University of Piraeus
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Project KPIs and Dashboards
Research and Implementation in MS Project

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Abstract

This dissertation aims to illuminate the importance of Key Performance Indicators (KPIs) and Dashboards in Project Management and Performance Management in modern organisations' context. In particular, it highlights the association between Project Management, Business Plan of performing organization and Performance management with KPIs as three major pillars of business welfare and elaborate on available tools and options regarding visual representations of project evolution.

To illustrate interrelation in practice, we define in detail a list of the most critical Project Management KPIs and assign them in four distinct dimensions of performance: **Financial Results**, **Process Efficiency, Execution Performance, and Customer Satisfaction & Stakeholder Management.** In order to verify and demonstrate value, we adjust these concepts as business intelligence tools.

The actual result from this approach is the design and implementation in MS Project and MS Excel of a KPI-based performance model. This interactive model integrates business activities horizontally and vertically, calculates and displays project performance in the form of interrelated dashboards.

The implemented model, offers a base of validation and elaboration regarding benefits for an organization to adopt and exploit such an approach in project management and business administration in general.

1. Introduction: Purpose and Scope

Projects are multidimensional and composite elements of business endeavor. Their importance to business wealth and contribution to business value is significant. In order to enhance chances for success, it is very important to set specific goals, align all efforts towards them and during the course of the project, ensure that all related actions are evolving smoothly according to the business plan.

This dissertation focuses on this specific area: elaborates on available tools and options regarding visual representations of project evolution. We conceptually assemble these elements in the form of Key Performance Indexes (KPIs) and dashboards, as vital objects of business intelligence that facilitate proper administration through monitoring, communication of information and justified decision making, when corrective actions are required.

Under this perspective, we initially explain the usefulness of such a model and how dashboards are a vital part of project management. To justify this approach, the concept of KPIs is analysed together with the generic steps that precede design and implementation of project management dashboards.

A collection of twenty-nine KPIs is employed in order to depict various aspects of significance of project management and thereafter presented in a structured manner to explicate usefulness and contribution. We introduce a common pattern of KPI definition and based on this, we construct a reference guide for each KPI that will determine forthcoming actions.

Then, we proceed with the implementation in order to illustrate a practical approach on how we can use these conceptual tools in project management context. Using MS Project and MS Excel, we adopt a scenario of a small project to serve as a realistic example on actually using our KPIs and exploiting their power with real values. As a result, a number of actual dashboards hosting KPIs representations are presented in order to conclude all aforementioned analysis. Finally, we elaborate on results and point out reasonable conclusions.

2. Data Analysis

2.1 Why Data Analysis is important in Project Management

Projects do not exist in isolation. They are usually vital components of broader structures, programs, which accommodate related projects enabling more effective administration. Likewise, programs reside under the umbrella of project portfolios, which are the carriers of business strategy. Apart from systematic guidance and oversight, projects encapsulate goals and objectives inherited from a broader framework. The common ground that all these structures share, is value generation for the customer, the business and the organization.

Under this perspective, we should consider how one project might contribute in maximizing value generation. And then, to define which are the constituent parts that justify value and establish ways to constantly monitor and ensure that projects indeed bring positive results into overall strategy and business plan execution.

Certainly, value is associated with financial benefits for the organization, revenue generation and profits. These are all important objectives to seek. However, there are additional value factors of equal importance, such as stakeholder satisfaction, business process improvement, operations improvement, HR development and business knowledge. All these aspects are often interrelated with visible interdependencies, but also in many cases with not so obvious inter-dependences.

In order to define, capture and measure different aspects of value, we employ the concept of Key Performance Indicator (KPI). KPIs represent a set of measures focusing on these aspects by linking broader objectives with project activities and outcomes. They provide us with an insight of the current state and at the same time a reference of where our performance should ideally reside, or simply how close or far we stand from an ultimate target.

In that sense, KPIs become very important Project Management tools and Business Intelligence enablers. In order to reflect a complete spectrum of value, we need to specify various dimensions of objectives, along with the corresponding indexes. At the same time, all relevant input data should be collected from various sources and analysed accordingly. In that way, plain input data is transformed into meaningful information enabling performance evaluation and decision making.

Defining and adopting a specific set of KPIs should be a joint effort between project administration and strategic management. During this process, we may also consider all

different administration layers (from divisions to employees) in order to integrate people, processes and project phases.

We may also regard KPIs under the perspective of project governance. In order to facilitate oversight and proper administration, KPIs are assembled and implemented as visual structures, commonly referred as dashboards. Dashboards are concentrated, targeted visual reports that provide information about performance of projects against their objectives (cost, deliverables, schedule, customer satisfaction, etc). They are intended for board of directors meetings, higher management, stakeholders, specialists and in general all those who may potentially make decisions regarding project progress.

2.2 Characteristics of KPIs

Key Performance Indicators (KPIs) are measurable values demonstrating how effectively organisations achieve key business objectives. There are numerous aspects, factors and activities of business interest that can be measured. However, we are seeking for those measurements which are useful, effective and at the same time manageable**.** This effort should be an open, inclusive and iterative process that involves feedback from departments, analysts and managers.

KPIs should be comprehensible and straightforward in measurement. Many of them, may require to be monitored frequently, so they are expected to provide concrete results in time.

As mentioned before, KPIs should be in line with the organisation's business plan and strategy, in the same way as projects do. A safe way to verify this required relevance is thinking of what kind of business views (goals, concerns, processes, value creation) do KPIs address.

KPIs require administration. Someone, whether an individual or a unit, should be responsible for maintaining them functional, feeding them systematically with appropriate input and being able to interpret measurements, variances and trends at all times. In other words, someone should be responsible and accountable for a group of KPIs.

Trend indication is another important characteristic of KPIs. Ideally, they should provide a precise view of the present situation, disclose performance snapshots from the past status points and –based on past and present performance- reveal an insight of what the forthcoming values might be.

As previously stated, KPIs should enable and urge on administrative or strategic decisions. Therefore, they should be very clear in subject and self - descriptive of included elements and

parameters. When further analysis and justification is required, they should also provide links to actual data and reference to a KPI's accountable owner. In the same sense, KPIs' definition should include thresholds of acceptable performance as well as the specific targets that we desire to reach during the project. When these thresholds are violated or performance leans towards limits, all implicated parties should be notified by triggering appropriate notifications for proactive or reactive response to undesirable events. Finally, KPIs should inherently imply a reasonable suggestion of what should we do to alleviate undesirable outcomes predicted by them.

2.3 Benefits from using KPIs

KPI usage enables the gradual construction of a valuable knowledge base that allows historical analysis, trend recording and forecasting. Lessons learned from past projects performance can highlight strengths and weaknesses, improve project and risk management and prevent from making the same mistakes.

They help in reducing ambiguity against controversial or clouded matters, so that in the end everyone shares a common perspective and invoke the same point of reference. KPIs offer a common perception of current state, opportunities, dangers and insight of the forthcoming project future. In other words, they facilitate communication between stakeholders, by using a common language.

Actual results in comparison with expected performance targets, highlight how manageable is this expectation distance. There may be cases where prompt alert of unexpected results is totally controllable, or others where it is less detrimental to end a project prematurely than continuing with a poor performance, impossible to overturn. In both situations, KPI design should identify deviations from acceptable result ranges and have triggers for timely action to rectify these deviations.

KPIs are tools to justify and demonstrate value acquisition. They contribute in understanding the present situation of a Project (and organization) and through achieving better KPI results, enable the transition to an improved level. At a larger extent, they enable internal and external benchmarking for project management and the organization, among peers in the industry.

2.4 Dashboards

Data dashboards are information management platforms that host mainly key performance indicators along with other relevant information, aiming to reflect one units' state, where unit can vary from a project, a process, a department or the whole organization. Apart from the front

level seen by the end viewer, there is a lot of functionality and reasoning in the background. So, comprehensive front visual elements like charts and gauges, are linked to various sources of feeding data, like files, databases or an erp system. In that way, dashboards allow for a high level unified view of business activity. They enable awareness and simultaneously provide substance for fast analysis, communication and decision taking.

Performance dashboards provide convenient views of a (project's) organization's KPIs. They will qualitatively and quantitatively indicate, which KPIs are close or exceeding targets and which are exceeding predetermined thresholds. For the later cases, if a KPI trend keeps declining, dashboards may generate a visual alert that will signify the need for remediation. Then, it is quite possible to analyze results, identify the source of poor performance and decide on the most appropriate solution in context. For that reason, dashboard design should be constrained to results depiction, but encourage and suggest corrective action.

Also, dashboards should include relevant and uniform groups of KPIs, allowing for clear decisions on a specific performance dimension

Effective dashboard design is a major subject on its own. Constituting elements' positioning, colors used, fonts and functionality options are key aspects to upscale interaction with the audience, direct their attention and highlight the most important subjects.

KPIs and dashboards usefulness is fully exploited by advanced information technologies. New powerful applications, cloud infrastructures and fast networks, enable better design and functionality, closer communication of distributed parties, facilitation of virtual teams, collaboration and real time content updates, so that anyone from any place can be involved and remain in tune with their associates.

2.5 The Nature of Data

The route of data from primitive sources to dashboards follow three basic layers. In the first one (Source System Layer) raw data are collected manually or electronically. That includes ERP systems, applications, databases, interviews, forms, etc. In practice, manual data collection usually takes more time and money than electronic data collection, therefore manual measurements are kept to a minimum or even not used at all. However, this is not always feasible or acceptable, as in many cases data can only be measured or have to be measured manually (for instance, data collection from the field, or customer related data that require personal communication). In either form, this will be the input for our KPIs, therefore it is

essential that we possess all relevant information, be certain that data are correct and collected at the proper time.

In the second layer (Data Warehouse), initial data are extracted, transformed and loaded into data warehouse shells, normalized structures of data storage. Data warehouse also act as older data repository. This is where KPIs are calculated, as well as KPI definitions and thresholds are maintained. Here, the organization should take into serious account matters like data protection, security, integrity and authorized access, because any violation of this type will have a direct impact on quality and validity of output.

Finally, there is Business Intelligence (Reporting and Communication) layer. There, data is shared and communicated is refined in multiple dimensions. This variation has to do with customization needs according to recipients of the data, hierarchy in organization, classification of information, authority, degree of interest, etc. Selection of proper KPIs, visualization means and dashboard design are of outmost importance here. In any case, Business Intelligence layer interactively displays KPIs within dashboards framework and literally transforms initial data to meaningful information.

Obviously, there is a logical relevance and sequential dependency between there three levels. State analysis, insights, interpretations and final conclusions drawn in the last stage, depend heavily on the quality of raw data, reliability of calculations and data transformation methods established in previous stages. PMO has the responsibility to maintain the integrity and efficiency of this chain of information.

Compliance and consistency also play a significant role here. Detailed and robust methodology, stability and well trained personnel may eliminate variances, biases, errors and doubts. Seeing this from a broader perspective, ultimately all these iterative functional steps across three layers must be integrated into the project or business processes.

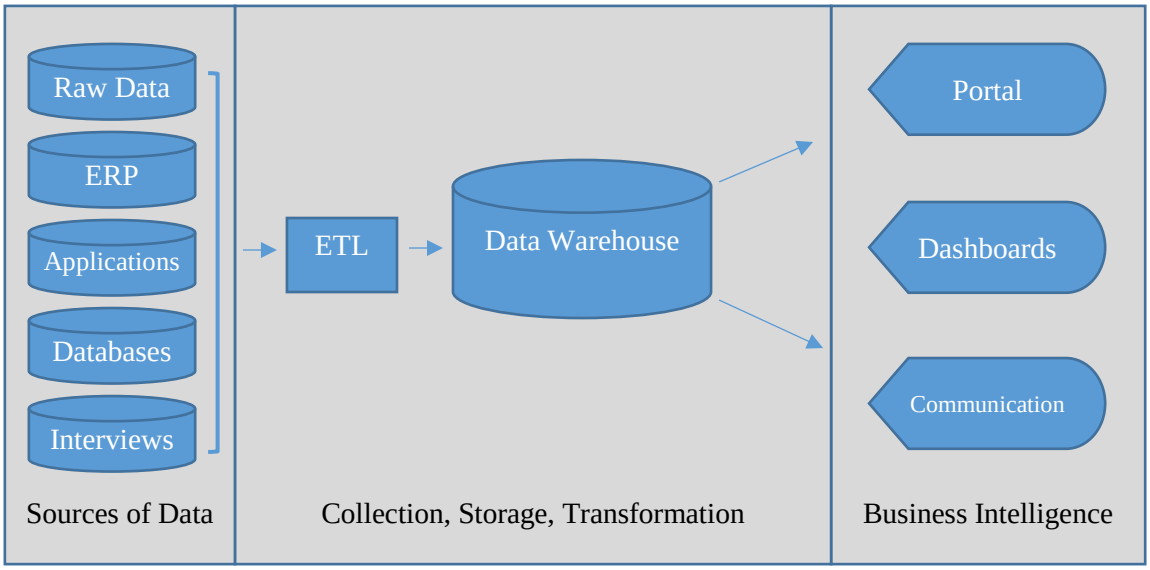


Figure 1 *Three-layered flow from Data to Information*

3. KPIs: Categorisation and Specification

3.1 Dimensions of performance

In order to effectively present our KPI set, we group them according to basic objectives that constitute project (and business) success. Initially, we define our KPIs by mapping them into four key dimensions: **Financial Results**, **Process Efficiency, Execution Performance, and Customer Satisfaction & Stakeholder Management**. Of course, there are organizations and projects that may develop interest for additional, more specific dimensions, however these four areas are always present and significant.

While designing one enterprise's project management related dashboards, we will use this segmentation as a leading guide. According to this approach, each dimension can be decomposed into its associated KPIs within the borders of a single dashboard. By showing side by side sophisticated yet simple and clear visualisations of similar in subject perspectives, one may definitely comprehend and receive clear insights on how well a specific project contributes towards a concrete business objective. It is beneficial not only to focus on a single area, but maintain a balanced dispersion of KPIs across these four dimensions to ensure that all objectives are properly managed.

3.1.1 Financial Results

This area examines whether project outcomes meet business expectations in monetary terms. In this dimension, a project is primarily an investment that should bring back adequate profits to satisfy stakeholders. Financial KPIs are usually considered the most important, therefore they attract the most interest and concern from shareholders.

Financial Results KPIs include:

- Gross Profit Margin
- Return On Investment
- Project Outsourcing Index (% of scope)
- Project Outsourcing Index (% of budget)
- Cost of Project Management
- (Organization) Resources planned on project
- Procurement Operating Cost and Managed Spend.

3.1.2 Execution Performance

In this dimension, KPIs refer mainly in how consistently a project evolves against constraints of scope, time, cost, quality, resources, and risk as approved. It is a means of reassuring stakeholders that the project remains on budget, on schedule and within agreed specifications.

