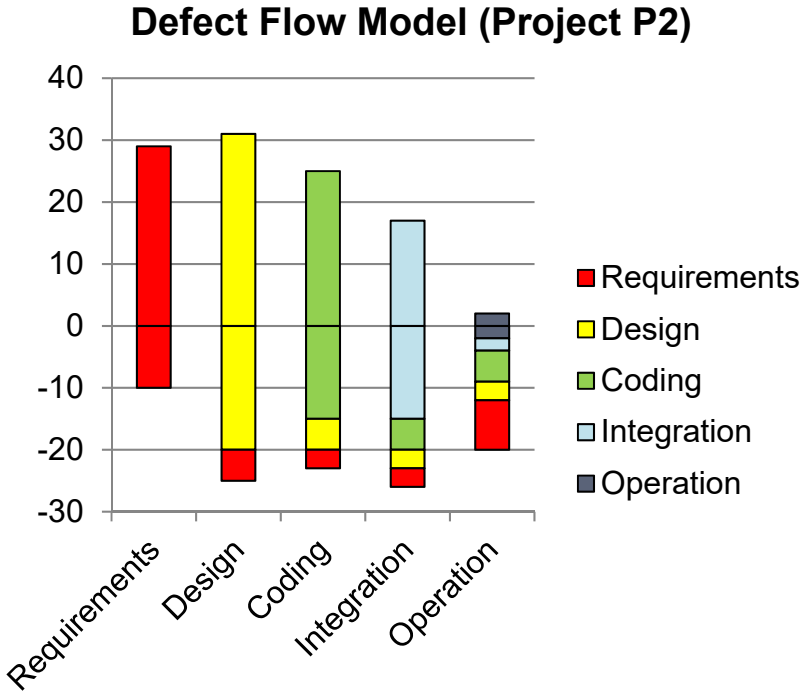
EXAMPLE

5 Analyze: Analyze and Interpret: “GQM-DS-G: Evaluate decrease of defects slipped”



DSR	86%	67%	50%	33%

DSR_AVG = 59%



DSR	66%	35%	40%	12%

DSR_AVG = 38%

DSR_AVG(2019H2) = 60%

DSR_AVG(2020H1) = 40%

Goal Achieved

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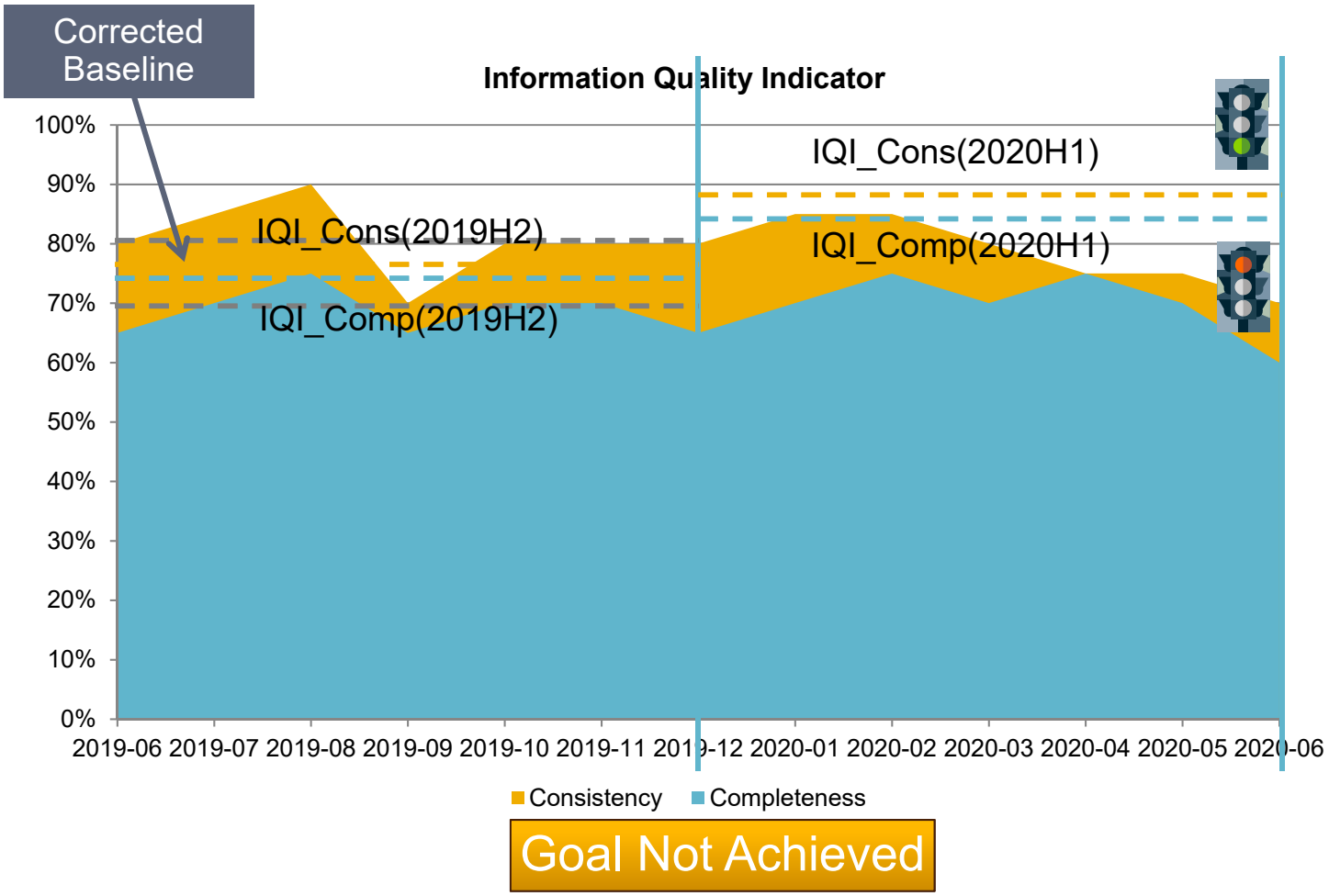
EXAMPLE