Execution Performance KPIs include:

- Schedule Performance Index
- Cost Performance Index
- To Complete Performance Index
- Tasks Completed
- Delayed Tasks
- Missed Deadlines
- Missed Milestones
- Critical tasks in schedule

3.1.3 Process Efficiency

In this dimension, we concentrate on internal processes within an organisation's boundaries and whether teams are efficient in meeting performance expectations. Project management specific processes are also subject of examination. So, here we measure up to which extend processes are improved or hindered by project execution.

Process Efficiency KPIs include:

- HR Utilization in Project
- Resource Availability Index
- Change Requests (number, frequency)
- Actual Work Hours vs Planed
- Purchasing Efficiency
- Upsell
- Suppliers' Fault/Inconsistency Index
- Supplier Dispersion Index
- Failures over Activity Category Index

3.1.4 Customer Satisfaction & Stakeholder Management

In this dimension, we focus on maintaining customer satisfaction, responding to stakeholder expectations and evaluate the whole interaction (relationship) with stakeholders. Support for

the project, engagement, commitment, participation in activities and events and stakeholders' perception of value delivered, are some of the key factors measured here.

Customer Satisfaction & Stakeholder Management KPIs include:

- Customer Satisfaction Index
- Key Stakeholder Engagement Index
- Contribution to Society, Environmental Preservation
- Energy Efficiency

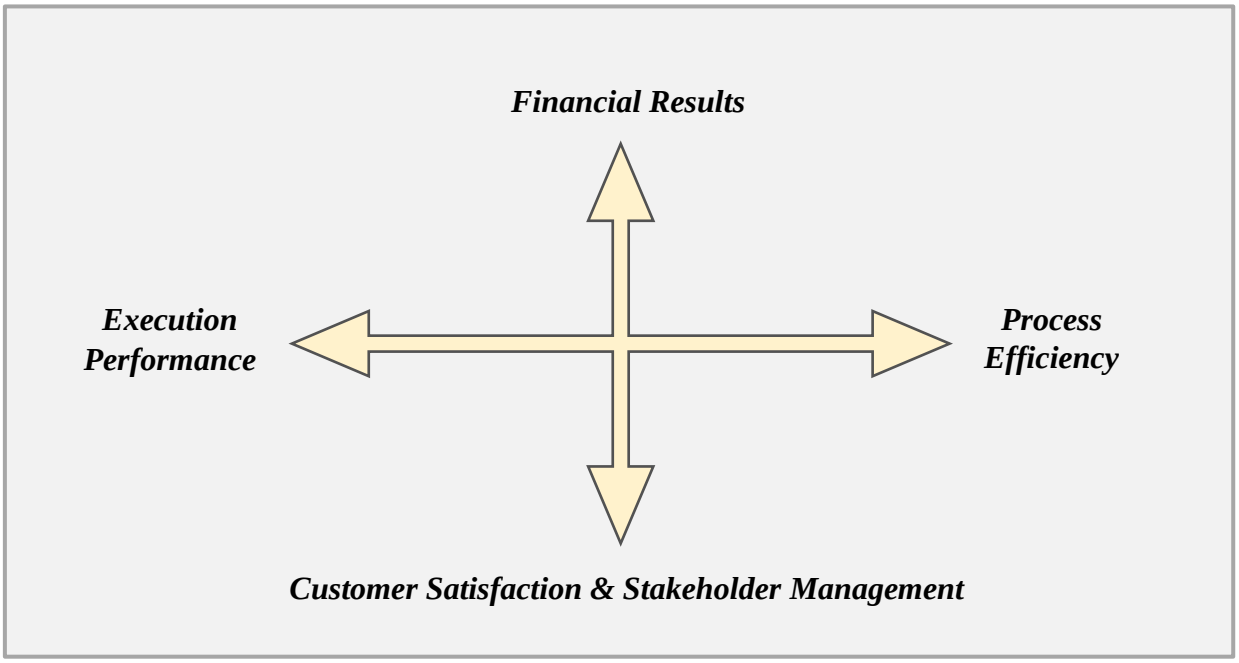


Figure 2 *Dimensions of Project performance*

3.2 Earned Value Analysis

The first set of KPIs fall under the umbrella of Earned Value Analysis (EVA), a concept that is based in general on measuring actual results against the baseline of a project. EVA is an established and widely accepted approach based on quantitatively calculating progress of authorized work and the budget for that work in order to monitor performance and predict the final required cost and time necessary to finish the project. Earned Value provides an insight on what has actually been earned to date based on what activities have been completed and what was originally planned to be spend (from the baseline) to complete those activities.

In order to use Earned Value Analysis, a detailed project schedule must be baselined. Baseline implies a series of essential preceding actions (Planning Phase), which include detailed activities with duration and effort estimates, resources assigned and allocated to each activity, costs associated with them and activity sequencing and interdependencies.

Below, we cite a few Earned Value Analysis terms, important not only for KPIs definition but for project management too.

Earned Value (EV) Also defined as Budgeted Cost of Work Performed, is value of completed work calculated by multiplying the work budget by the proportion of the work completed. Based on the original approved plan as well as the activities completed to date, what one should have spent to complete those activities. Literally, it represents what has actually been accomplished (earned) so far in the project

Planned Value (PV): Also defined as Budgeted Cost of Work Scheduled, is the part of the approved cost estimation (budget) scheduled to be spent during a given time period. It is based on the original baselined plan, what we planned to spend by this time in the schedule Literally, it is the budget cost of what was scheduled to be done, what was planned to spend by one specific time in the schedule

Actual Cost (AC): Also defined as Actual Cost of Work Performed, are costs incurred while performing the required work on a task. Literally, it represents what the project work actually cost, based on current progress to date.

Budget at Completion (BAC): This is the Planned Value of the entire project. Literally, it is the expected cost of the entire project according to the original baselined plan.

Schedule Variance (SV): It is the difference between the Earned Value of work done and the Planned (baseline) Value of work done (SV = EV – PV).

Cost Variance (CV): It is the difference between the Earned Value of work done the Actual Cost of work done (CV = EV – AC)

3.3 KPI definition template

In order to present the chosen KPIs in a uniform and comprehensive manner, we use specification cards for each one of them. The purpose is to provide an indexed library as a reference, each time we need a clarification about the contents of a dashboard.

Every KPI specification card contains the following:

Suggested Graphical representation in a Dashboard

A graph sample of KPI and the kind of visualization that would best emphasize a specific KPI within the context of a dashboard.

KPI Dimension

Categorisation according to the four dimension explained previously

Index weight within KPI Dimension

Within one of the four dimensions, each KPI's importance varies. They do not determine the overall dimension status with the same strength. Hence, we assign each one a gravity scale, a grade from 1 (minor contribution) to 5 (major contribution) to declare significance. In this way, we may compute a weighted average result for each dimension.

Definition

What this KPI represent and what we have to measure. What is the business concern that this KPI address.

Type

The computation formula stems from KPI definition.

Purpose

What is the meaning of a specific KPI, how can we use it and what kind of conclusions may arise on evaluating a measurement.

Desirable values and trend

Qualitative and quantitative interpretation of outcome value spectrum.

Computation frequency

How often we should (or it makes sense) to perform measurements.

Source of Data (also Tools and Systems used)

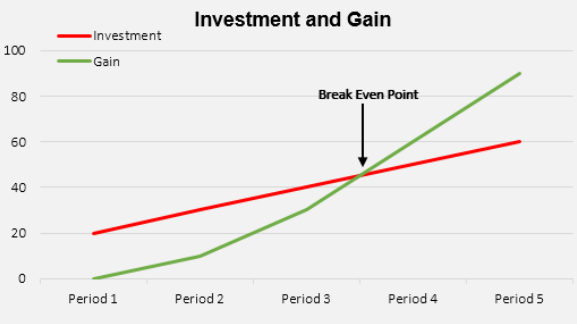
Where do primitive data come from in order to feed our KPI model.

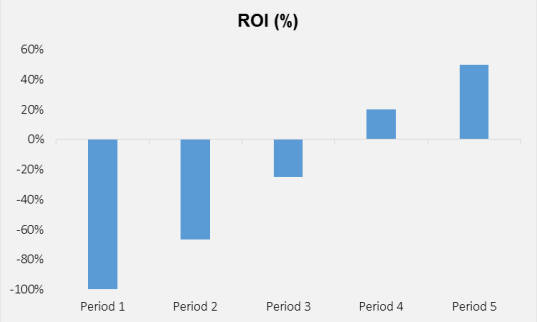
3.4 KPIs Reference

3.4.1 Return on Investment (ROI)

Suggested Graphical representation in a Dashboard

Sparkline type charts, to depict trend over time





KPI Dimension

Financial Results

Index weight within KPI Dimension

4/5

Definition

This is the ratio of profit or loss made expressed in terms of an investment, as a percentage of increase or decrease of the invested value during a period of interest. Literally, it is the degree a given investment pays back, expressed as a percentage of the original investment. A wide range of direct or indirect outcomes can be considered as benefits, including cost savings, increasing profits, increasing output, time saved, streamlined business processes, etc.

Type

ROI = [(Financial value – Project cost) / Project cost] x 100

Financial value: Project's payback

Project cost: Work decomposition of work over time and cost

Purpose

ROI reflects on project profitability and indicates whether its benefits exceed costs. It's perfectly normal for a project not to have positive ROI in the beginning. Many projects take a serious amount of time to generate profits, or even profits are materialized later in time. Sometimes, the ROI should be considered long term, as some projects take more time to grow profits. In every case, it demonstrates project worth value in monetary terms and which is

ultimately what owners and stakeholders are looking for. Thus, it acts as a reliable reference for strategic decisions and catalyst to build stakeholder support.

Desirable values and trend

Values start from -100% (when we have zero revenue and only costs) and in theory may increase at large, as revenues surpass costs. ROI should demonstrate increasing value over time. Furthermore, break-even point (where investment equals benefits) should be as close to project start as possible

Computation frequency

At the same time with project update.

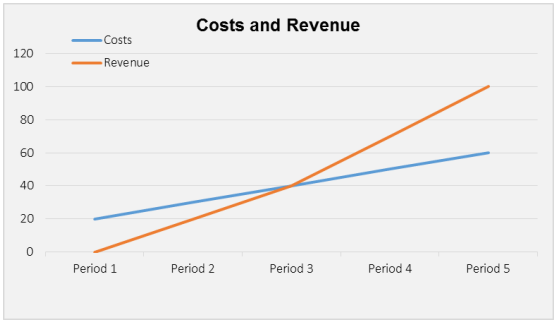
Source of Data (also Tools and Systems used)

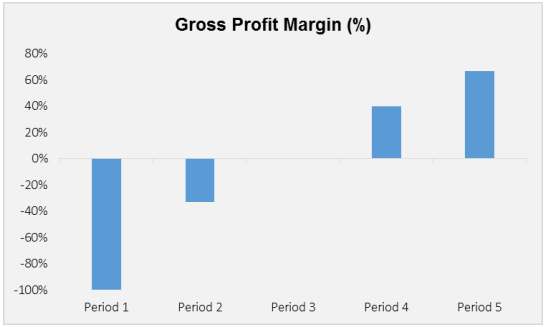
MS Project

3.4.2 Gross Profit Margin

Suggested Graphical representation in a Dashboard

Sparkline type charts, to depict trend over time





KPI Dimension

Financial Results

Index weight within KPI Dimension

5/5

Definition

Gross margin is a financial ratio that compares revenue and direct costs, expressed as a percentage.

Type

Gross Profit Margin Index = [(Project Revenue – Project cost) / Project cost] x 100

Purpose

Though similar, gross profit margin is more of a predictor of return on investment. Gross margin is closely associated with markup. Projects with a healthy gross margin are significantly more likely to be profitable than those that are barely covering their costs. Projects with adequate gross margins will eventually generate enough revenue to finance other operations. In many projects, especially long-term ones, we may observe negative or low return on investment in early stages due to startup costs, but those having a high gross margin are much more likely to realize a profit in the end, if they overcome negative financial result of first period.

By taking into account current costs of the project, scheduled future costs and projects budget, we may get an insight of profit margin percentage at completion. Then, depending on the results, we will be able to determine actions and make necessary adjustments to increase the projected value of margin at completion.

Desirable values and trend

Values start from -100% (when we have zero revenue and only costs) and in theory may increase at large as revenues surpass costs.

Computation frequency

At the same time with project update.

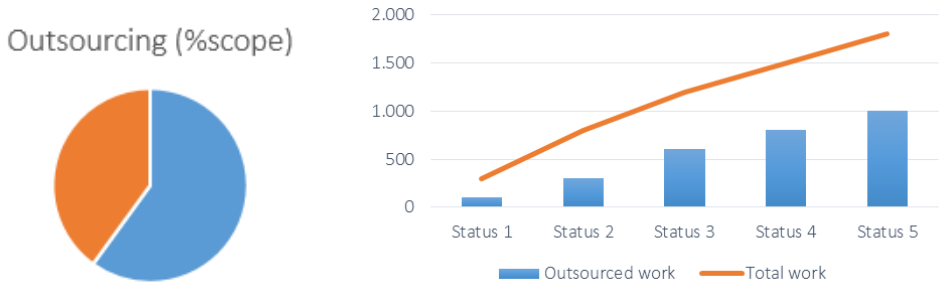
Source of Data (also Tools and Systems used)

MS Project

3.4.3 Project Outsourcing Index (% of scope)

Suggested Graphical representation in a Dashboard

Pie charts or combined charts to show percentage



KPI Dimension

Financial Results

Index weight within KPI Dimension

2/5

Definition

It describes what part of the project's scope is not performed by own means and resources (in-house), but instead is assigned to a third party to perform services or make constructions.

Type

Project Outsourcing Index = (Project Scope Outsourced) / (Project Scope)

Purpose

Ideally, drill down option should be available in order for further analysis. In combination with other quality characteristics, we can draw useful conclusions regarding relevance between one organization's business plan and projects undertaken

Desirable values and trend

In general, this ratio should be relatively low. It depends on project's subject and organization's business plan. In any case, it is essential to perform «make or buy» analysis for outsourced activities

Computation frequency

At the same time with project update.

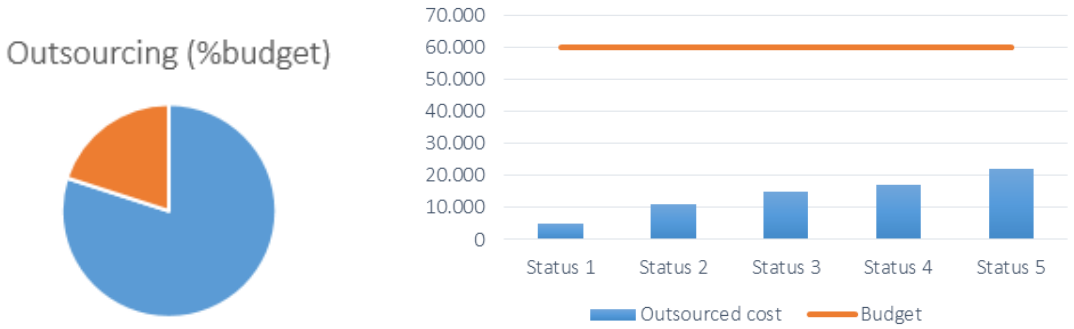
Source of Data (also Tools and Systems used)

MS Project

3.4.4 Project Outsourcing Index (% of budget)

Suggested Graphical representation in a Dashboard

Pie charts or combined charts to show percentage



KPI Dimension

Financial Results

Index weight within KPI Dimension

2/5

Definition

It describes what part of the project budget is not performed by own means and resources (in-house), but instead is assigned to a third party to perform services or make constructions.