5 Analyze: Analyze and Interpret: “GQM-IQ-G: Evaluate improvement of IQ of Enterprise IS”



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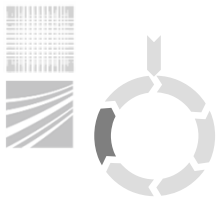
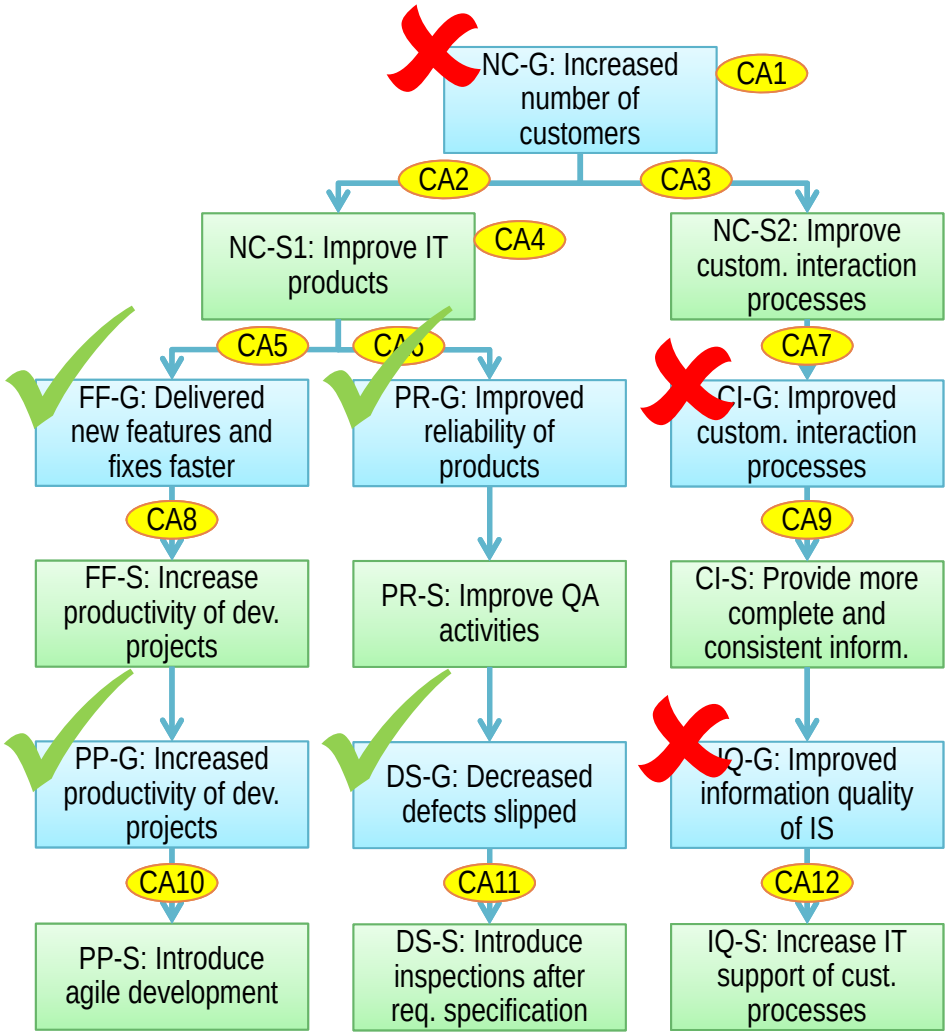