Type

Project Outsourcing Index = (Budget for Outsourced activities) / (Project Budget)

Purpose

Ideally, drill down option should be available in order for further analysis. In combination with other quality characteristics, we can draw useful conclusions regarding relevance between one organization's business plan and projects undertaken

Desirable values and trend

In general, this ratio should be relatively low. It depends on project's subject and organization's business plan. In any case, it is essential to perform «make or buy» analysis for outsourced activities

Computation frequency

At the same time with project update.

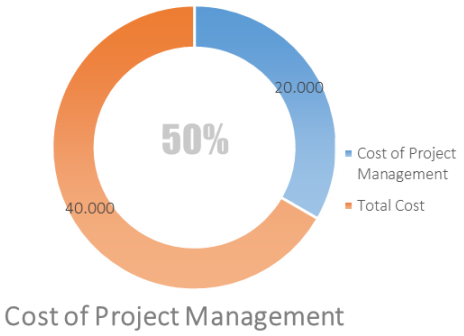
Source of Data (also Tools and Systems used)

MS Project

3.4.5 Cost of Project Management Index

Suggested Graphical representation in a Dashboard

Pie chart or combined charts to show percentage



KPI Dimension

Financial Results

Index weight within KPI Dimension

2/5

Definition

It denotes which part of project's actual costs are associated with pure project management activities (project team fees, transportation, public relationships, meetings, education needs, etc)

Type

Cost of Project Management Index = (Project Management Cost / Project cost) x 100

Purpose

It reveals how much a new project endeavor requires to be managed. It gives incentive in order to analyse and streamline project management. It enables for more accurate cost planning in future projects. It is also a performance index for project management team.

Desirable values and trend

Lower values may indicate more efficient project management.

Computation frequency

At the same time with project update.

Source of Data (also Tools and Systems used)

MS Project

3.4.6 (Organization) Resources planned on project Index

Suggested Graphical representation in a Dashboard

KPI Dimension

Financial Results

Index weight within KPI Dimension

3/5

Definition

Organization's resources and assets are calculated and then we determine what part of this value accounts for a specific project.

Type

Resources planned on project Index = (Project resources requirements) / Organization resources) x 100

Purpose

It is mostly associated with the risk undertaken in a project and the stakes involved. Thus, a project with high index is of critical importance and requires much more effort and attention.

Desirable values and trend

It is a calculation made during project planning and most probably will not change until the end, unless plan goes wrong and additional resources are needed, that cannot be covered from reserves.

Computation frequency

At the beginning of the project.

Source of Data (also Tools and Systems used)

MS Project

3.4.7 Procurement Operating Cost and Managed Spend

Graphical representation - Suggested representation in a Dashboard

KPI Dimension

Financial Results

Index weight within KPI Dimension

2/5

Definition

Procurement operating costs represent the costs the organization incurs for maintaining a procurement department (payments, facilities costs, equipment, etc). Managed Spend is the amount of capital that the procurement department administers.

So, it's the total operating-expense incurred by the Procurement Department over the amount Procurement Department has spent on purchases at the same period.

Type

Procurement Operating Cost / Managed Spend = (Procurement Operating Cost / Managed Spend) x 100

Purpose

This KPI measures the procurement department's cost efficiency

Desirable values and trend

We definitely prefer values below 1 (100%) and as close to 0 (1%) as possible.

Computation frequency

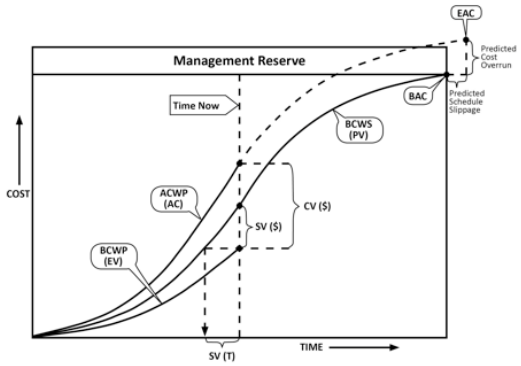
At the same time with project update.

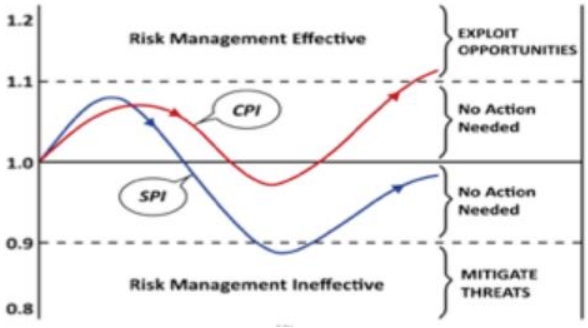
Source of Data (also Tools and Systems used)

MS Project, ERP system, accounting office, procurement department

3.4.8 Schedule Performance Index (SPI)

Graphical representation - Suggested representation in a Dashboard





KPI Dimension

Execution Performance

Index weight within KPI Dimension

5/5

Definition

It denotes a correlation between work performed and work planed.

Type

SPI = EV / PV

Purpose

Understand to which extent our project is behind schedule or ahead of schedule.

Desirable values and trend

Ideally, SPI should be exactly or very close to 1 (SPI = 1). This happens when Earned Value equals Planned Value (EV=PV), meaning that the project is on schedule, as it has been earned exactly what was planned to earn by this point in the project.

SPI values below 1 (SPI<1) imply delay in execution (project is behind schedule), as it has been earned less than was planned to earn by this point in the project. This happens when Earned Value is less than Planned Value (EV<PV, or equally SV=EV-PV<0)

SPI values above 1 (SPI>1) imply that actual execution precedes schedule, (project is ahead of schedule), as it has been earned more than was planned to earn by this point in the project. This happens when Earned Value is greater than Planned Value (EV>PV, or equally SV=EV-PV>0).

A useful approach is to define thresholds for SPI values. Outside the scope of such acceptable range of values, corrective actions should be immediately triggered.

Computation frequency

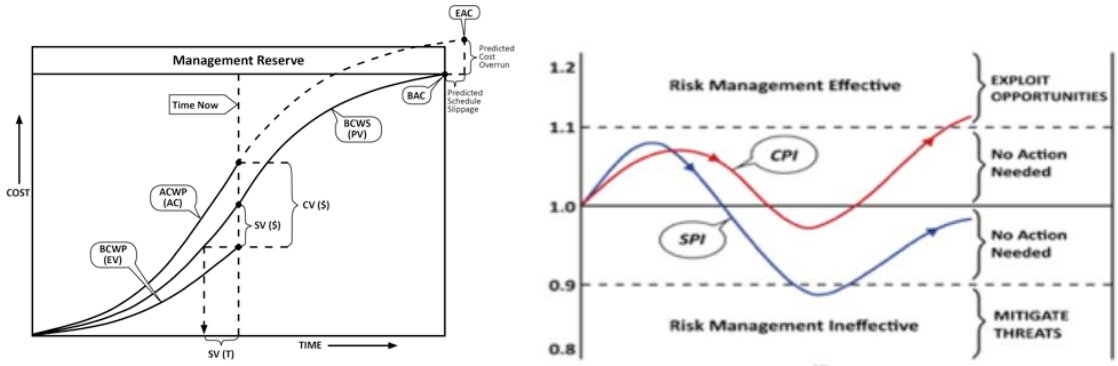
According to predefined time segmentations of the Project

Source of Data (also Tools and Systems used)

MS Project

3.4.9 Cost Performance Index (CPI)

Graphical representation - Suggested representation in a Dashboard



KPI Dimension

Execution Performance

Index weight within KPI Dimension

5/5

Definition

It denotes a correlation between work performed and actual costs incurred for this amount of work (budget deficit or surplus).

Type

CPI = EV / AC

Purpose

Realise how well we are using project funds. Forecast whether project will finish under projected costs, or whether we will face a project overrun.

Desirable values and trend

Ideally, CPI should be exactly or very close to 1 (CPI = 1). This happens when Earned Value equals Actual Costs (EV=AC), meaning that the project is on budget, as it has been earned exactly what was actually spent by this point in the project.

CPI values below 1 (CPI<1) imply cost exceedance (project is over budget), as it has been earned less than was actually spent by this point in the project. This happens when Earned Value is less than Actual Cost (EV<AC, or equally CV=EV-AC<0)

CPI values above 1 (CPI>1) imply cost saving, (project is under budget), as it has been earned more than was actually spent by this point in the project. This happens when Earned Value is greater than Actual Cost (EV>AC, or equally CV=EV-AC>0).

A useful approach is to define thresholds for CPI values. Outside the scope of such acceptable range of values, corrective actions should be immediately triggered in order to compensate cost exaggeration or even reconsider planning accuracy.

Computation frequency

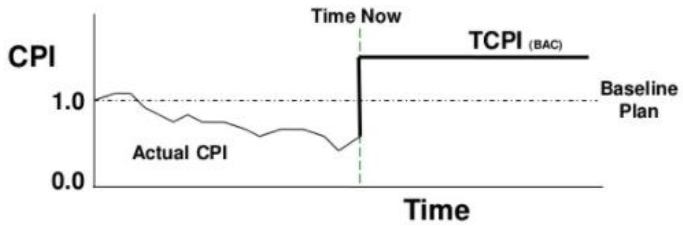
According to predefined time segmentations of the Project, concurrently with SPI.

Source of Data (also Tools and Systems used)

MS Project

3.4.10 To Complete Performance Index (TCPI)

Graphical representation - Suggested representation in a Dashboard



KPI Dimension

Execution Performance

Index weight within KPI Dimension

4/5

Definition

It is a calculation of the future cost performance (cost related) that a project is required to reach in order to achieve re-estimated forecasted value of the project upon completion (EAC) or solely project budget upon completion (BAC).

Type

Case A (When project is Over Budget):

TCPI = (Work Remaining) / (Funds Remaining) = (BAC – EV) / (EAC – AC)

Case B (When project is Under Budget):

TCPI = (Work Remaining) / (Funds Remaining) = (BAC – EV) / (BAC – AC)

Purpose

TCPI serves as a suggestion of cost performance for the remaining project, based on the concept of CPI. Literally, it denotes the desired trend for CPI in order for the project to be on budget upon completion.

Desirable values and trend

Case A (Project is Over Budget):

TCPI >1.0, is an undesirable range of values, a negative indication for the project future, as it is required to continue with a performance with CPI >1.0. In such a case, the desirable trend is declining until converge to value 1.0 (Baseline)

Case B (Project is Under Budget):

TCPI <1.0, is a desirable range of values, an optimistic indication for the project future, as there is latitude to continue with a performance of CPI <1.0. In such a case, the desirable trend is incremental until converge to value 1.0 (Baseline)

Computation frequency

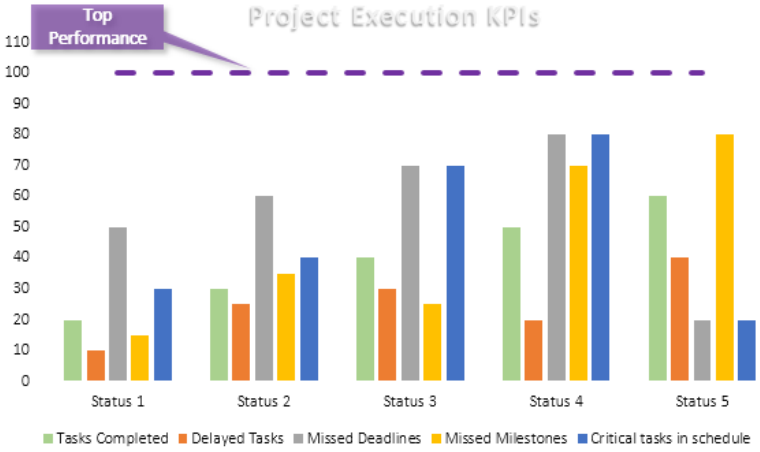
According to predefined time segmentations of the Project, concurrently with SPI and CPI

Source of Data (also Tools and Systems used)

MS Project

3.4.11 Tasks Completed

Graphical representation - Suggested representation in a Dashboard



KPI Dimension

Execution Performance

Index weight within KPI Dimension

2/5

Definition

This index shows in a given point in time, how many tasks are completed over the total number of project tasks. Alternatively, it could be applied to Summary tasks level, indicating percentage of summary tasks completion.

Type

Tasks Completed = Number of Completed Tasks / Total number of Tasks

Purpose

It shows which part of the project has been completed, or how far we stand from project's end. This completed part can be presented to the customer, evaluated and probably encapsulated as intermediate deliverable.

Desirable values and trend

This is a percentage value which should gradually converge to 100%, when all project tasks are complete.

Computation frequency

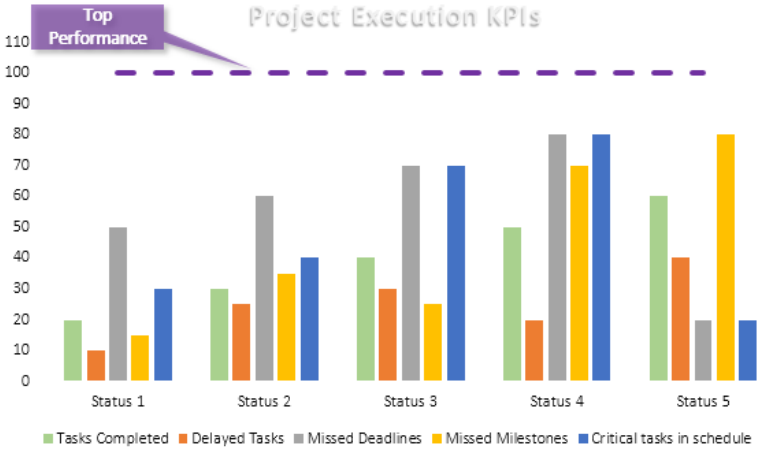
At the same time with project update.

Source of Data (also Tools and Systems used)

MS Project

3.4.12 Delayed (Overdue) Tasks

Graphical representation - Suggested representation in a Dashboard



KPI Dimension

Execution Performance

Index weight within KPI Dimension

2/5

Definition

This index shows in a given point in time, how many tasks have been delayed according to schedule over total number of project tasks. Alternatively, it could be applied to Summary tasks level, indicating percentage of summary tasks delay.

Type

Delayed Tasks = Number of Delayed Tasks / Total number of Tasks

Purpose

It shows what part of the project has fallen behind

Desirable values and trend

This is a percentage value which hopefully will remain in low levels

Computation frequency

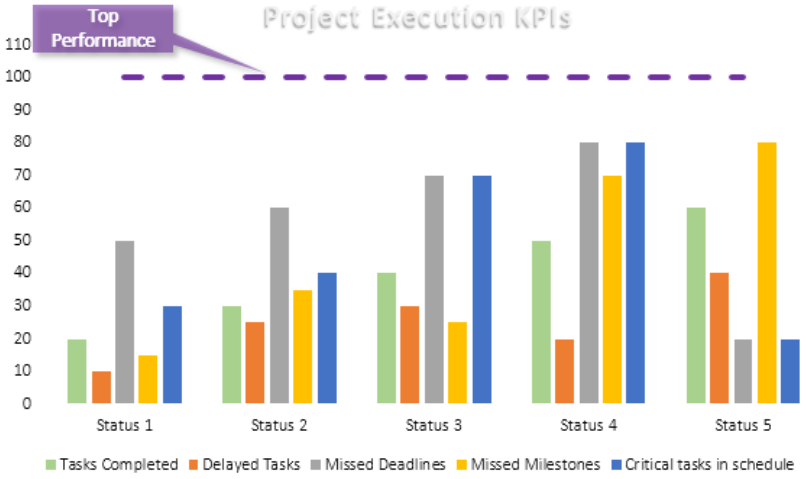
At the same time with project update.

Source of Data (also Tools and Systems used)

MS Project

3.4.13 Missed Deadlines

Graphical representation - Suggested representation in a Dashboard



KPI Dimension

Execution Performance

Index weight within KPI Dimension

3/5

Definition

This is the percentage of missed deadlines over total number of project deadlines, according to schedule.

Type

% Missed Deadlines = (Number of Missed Deadlines) / (Total Number of Project Deadlines)

Purpose

It could be used in conjunction with Schedule Variance to justify project delay.

Desirable values and trend

Ideally, this should be zero or as close to zero as possible with a declining trend.

Computation frequency

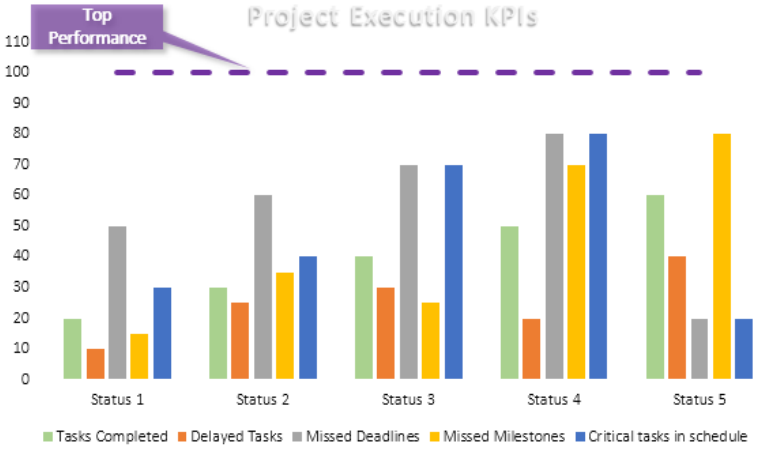
Upon termination of every scheduled deadline

Source of Data (also Tools and Systems used)

MS Project

3.4.14 Missed Milestones

Graphical representation - Suggested representation in a Dashboard



KPI Dimension

Execution Performance

Index weight within KPI Dimension

2/5

Definition

This is percentage of missed milestones (or shifted later in time) over total number of defined milestones, according to project schedule

Type

% Missed Milestones = (Number of Missed or Shifted Milestones) / (Total Milestones)

Purpose

Milestones are distinct events in the course of a project that signify an important event, usually the conclusion of a summary task or reach of a certain goal. In that sense, being in sync with milestones is important to maintaining momentum. Otherwise, this is a negative indication that can bring frustration and disappointment to stakeholders, especially within project team. Identifying when and why milestones are missed may improve planning process.

Desirable values and trend

As a rough guide, 0 to 20% denotes high performance whereas over 60% implies low performing project team.

Computation frequency

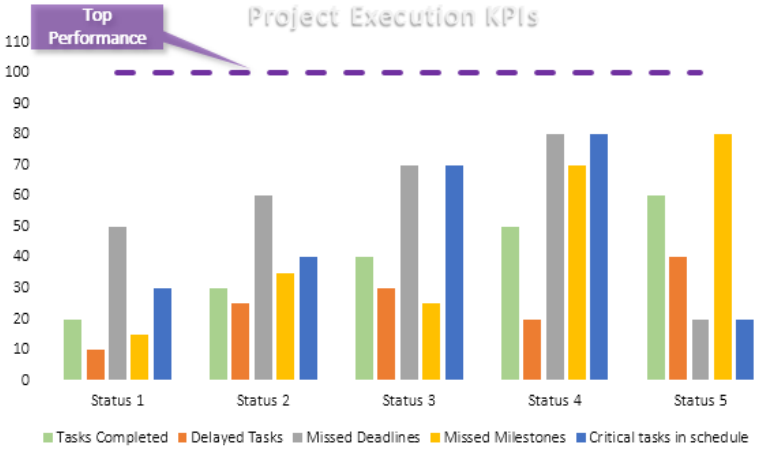
Every time a milestone is reached

Source of Data (also Tools and Systems used)

MS Project

3.4.15 Critical tasks in schedule

Graphical representation - Suggested representation in a Dashboard



KPI Dimension

Execution Performance

Index weight within KPI Dimension

3/5

Definition

Critical path approach highlights the shortest time possible to complete the project on due date and thus determines the appropriate task sequencing in planning. As a result, there is additional concern for those activities that form critical path. This index justifies proper planning and gives an insight on the possibility for on time project completion.

Type

Critical tasks in schedule = (Number of Critical Tasks completed on schedule) / (Total number of Critical Tasks)

Purpose

Draw attention and trigger corrective actions for delays in schedule that will have impact.

Desirable values and trend

This is a percentage value which should gradually converge to 100%, when all project tasks are complete.

Computation frequency

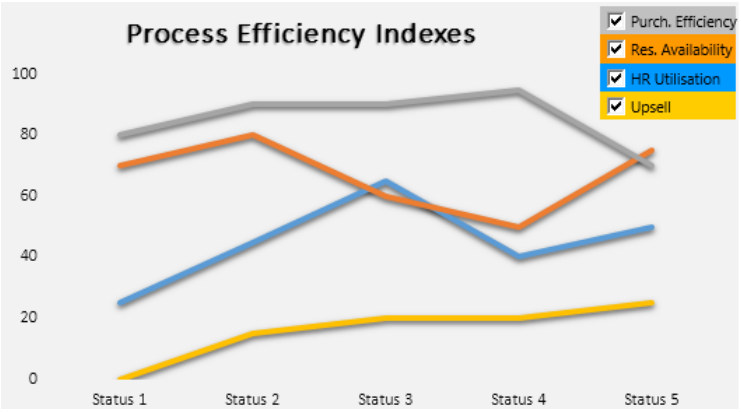
At the same time with project update.

Source of Data (also Tools and Systems used)

MS Project

3.4.16 HR Utilization in Project Index

Graphical representation - Suggested representation in a Dashboard



KPI Dimension

Process Efficiency

Index weight within KPI Dimension

2/5

Definition

It describes the variance between human resources' allocation time in project schedule (including secondary tasks or generic work that cannot be isolated and charged separately) and pure time solely devoted in project's tasks.

Type

HR Utilization Index = (Time exclusively spent on project tasks) / (Total time allocated in project plan)

Purpose

This index provides quantitative and qualitative evaluation of project plan, regarding HR allocation. It is also associated with reliability and feasibility of schedule.

Desirable values and trend

Higher values are most desirable. Increasing trends may be results of training and process improvement

Computation frequency

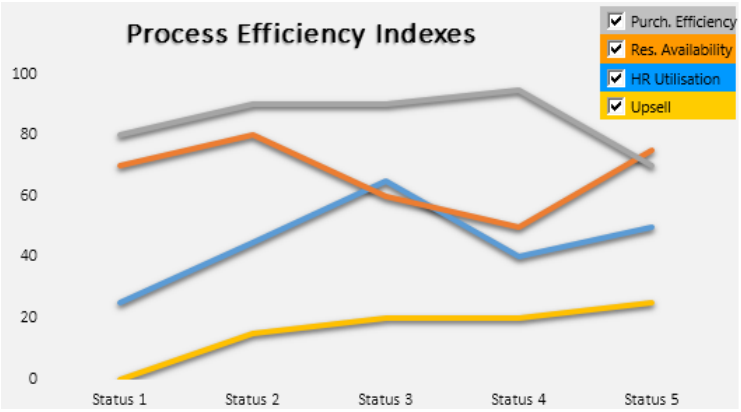
At the same time with project update.

Source of Data (also Tools and Systems used)

MS Project, HR management applications

3.4.17 Resource Availability Index

Graphical representation - Suggested representation in a Dashboard



KPI Dimension

Process Efficiency

Index weight within KPI Dimension

1/5

Definition

It measures the percentage of organisation's available HR that could be assigned to a new activity. It also includes those allocated and still engaged to a project, nevertheless for some reason they remain available and thus can be used in other projects or external activities.

Type

Resource Availability Index = (HR available) / (HR allocated or Total HR)

Purpose

This measurement helps a Project Manager to understand the limits of a project team and a PMO to estimate organisation's capacity in undertaking additional endeavours.

It gives an insight of HR availability (pool) at every time and enables more efficient personnel utilization. It must be accompanied with additional information, such as HR type, skills category, interval until next programmed obligation, etc.

It is better exploited in the broader framework of a portfolio. Usually, within a portfolio, every project allocates resources from a common resource pool. This measurments helps in avoiding potential resource shortages or conflicts. In any case, it helps forecasting resource needs for future initiatives. When we have concurrent resource demands, it is essential to establish a practice of prioritizing projects according to expected delivered value. In that sense, it is expected to promote the highest priority projects by staffing them first

Desirable values and trend

Values may vary regardless of the project. Minimum value 0% means that all organisations resources are fully allocated and occupied, which is positive for most cases, but the organisation may not be able to respond timely in new challenges. Values close to maximum 100% (100% is practically impossible) may have a dual meaning. They may refer to situations with few active projects, therefore excessive staff appears unjustified and probably have to be laid off. Or, they may indicate organisations' readiness to take up new business opportunities or being able to respond to one's project unexpected need for additional staff.

For demonstration purposes, in our scenario we will consider values close to 100% as a positive fact, whereas values close to 0% as negative.

Computation frequency

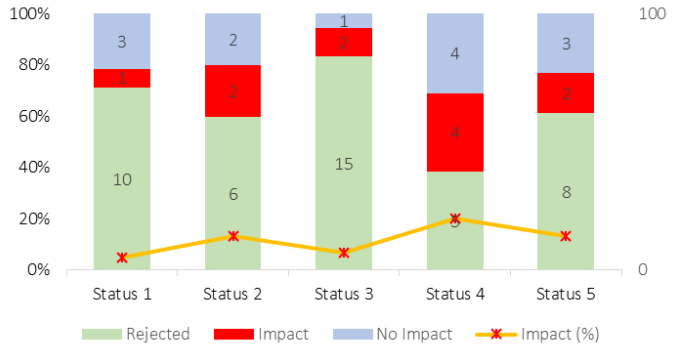
At the same time with project update or even more often.

Source of Data (also Tools and Systems used)

MS Project

3.4.18 Change Requests

Graphical representation - Suggested representation in a Dashboard



KPI Dimension

Process Efficiency

Index weight within KPI Dimension

4/5

Definition

This is the number of approved changes with significant impact on project constraints, over the total number of change requests within a time period.

Type

Change Requests Index= (Approved changes with Impact) / (Total change requests)

Purpose

It can be used as a warning for upcoming scope creep or cost inflation. We should also consider actual number of change requests (irrespective of whether they are finally approved) and frequency.

Desirable values and trend

Frequent and radical changes to project plan or scope are undesirable. In that sense, values close to 0% are optimum.

Computation frequency

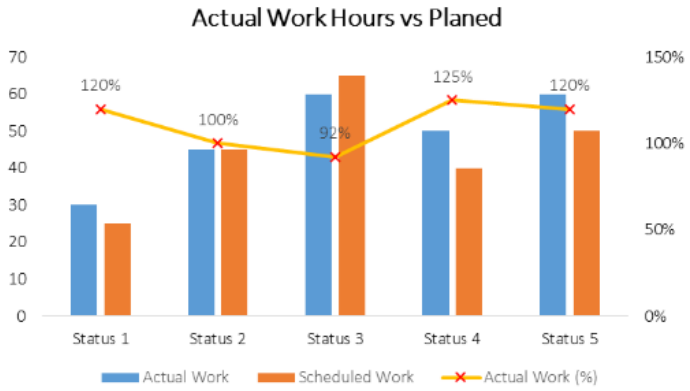
At the same time with project update.

Source of Data (also Tools and Systems used)

MS Project

3.4.19 Actual Work Hours vs Planned

Graphical representation - Suggested representation in a Dashboard



KPI Dimension

Process Efficiency

Index weight within KPI Dimension

3/5

Definition

It is the percentage of actual working hours (effort) spent on project processes over total working hours planned.

Type

Actual Work Hours vs Planed = (Actual working hours) / (Total working hours)

Purpose

If we find that scheduled time is significantly less than actual amount of hours spent, this is probably an indication of bad planning and therefore time scheduled for the project should be re-estimated anew.

Desirable values and trend

Increasing values as close as possible to 100% are desirable. Above 100% (optimum value), lower values indicate better performance.

Computation frequency

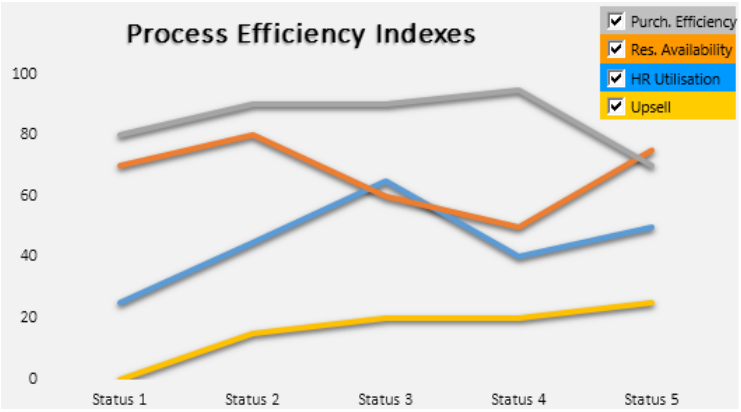
At the same time with project update.

Source of Data (also Tools and Systems used)

MS Project

3.4.20 Purchasing Efficiency

Graphical representation - Suggested representation in a Dashboard



KPI Dimension

Process Efficiency

Index weight within KPI Dimension

4/5

Definition

Out of total number of contracts, directly or indirectly associated with a specific project, how many of them are progressing according schedule and satisfy the initial need of goods or services purchase. We are concerned about inconsistencies and issues that are entirely due to our procurement department fault or responsibility, rather than cases of suppliers' fault.