5 Analyze: Review Results and Interpretation Models



- Observation
  - Information quality (IQ) could not be improved significantly
  - Customers keep complaining about IQ
  - Number of customers increased (positive trend), but not to sufficiently
- Potential interpretation
  - (I1) CA3, CA7, CA 9, or CA12 are wrong
  - (I2) The goals have been too ambitious
  - (I3) The strategies were not sufficient

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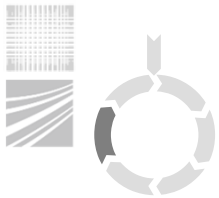

EXAMPLE

5 Analyze: Check Interpretations

- Interpretation I1: CA3, CA7, CA 9, or CA12 are wrong
  - Assumption CA3: For getting more customers in the insurance area, the quality of the customer interaction processes has to be improved. ⇒ Checked and found TRUE
  - Context CA7: Customers complain about many issues related to the customer interaction process. ⇒ Checked and found TRUE
  - Context CA9: Customers complain about inconsistent and incomplete information during their interaction with company X. ⇒ Checked and found TRUE
  - Context CA12: Not all services of X are completely IT supported; some have to be provided manually, which decreases information quality. ⇒ Checked and found TRUE
- Interpretation I2: The goals have been too ambitious
  - There is a positive trend on the customer numbers in the insurance area
  - There was not enough time to implement IT support for dealing with all issues related to information quality
  - The timeframes of the goals have to be revised
- Interpretation I3: The strategies were not sufficient
  - An additional strategy is needed until IT support is in place

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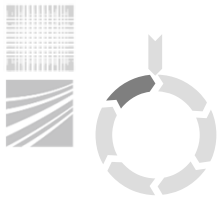

6 Package: Package and Improve

- Synthesize and communicate results
  - Prepare results of GQM⁺Strategies application
  - Communicate results to involved parties
- Perform a cost-benefit analysis
  - Analyze cost and benefits of GQM⁺Strategies measurement program
  - Compare benefits and results to derive improvement suggestions
  - Perform feedback sessions
- Store relevant outcomes
  - GQM⁺Strategies Grid
  - Measurement program
  - Measurement data and analysis results
  - Improvement suggestions

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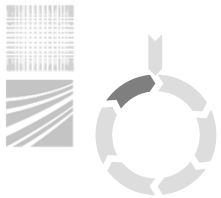

EXAMPLE

6 Package: Improve GQM+Strategies Grid

- Synthesize and communicate results
  - Company X shares analysis results with all people involved (data collection resources and stakeholders)
  - People give feedback on interpretation
- Perform a cost-benefit analysis
  - Schiller analyzes the overhead cost related to collecting the data
  - Schiller collects feedback for optimizing the data collection process
- Store relevant outcomes
  - (1) The timeframes for goals are reworked to have more time to introduce IT support for improving information quality
  - (2) An additional strategy is introduced for coping with customer complaints regarding information quality in the mean-time: More personnel is assigned to manually check information