Type

Purchasing Efficiency = (Number of flawless Contracts) / (Total Number of Contracts)

Purpose

It is an indicator of Procurement Department efficiency regarding a specific perspective. In order to determine overall Procurement Department efficiency, we should calculate this index for all projects and operational activities and take into account additional factors, such as personnel assigned, department's operating costs, etc. Of course, we should also consider the impact of each problematic case on project's constraints.

Desirable values and trend

Values close to 1 (or 100%) are desirable

Computation frequency

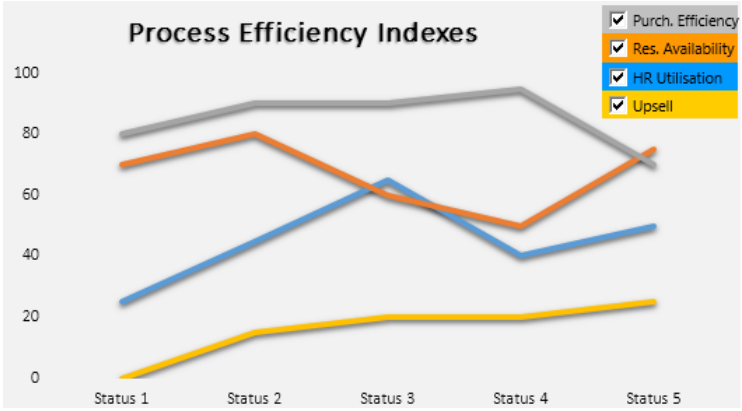
At the same time with project update.

Source of Data (also Tools and Systems used)

MS Project, ERP system, Legal Department

3.4.21 Upsell

Graphical representation - Suggested representation in a Dashboard



KPI Dimension

Process Efficiency

Index weight within KPI Dimension

1/5

Definition

Upsell refers to change request to the project scope. This measure refers to what percentage initial scope has been augmented comparted to initial baselined scope. Upsell should not be confused with scope creep which, as explicitly defined in PMBOK, is adding features and functionality (project scope) without addressing the effects on time, costs, and resources, or without customer approval. The fundamental difference is that in upsell, expansion of scope is approved.

Type

Upsell = (Last approved) Augmented scope / Initial scope

Purpose

This index reflects on project managers' ability to convince customer that there is value that can be added to the project, gain stakeholders' buy-in and create conditions from additional profit margin. Apparently, augmentation should be examined in conjunction with added profit potential, opportunity cost and other similar factors.

Desirable values and trend

Ideally we would like to observe values above 1 (100%)

Computation frequency

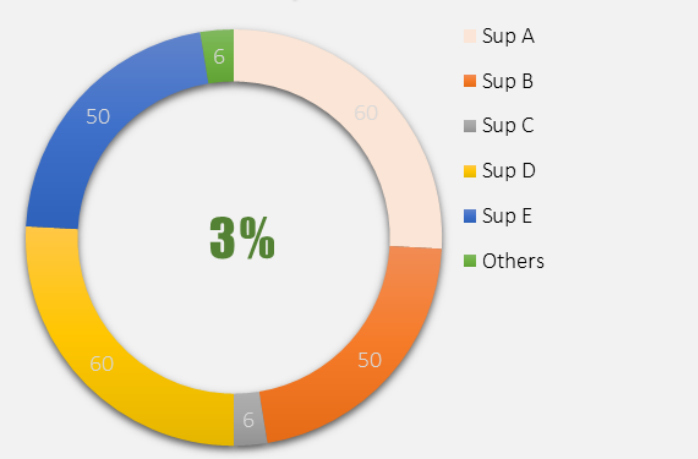
At the same time with project update.

Source of Data (also Tools and Systems used)

MS Project

3.4.22 Suppliers' Fault/Inconsistency Index

Graphical representation - Suggested representation in a Dashboard



KPI Dimension

Process Efficiency

Index weight within KPI Dimension

2/5

Definition

It measures the percentage of products or services received from suppliers that do not meet due dates, compliance specifications, quality requirements or any other contractual obligations. This measurements refers to each individual supplier and then a weighted average calculation is performed in order to determine a unified score for all suppliers involved in the project.

Type

Suppliers' Fault/Inconsistency Index = (Faulty or Inconsistent receipts) / (Total receipts)

Purpose

This index is extremely important in projects that are supplier dependent in large scale, supplier availability is scarce and risk is high. Tracking different suppliers' defect rates and further analyze into defect type and impact, will provide information on supplier's performance and reliability and enable maintenance of a trustworthy supplier database.

Desirable values and trend

This rate, apart from frequency of events, should also take into consideration the impact caused to the project due to these events. Apparently, low level scores and declining trends are preferred.

Computation frequency

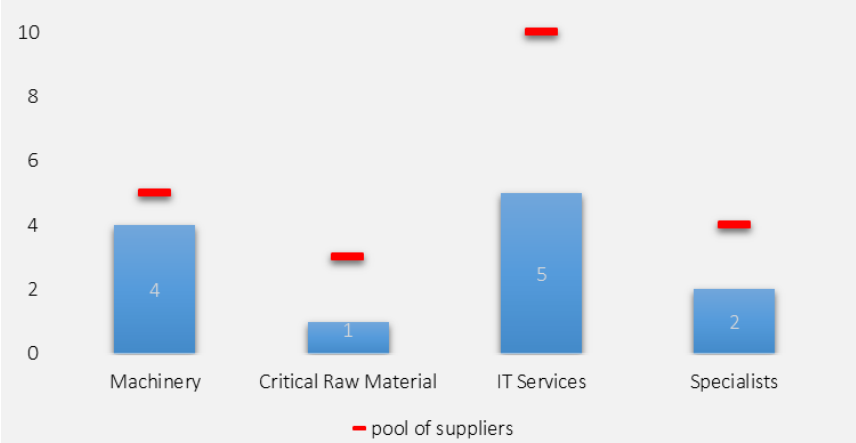
At the same time with project update and every supply receipt.

Source of Data (also Tools and Systems used)

MS Project

3.4.23 Supplier Dispersion Index

Graphical representation - Suggested representation in a Dashboard



KPI Dimension

Process Efficiency

Index weight within KPI Dimension

2/5

Definition

This is the frequency of selecting a specific supplier for a particular type of assignment. Alternatively, which is the variety or dispersion of suppliers chosen out of a pool of eligible and **equally evaluated** suppliers. This measurements refers to supply category and then a

weighted average calculation is performed in order to determine a unified score for all supply categories and suppliers involved in the project.

Type

Supplier Dispersion Index = (Number of one supplier's assignments in a supply category) / (Total number of eligible suppliers)

Purpose

It can be used to track repeated assignments to specific suppliers, and thus reveal the level of dependency towards those few suppliers. It may also serve as an indication of transparency and impartiality.

Desirable values and trend

Apart from inevitable cases of single source procurement, a high dispersion rate is mostly preferred.

Computation frequency

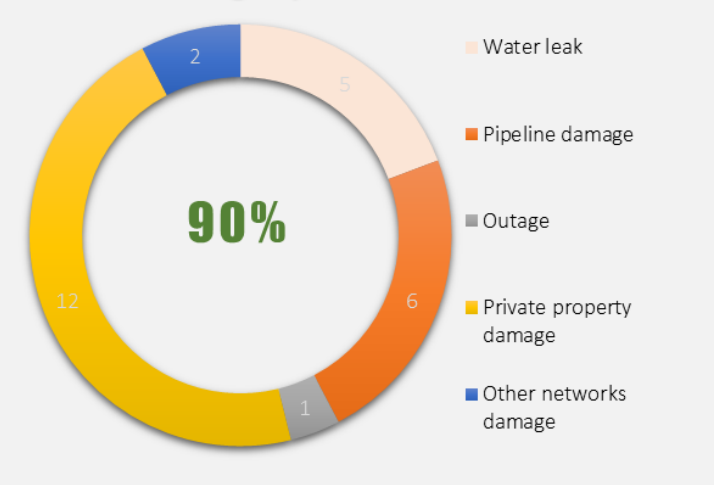
At the same time with project update.

Source of Data (also Tools and Systems used)

MS Project

3.4.24 Failures over Activity Category Index

Graphical representation - Suggested representation in a Dashboard



KPI Dimension

Process Efficiency

Index weight within KPI Dimension

3/5

Definition

Failures may include a variety of abnormal events, which are unplanned and caused delays in schedule, additional costs and various other side effects in the project. Depending on project's nature, we may focus on particular categories of high impact events that affect project's success the most. For instance, in a project of expanding water supply network, we may track the most frequent and high impact failures, such as major water leaks, pipelines damage, unplanned and extended outages, ruin other adjacent networks, damage of private property, etc.

Type

Failures over Activity Category Index = (Number of Failures in an Activity Category)/(Total Failures)

Purpose

It can be used to eliminate repeated cases of fault that have not been addresses effectively until now.

Desirable values and trend

Low level scores and declining trends are preferred.

Computation frequency

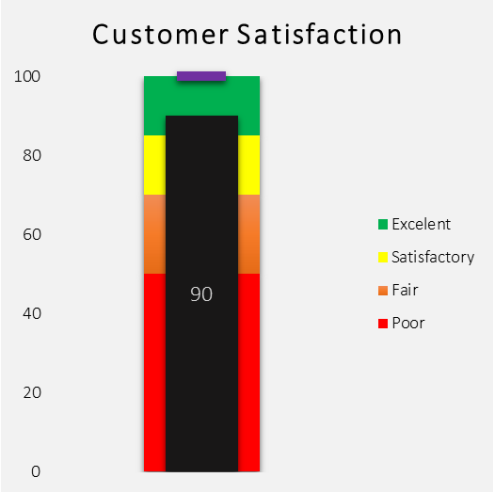
At the same time with project update and failure events.

Source of Data (also Tools and Systems used)

MS Project

3.4.25 Customer Satisfaction Index

Graphical representation - Suggested representation in a Dashboard



KPI Dimension

Customer Satisfaction & Stakeholder Management

Index weight within KPI Dimension

5/5

Definition

This index is the outcome of thorough analysis on factors that shape customer satisfaction. As customer satisfaction is a highly subjective concept, there cannot be a unique way to define it. Therefore, we assume that this is a weighted average computation defined differently in various projects, taking into account the importance of each attribute as well as potential interdependencies between these attributes. Nevertheless, each contributing factor is accompanied by predefined weights, a scale of satisfaction scores and "what if" scenarios based on potential improvements to service levels.

Type

A generic type could be as following:

CSI = Weight1*Score_On_Attribute_1 + Weight2*Score_On_Attribute_2 + … WeightN*Score_On_Attribute_N

Weights and attributes are pre-defined in collaboration with customer.

Purpose

It denotes degree of customer satisfaction during the project. It triggers corrective action and suggest measures towards improvement and against potential frustration.

Desirable values and trend

A potential scale could be the following:

85 - 100	High Satisfaction
65 – 85	Moderate Satisfaction
40 – 65	Low Satisfaction
0 – 40	No Satisfaction

Scores should definitely reside in the higher end, otherwise trend should become incremental from the earliest stages of the project.

Computation frequency

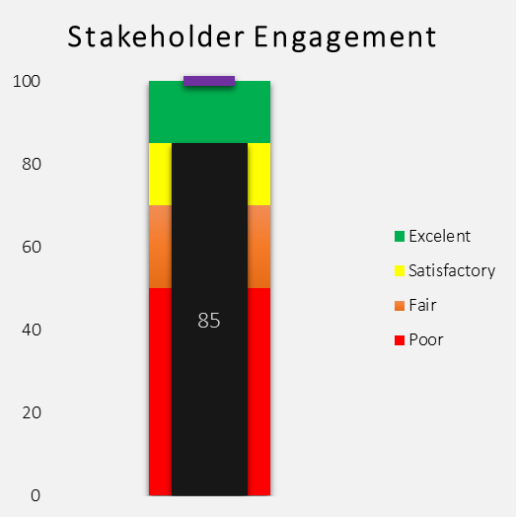
Upon completion of major tasks, as early as possible and definitely before acceptance of intermediate project deliverables.

Source of Data (also Tools and Systems used)

MS Project, Other tools and systems that record customer interaction

3.4.26 Key Stakeholder Engagement Index

Graphical representation - Suggested representation in a Dashboard



KPI Dimension

Customer Satisfaction & Stakeholder Management

Index weight within KPI Dimension

4/5

Definition

It reflects the degree of engagement on behalf of most important project stakeholders, based on related attributes, supportiveness and receptiveness. The former reflects on involvement and contribution, while the later mostly relates to attitude and inclination towards project. Accordingly, these two attributes are analysed in the following scales, ranging from 1 (worst) to 5 (best).

Supportiveness

1 Active opposition

2 Denial

3 Neutral

4 Positive tendency, without significant involvement

5 Active support

Receptiveness:

1 Lack of interest

2 Low, typical interest

3 Neutral

4 Mostly receptive. Willing to get involved and provide feedback

5 Highly responsive and substantial predisposition

Type

KSEI = (SQRT(R*S) – 1)*25

Purpose

KSEI index is a powerful aim for proper Stakeholder management, which is a crucial parameter for a successful project. It may be calculated for each stakeholder separately, according to Stakeholders Register or can be utilized in conjunction with other similar structures, like Power/Interest grid. It helps estimation of stakeholders' engagement during project execution and provides reasoning for corrective action when degree of engagement is not as expected.

A rough segmentation of KSEI value range could be the following:

80 – 100: Stakeholders are totally cooperative, supportive and in tune with project management team.

60 – 80: Stakeholders are almost positive, but certain actions are required to increase interest and improve communication.

40 – 60: Stakeholders are neutral and not exploited in their full potential. Communications and Stakeholder management should be reconsidered.

0 – 40: Stakeholders are distant, idle or uninterested. Project is in great danger.

Desirable values and trend

Scores above 80 confirm effective communication and active involvement. Otherwise, trend of KSE index should definitely be incremental.

Computation frequency

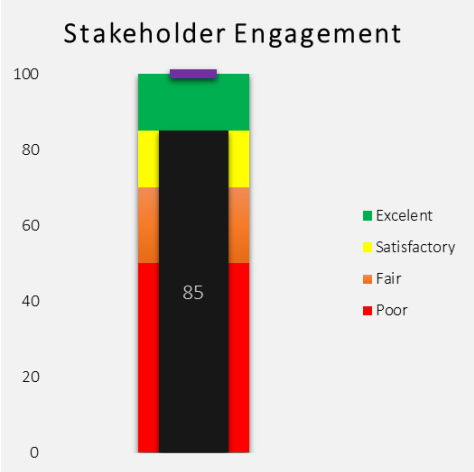
Upon status updates and completion of major tasks.

Source of Data (also Tools and Systems used)

Stakeholders Register, Stakeholders Analysis structures, MS Project

3.4.27 Contribution to Society, Environmental Preservation

Graphical representation - Suggested representation in a Dashboard



KPI Dimension

Customer Satisfaction & Stakeholder Management

Index weight within KPI Dimension

2/5

Definition

This is an indication of whether a project has an increased value for the common wealth (utility project) or is meant to be a new infrastructure given as a donation to a public or non-profitable institution.

Type

Initial value is decided upon project initiation, based on project statement and the broader business plan.

Purpose

It demonstrates social and corporate responsibility and enhances ecological profile of the organization.

Desirable values and trend

In general, it is more likely to be an “ad hoc” specification. Nevertheless, there may be collateral opportunities realized in the course of the project which may upgrade project’s profile in this dimension.

Computation frequency

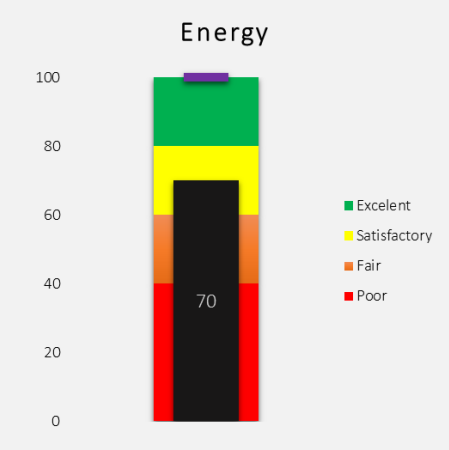
At project initiation

Source of Data (also Tools and Systems used)

Project Statement

3.4.28 Energy Efficiency

Graphical representation - Suggested representation in a Dashboard



KPI Dimension

Customer Satisfaction & Stakeholder Management

Index weight within KPI Dimension

2/5

Definition

This index indicates whether this project is part of a wider portfolio with emphasis on green energy, reduced emissions, recycle process activities, waste treatment installations and sustainability.

Type

Initial value is decided upon project initiation, based on project statement and the broader business plan

Purpose

It demonstrates social and corporate responsibility and enhances ecological profile of the organization.

Desirable values and trend

As 'Contribution to Society, Environmental Preservation Index', it is more likely to be an "ad hoc" specification. Nevertheless, there may be collateral opportunities realized in the course of the project which may upgrade project's profile in this dimension

Computation frequency

At project initiation

Source of Data (also Tools and Systems used)

Project Statement

3.4.29 Direct Impact Index

KPI Dimension

This is more like a meta-project measurement; therefore, it should not be exclusively associated with one of the four dimensions

Definition

We usually focus on the in-project metrics only, disregarding the ultimate outcome. However, the size of one project's impact on a subject (a process, a product, an organization, group of people, etc) is by itself an aspect of project's success. It's the difference before project's beginning and after project's end, against a target that the project aimed to alter its value. This difference in value, can be realised in financial benefits, quality augmentation or business process improvement

Type

Direct Impact Index = Impact realised / Impact anticipated

Purpose

Implementing a project on-time and on-budget is not the ultimate goal. It doesn't necessarily mean that we have achieved the impact that the business case anticipated. This index provides an additional reassurance that project indeed fulfilled its purpose. Also, it is best used in pilot projects where the primary goal is to give a proof of concept and gather data to support business case.

Desirable values and trend

Unlike previous measures, this one makes particular sense after the end of a project. It is also very possible not to possess any data to measure during the project.

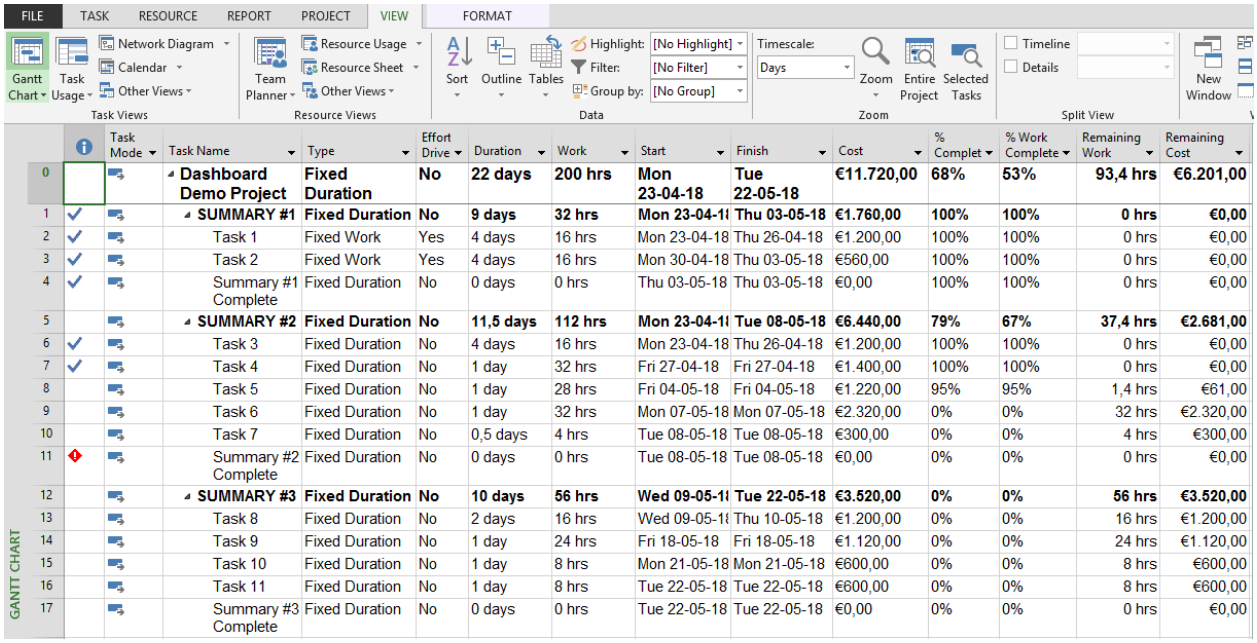
Computation frequency

During project and after project's completion

4. KPIs in MS Project: Fundamental Analysis

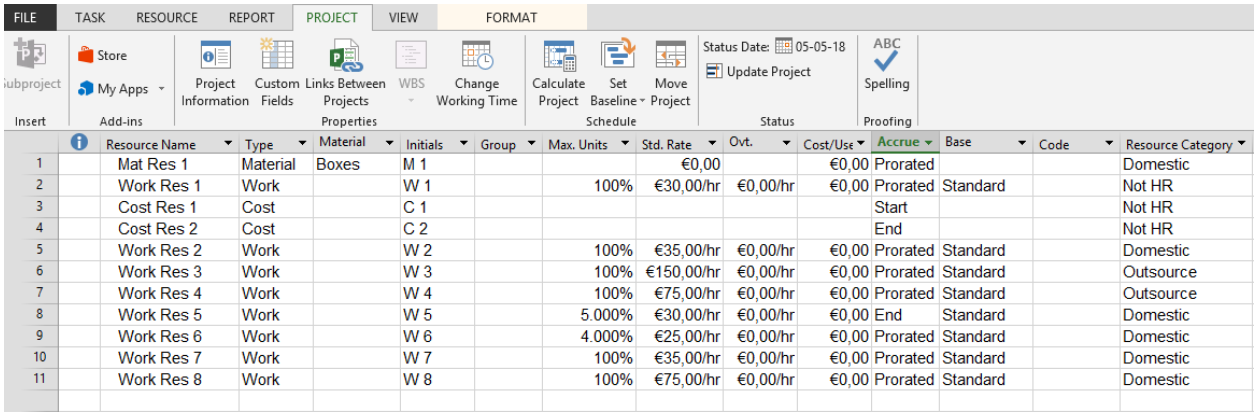
4.1 Implementation in MS Project

As soon as we have defined an adequate collection of project management KPIs, we may proceed with implementation in order to demonstrate their visual power and usability. For this purpose, we set up a simple project scenario with tasks, resources, assignments and constraints. We set realistic values, make a schedule and set a baseline to serve as calculation reference. In the following images, the initial setup is presented.



	Task Mode	Task Name	Type	Effort Drive	Duration	Work	Start	Finish	Cost	% Complet	% Work Complete	Remaining Work	Remaining Cost
0		**Dashboard Demo Project**	**Fixed Duration**	**No**	**22 days**	**200 hrs**	**Mon 23-04-18**	**Tue 22-05-18**	**€11.720,00**	**68%**	**53%**	**93,4 hrs**	**€6.201,00**
1	✓	**SUMMARY #1**	**Fixed Duration**	**No**	**9 days**	**32 hrs**	**Mon 23-04-1**	**Thu 03-05-18**	**€1.760,00**	**100%**	**100%**	**0 hrs**	**€0,00**
2	✓	Task 1	Fixed Work	Yes	4 days	16 hrs	Mon 23-04-18	Thu 26-04-18	€1.200,00	100%	100%	0 hrs	€0,00
3	✓	Task 2	Fixed Work	Yes	4 days	16 hrs	Mon 30-04-18	Thu 03-05-18	€560,00	100%	100%	0 hrs	€0,00
4	✓	Summary #1 Complete	Fixed Duration	No	0 days	0 hrs	Thu 03-05-18	Thu 03-05-18	€0,00	100%	100%	0 hrs	€0,00
5		**SUMMARY #2**	**Fixed Duration**	**No**	**11,5 days**	**112 hrs**	**Mon 23-04-1**	**Tue 08-05-18**	**€6.440,00**	**79%**	**67%**	**37,4 hrs**	**€2.681,00**
6	✓	Task 3	Fixed Duration	No	4 days	16 hrs	Mon 23-04-18	Thu 26-04-18	€1.200,00	100%	100%	0 hrs	€0,00
7	✓	Task 4	Fixed Duration	No	1 day	32 hrs	Fri 27-04-18	Fri 27-04-18	€1.400,00	100%	100%	0 hrs	€0,00
8		Task 5	Fixed Duration	No	1 day	28 hrs	Fri 04-05-18	Fri 04-05-18	€1.220,00	95%	95%	1,4 hrs	€61,00
9		Task 6	Fixed Duration	No	1 day	32 hrs	Mon 07-05-18	Mon 07-05-18	€2.320,00	0%	0%	32 hrs	€2.320,00
10		Task 7	Fixed Duration	No	0,5 days	4 hrs	Tue 08-05-18	Tue 08-05-18	€300,00	0%	0%	4 hrs	€300,00
11	!	Summary #2 Complete	Fixed Duration	No	0 days	0 hrs	Tue 08-05-18	Tue 08-05-18	€0,00	0%	0%	0 hrs	€0,00
12		**SUMMARY #3**	**Fixed Duration**	**No**	**10 days**	**56 hrs**	**Wed 09-05-1**	**Tue 22-05-18**	**€3.520,00**	**0%**	**0%**	**56 hrs**	**€3.520,00**
13		Task 8	Fixed Duration	No	2 days	16 hrs	Wed 09-05-1	Thu 10-05-18	€1.200,00	0%	0%	16 hrs	€1.200,00
14		Task 9	Fixed Duration	No	1 day	24 hrs	Fri 18-05-18	Fri 18-05-18	€1.120,00	0%	0%	24 hrs	€1.120,00
15		Task 10	Fixed Duration	No	1 day	8 hrs	Mon 21-05-18	Mon 21-05-18	€600,00	0%	0%	8 hrs	€600,00
16		Task 11	Fixed Duration	No	1 day	8 hrs	Tue 22-05-18	Tue 22-05-18	€600,00	0%	0%	8 hrs	€600,00
17		Summary #3 Complete	Fixed Duration	No	0 days	0 hrs	Tue 22-05-18	Tue 22-05-18	€0,00	0%	0%	0 hrs	€0,00

Figure 3 *Definition of Tasks (durations, required effort, dependencies)*



	Resource Name	Type	Material	Initials	Group	Max. Units	Std. Rate	Ovt.	Cost/Use	Accrue	Base	Code	Resource Category
1	Mat Res 1	Material	Boxes	M 1			€0,00		€0,00	Prorated			Domestic
2	Work Res 1	Work		W 1		100%	€30,00/hr	€0,00/hr	€0,00	Prorated	Standard		Not HR
3	Cost Res 1	Cost		C 1						Start			Not HR
4	Cost Res 2	Cost		C 2						End			Not HR
5	Work Res 2	Work		W 2		100%	€35,00/hr	€0,00/hr	€0,00	Prorated	Standard		Domestic
6	Work Res 3	Work		W 3		100%	€150,00/hr	€0,00/hr	€0,00	Prorated	Standard		Outsource
7	Work Res 4	Work		W 4		100%	€75,00/hr	€0,00/hr	€0,00	Prorated	Standard		Outsource
8	Work Res 5	Work		W 5		5.000%	€30,00/hr	€0,00/hr	€0,00	End	Standard		Domestic
9	Work Res 6	Work		W 6		4.000%	€25,00/hr	€0,00/hr	€0,00	Prorated	Standard		Domestic
10	Work Res 7	Work		W 7		100%	€35,00/hr	€0,00/hr	€0,00	Prorated	Standard		Domestic
11	Work Res 8	Work		W 8		100%	€75,00/hr	€0,00/hr	€0,00	Prorated	Standard		Domestic

Figure 4 *Definition of Resources*

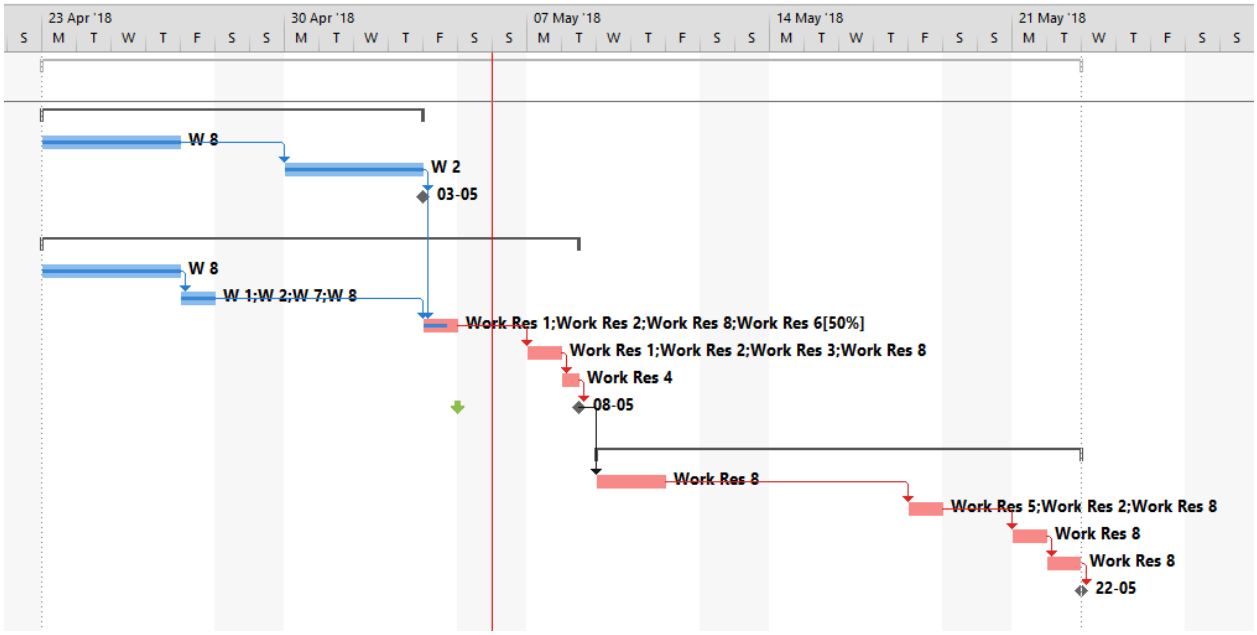


Figure 5 *Project Baseline and Schedule Update*

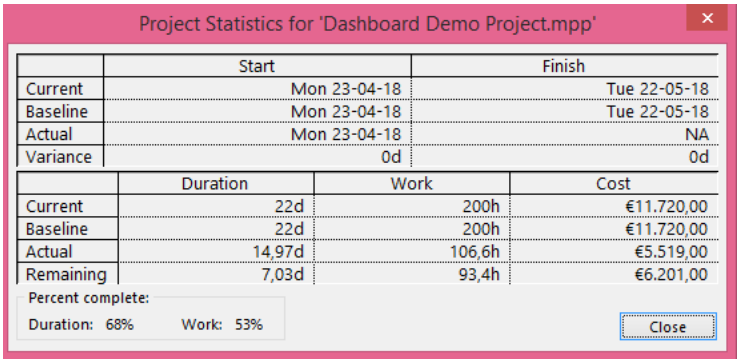


Figure 6 *Project accumulated information when updated*

After we have set up our project scenario, we initially present some basic reports and dashboards that are already available in MS Project.