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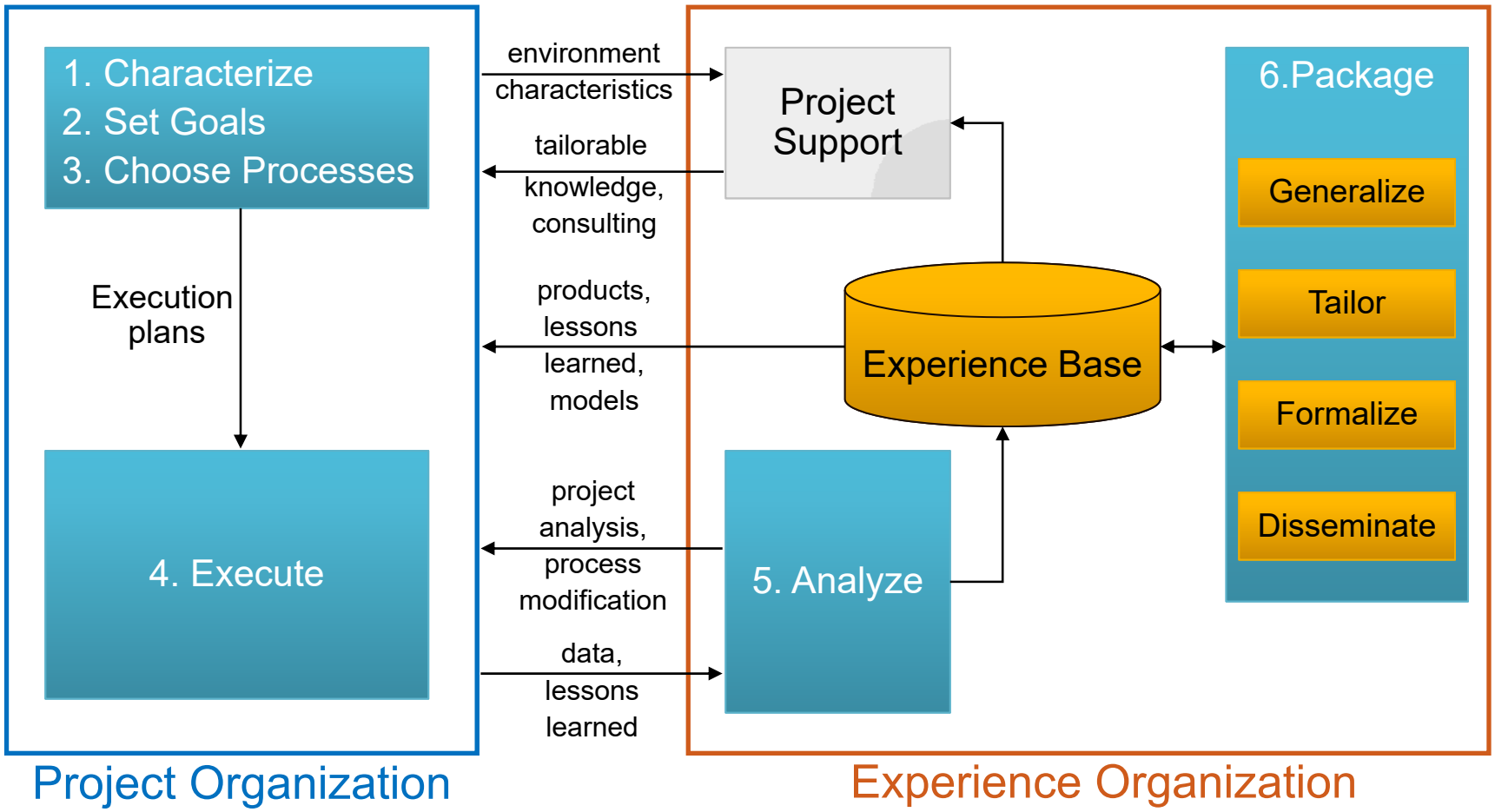
Structure of a Learning Organization



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Was sollten Sie mitnehmen

- Sie kennen…
  - Struktur lernender Organisation
- Sie können erklären…
  - Ziel und Ablauf/Aktivitäten (grob) jeder Phase des GQM$^+$Strategies Zyklus, inkl. drei Unterphasen der „Execute“ Phase
  - Welche Aspekte muss man bei der Erstellung eines Messplanes für jede Metrik betrachten: Definition, Skala, Daten Erfassung und Analyse (wer, was, wann, wie), …
  - Beispielaspekte der Datenqualität (Validation): Korrektheit, Konsistenz (intern/extern), Vollständigkeit, Redundanz, …
    - Das Thema wird noch in der kommenden „Daten Aufbereitung“ Vorlesung vertieft

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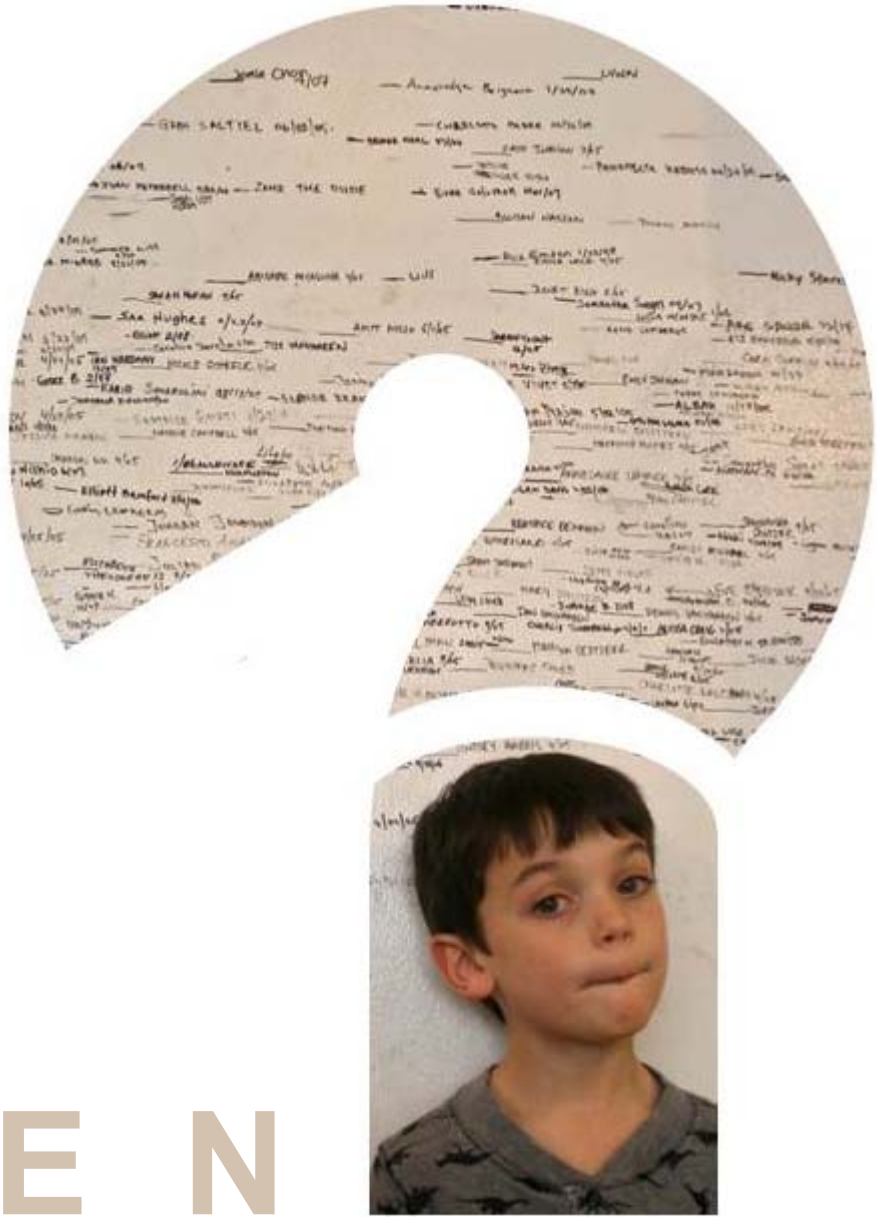

F R A G E N

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Exercise & Discussion

- Problem Description
  - Continue exercise from the previous lecture
    - The insurance company from the example wants to cut costs
    - Software department should reduce costs of developing the insurance software
- Your tasks
  - Complete defining strategies, goals (incl. quantification and interpretation), if not finished yet
  - Define operational-level strategies and goals, if necessary
  - Create measurement plan
    - *Who*: assign responsibilities
    - *What*: provide metrics definitions to responsible persons
    - *When*: schedule measurement activities within the project
    - *How*: specify measurement instruments (data collection and storage, etc.)
  - Propose data collection and analysis approach and tools
    - Measurement, storage, and validation
    - Analysis and visualization

- Group work: **30 min**
- Presentation: **15 min** (5 min per group)
- Discussion

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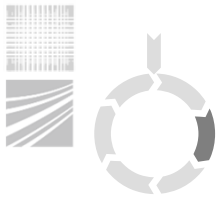

Context

- Company X collects existing assets for the defined scope (organizational units) based on existing documentation and a workshop
- X performs an analysis of potential issues (which will need to be addressed when building the grid later on)

Unit	Goals	Strategies	Data
Insurance Business Unit	Cut costs	Reduce software development costs	Software Group Costs
Insurance Software Group	Reduced cost of software development and maintenance	**Your Task** (previous lecture)	**Your Tasks** (previous lecture)
Software Group: personnel, processes and products/artifacts	**Your Task**	**Your Task**	**Your Tasks**

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