4.2 Project Overview Dashboard

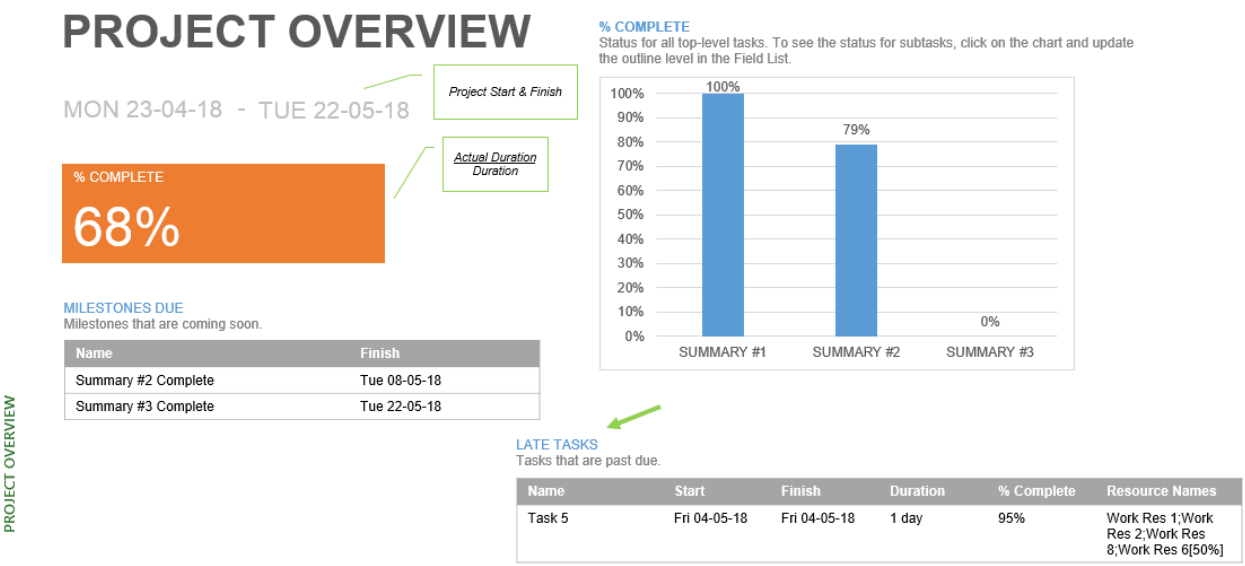


Figure 7 *Project Overview Dashboard*

As the title implies, this dashboard gives us an idea of the general status of the project. There is information about project's major deliverables (phases) and their progress to date. Also, there is information about which milestones are coming soon, which tasks are already late (possible source of an issue) and which is the total progress of the project as a percentage of total work completed.

4.3 Burndown Dashboard

Figure 8 *Burndown Dashboard*

Burndown dashboard offers an insight of project's status regarding scope and effort. In particular, there is information about total effort required, what proportion of this effort has been accomplished and what remains, how many tasks have been completed and how many remain and in that way we receive a forecast on whether are we going to finish the project on time.

4.4 Cost Overview Dashboard

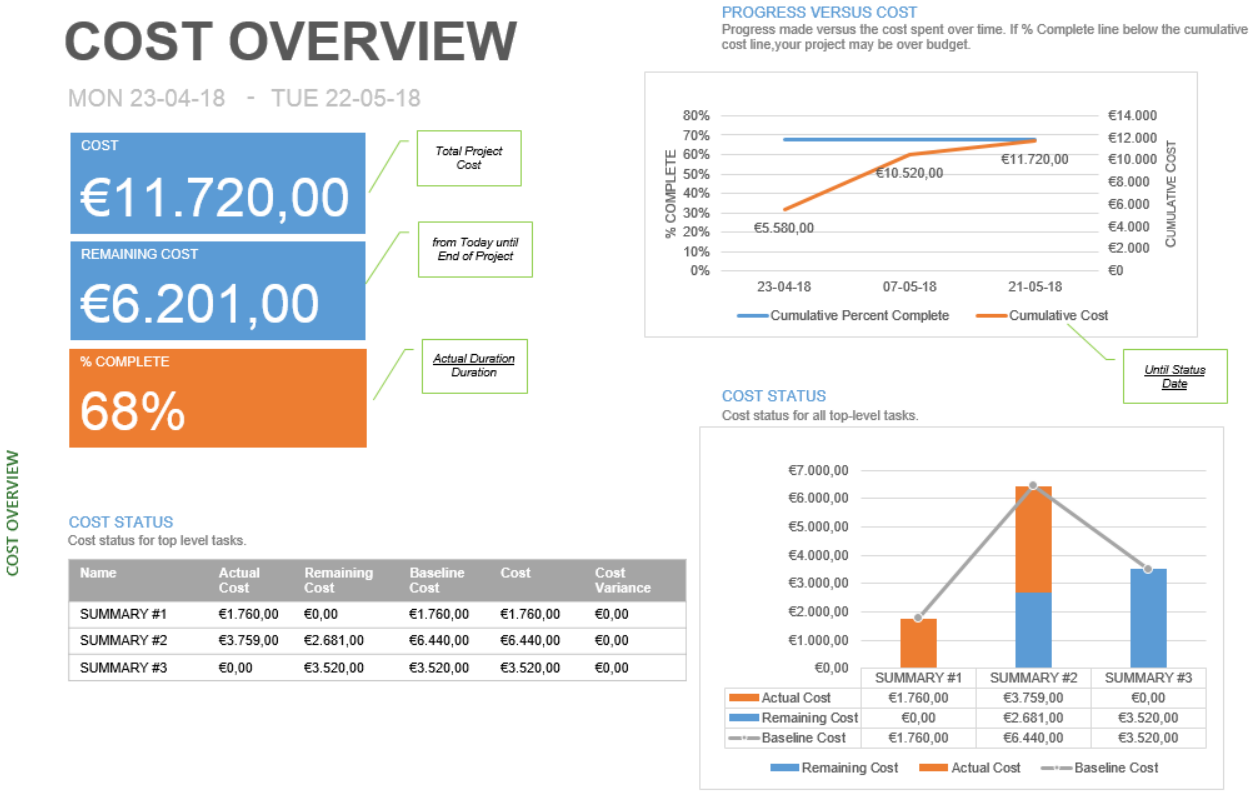


Figure 9 *Cost Overview Dashboard*

This dashboard describes our project's status in terms of costs. In particular, we are shown what is the budgeted, actual and remaining cost of the project. Also, there is cost analysis for various levels of Work Breakdown Structure of project and cost variances against baseline. Again, we may receive a forecact on whether our project is likely to end under budget.

4.5 Work Overview Dashboard

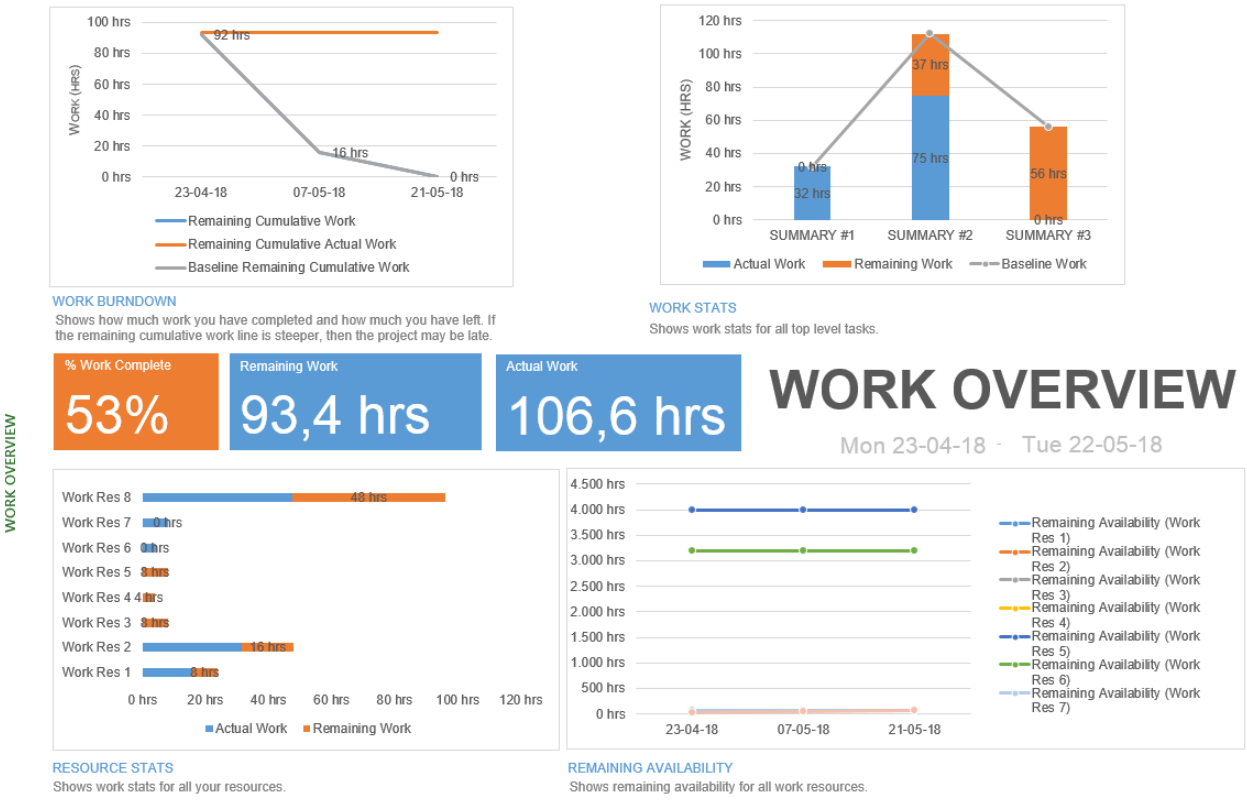


Figure 10 *Work Overview Dashboard*

This dashboard describes our project status in terms of work. In particular, we can see how much work has been performed to date and how much remains, either in total or analysed per level of Work Breakdown Structure. Also, we can see an analysis of work associated with respective resources and even more, remaining availability for each resource.

4.6 Milestone Report

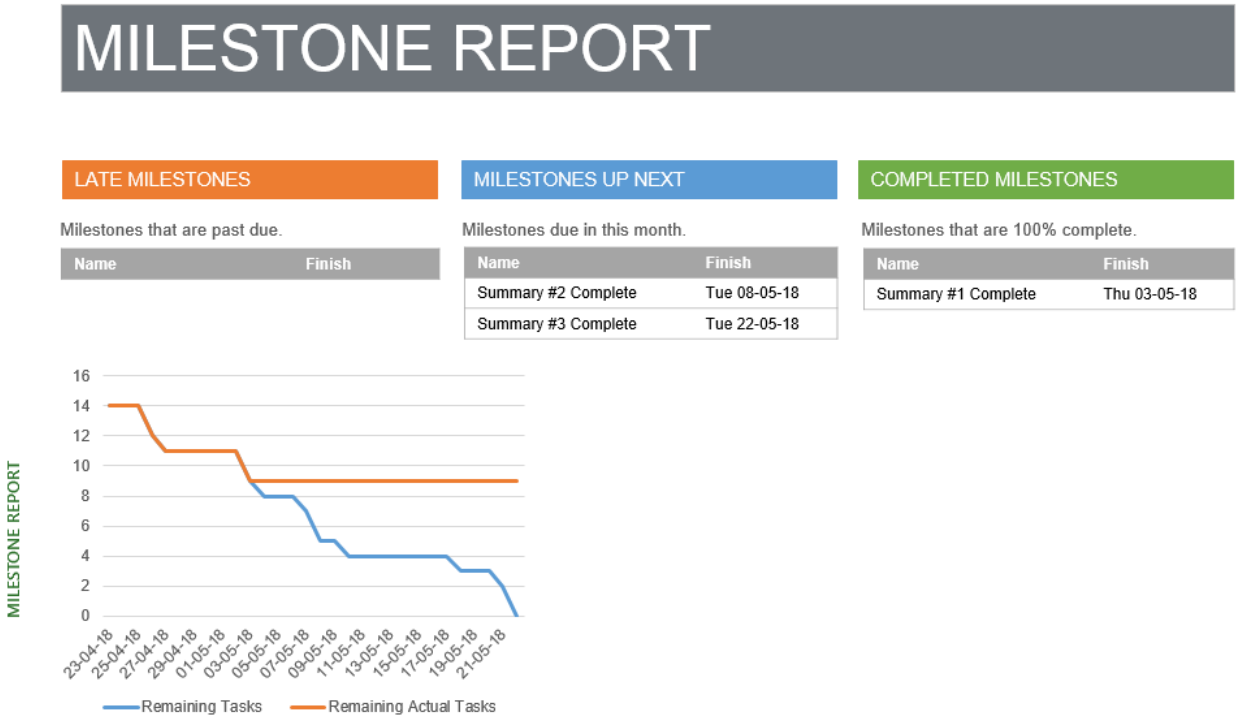


Figure 11 *Milestone Report*

Milestones are significant points or events in the project. They are used in project management in order to delimit phases and signify the completion of major deliverables. Therefore, this is a very useful view of the project's progress, where the whole project is conceptually analysed as a consecutives series of milestones from beginning to end. In particular, we receive details about late, upcoming and completed milestones.

4.7 Earned Value Report

Figure 12 *Earned Value Report*

Based on Earned Value Analysis model that we analysed in previous chapter, Earned Value Report plots earned value graphs based on Planed Value, Earned Value and Actual Costs. It is a pictorial representation of progress from the beginning of the project until date of measurement, aiming to track cost and schedule performance.

4.8 Resource Overview Report

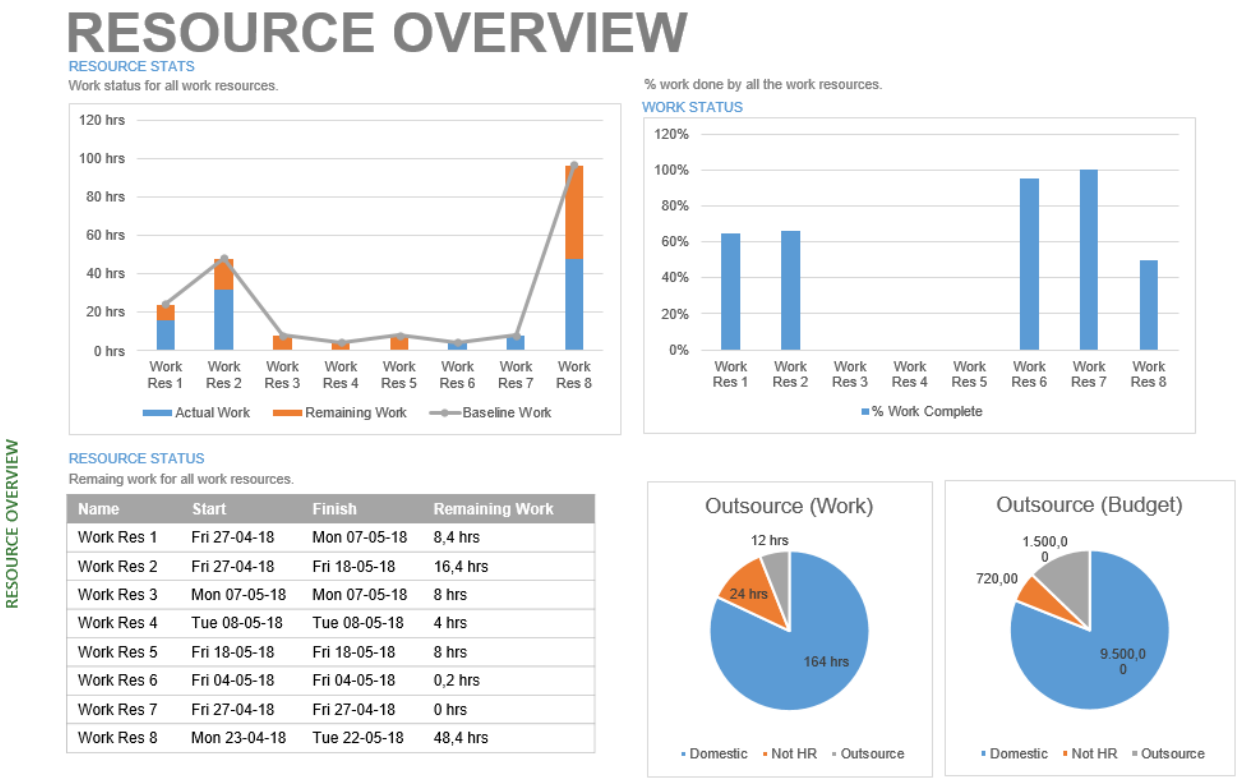


Figure 13 *Resource Overview Report*

Resource Overview Dashboard analyses project in terms of resource allocation. Specifically, we can see total work of the project apportioned to every work resource, along with details of actual, baseline and remaining work. As an enhancement, we added some extra information regarding what part of this work is outsourced (both as a percentage of work and as a percentage of budget)

4.9 Customer Satisfaction & Stakeholder Management in MS Project

These already available default reports and dashboards provide us with some very enlightening views of our project status without any special effort on our behalf. In order to expand functionality, we have to make a few more steps towards customization and try to build a dashboard for one of our dimensions, for example **Customer Satisfaction & Stakeholder Management.**

To do so, we have to define in MS Project all relevant KPIs: Customer Satisfaction, Key Stakeholder Engagement, Contribution to Society, Environmental Preservation and Energy Efficiency. As these KPIs refer specifically to our implementation, they will be implemented as user defined variables, by using custom field functionality of MS Project. In several cases, along with KPIs, we also have to define companion variables that facilitate KPI calculation

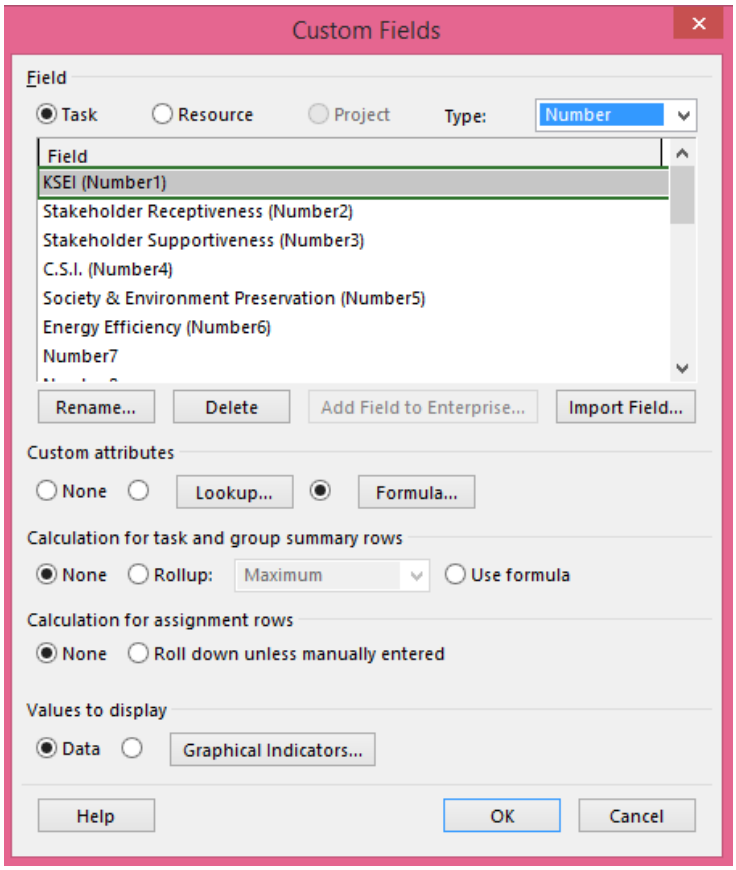


Figure 14 *Custom Fields definition*

Having defined KPI variables, we may assign them real values every time we update our project during execution. By using tables, charts and other reporting tools, we create a new customized dashboard that hosts Customer Satisfaction & Stakeholder Management KPIs and gives a clustered picture of project's performance regarding this dimension. Additionally, we visualize

range of possible values by using appropriate colors (red, orange, yellow, green) to give a sense of actual performance (poor, fair, good, excellent).

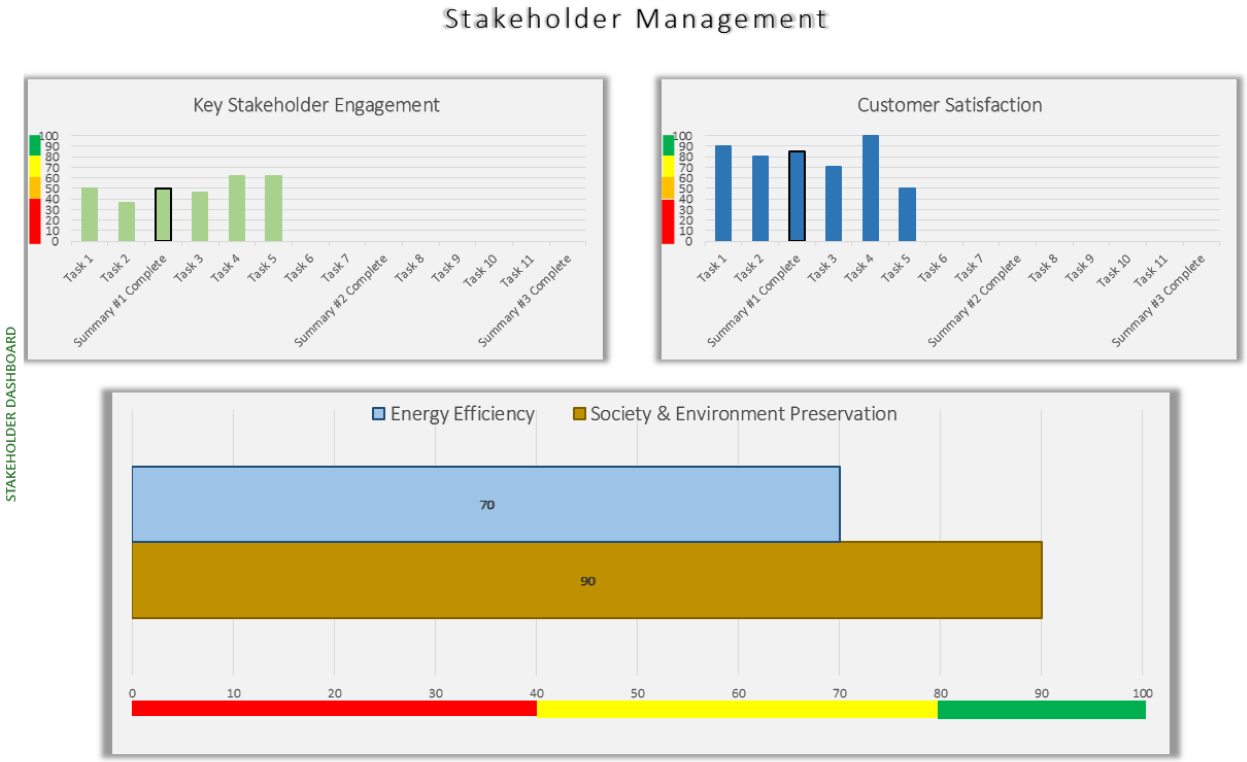


Figure 15 *Customer Satisfaction & Stakeholder Management Dashboard*

5. KPIs in MS Excel: Advanced Analysis

5.1 Constraints in MS Project

Whereas Ms Project is a brilliant system for project management, its options in visualization and reporting are limited. In comparison with MS Excel for instance, it has constrained capabilities in chart design and user interaction options. Moreover, there is no straightforward way to store data non-associated directly with task or resources, nor capability to store and retrieve KPIs states at different points in project.

Nevertheless, at the same time, we are allowed to export raw data from MS Project to Excel and carry on implementation with a relative application, taking advantage of a wider range of computation and visualization options. Therefore, we transfer all required raw data from MS Project to MS Excel and proceed with KPI definition and dashboard design from there on. Obviously there is a great deal of compatibility and interrelation between two environments, since they are both part of Microsoft Office Suite.

5.2 MS Excel solution

Our approach is comprised of the following steps. Initially, we assign two worksheets for each of the four dimensions we defined. The first worksheet will have a fourfold role, being simultaneously:

a) a repository for each dimension's KPIs maintaining required data (both for those implemented in MS Project and the rest)

b) the destination of several links, where raw data from various sources will update with fresh data.

c) a staging area where necessary calculations and data transformation will take place

d) the direct source for each dimension's dashboard, along with parameters that will control functionality and user interaction.

The second workbook of each dimension will implement visually and host KPIs as an enclosing dashboard.

Within each dimension's repository, we calculate a weighted average score to describe dimensions "health". This will be based on a weight value for each index, which will be defined parametrically and recognize KPI's contribution within its enclosing dimension.

Finally, we assemble these four scores (one from each dimension dashboard) and construct the ultimate dashboard as the upmost level of presentation, giving a high level insight about the project. Again, we will parametrically define significance of each dimension and calculate a weighted average score that will characterize the project as a whole, taking into account every constituent aspect of performance and contribution.

5.3 Normalization of KPI values

After assembling all necessary elements from different sources and calculating KPIs according to their definition, we come across another important aspect we have to deal with, which is data uniformity.

In order to compare and combine KPIs to reach a unified result of total performance, component values should be comprehensible in the common manner. However, due to their inherent meaning and definition, indexes denoting benefits are translated differently than those referring to costs, losses and negative performance. For the former, increasing values indicate more benefits and better performance, therefore, when we examine this category of KPIs we seek for higher values. For the later on the other hand, increasing values indicate worsening and lower performance. In that sense, KPIs are divided in two categories with separate approach in interpretation.

Furthermore, according to their definition KPIs most probably differ in their range of possible values as well as their lower and higher limits. For example, one KPI may range from -100% to 100% and another from 0 to infinity. These cases are incompatible for comparison.

To deal with these data uniformity obstacles, we apply normalization to KPI values, when necessary, in two steps. Firstly, we invert KPIs whose increasing value is inversely proportional with benefits, so that, a high or low score means the same for all KPIs. Secondly, we transform their scale of values to a common scale, ranging from 0% to 100%. This transformation takes place in a liner form according to the following formula:

‘Normalized Value’: (‘Original Value’ – ‘Lower End’) / (‘Upper End’ – ‘Lower End’) * 100

‘Normalized Value’: KPI score transformed in new scale from 0% to 100%

‘Original Value’: KPI score according to definition

‘Lower End’: Minimum value of KPI initial range

‘Upper End’: Maximum value of KPI initial range

In this way, all KPIs become analogous and easily comparable. Obviously, all these transformations take place in the backstage and only when we need to combine several KPIs to calculate the total performance of one dimension or the whole project. Otherwise, KPIs presented on dashboards retain their original scale and gradation.

Finally, within each dimension that we want to determine total performance, not all KPIs contribute the same as they don’t represent equally critical factors. To embody this concept in our model, we assign each KPI a weight of relative significance. Weights are then combined in calculation with their respective KPI values and we deliver a final result, as a weighted average of all dimension’s KPIs.

We also adopt the same approach for calculating the hyper KPI value of the total project performance. This total performance is a combination result from each dimension value. Again, it is quite possible not to assign equal significance to each of the four dimensions we defined in our model. Therefore, we also assign different importance (weight) to each dimension and in that way total project KPI is the weighted average of each dimension.

5.4 Basic Components of Implementation in MS Excel

There are certain points in time (snapshots) when all necessary data are collected in order to feed KPI repositories and perform calculations. All raw data and KPIs calculations associated with each status point, remain stored in repositories, so that we retain all historic data for future reference. Within each dashboard, we can refer to each project status point by selecting the appropriate time reference in a list control. Upon selection, each KPI is recalculated and graphic elements are updated seamlessly in the background to depict the correct values.

We have used various chart options in order to underline alternative options available. In order to enhance visibility and transparency, each graphic component on the dashboards, is accompanied by a small red pointer at the lower right end. When clicking on this pointer, we can navigate to the corresponding source table to see actual data. Also, there are similar pointers in every table of the repository worksheets that permit us to navigate the opposite direction, from data tables to the representation point on the dashboard. The central element in every dashboard is a performance “speedometer” that summarises each KPI performance and characterizes the whole dimension.

5.4.1 Customer Satisfaction & Stakeholder Management Dashboard (MS Excel)

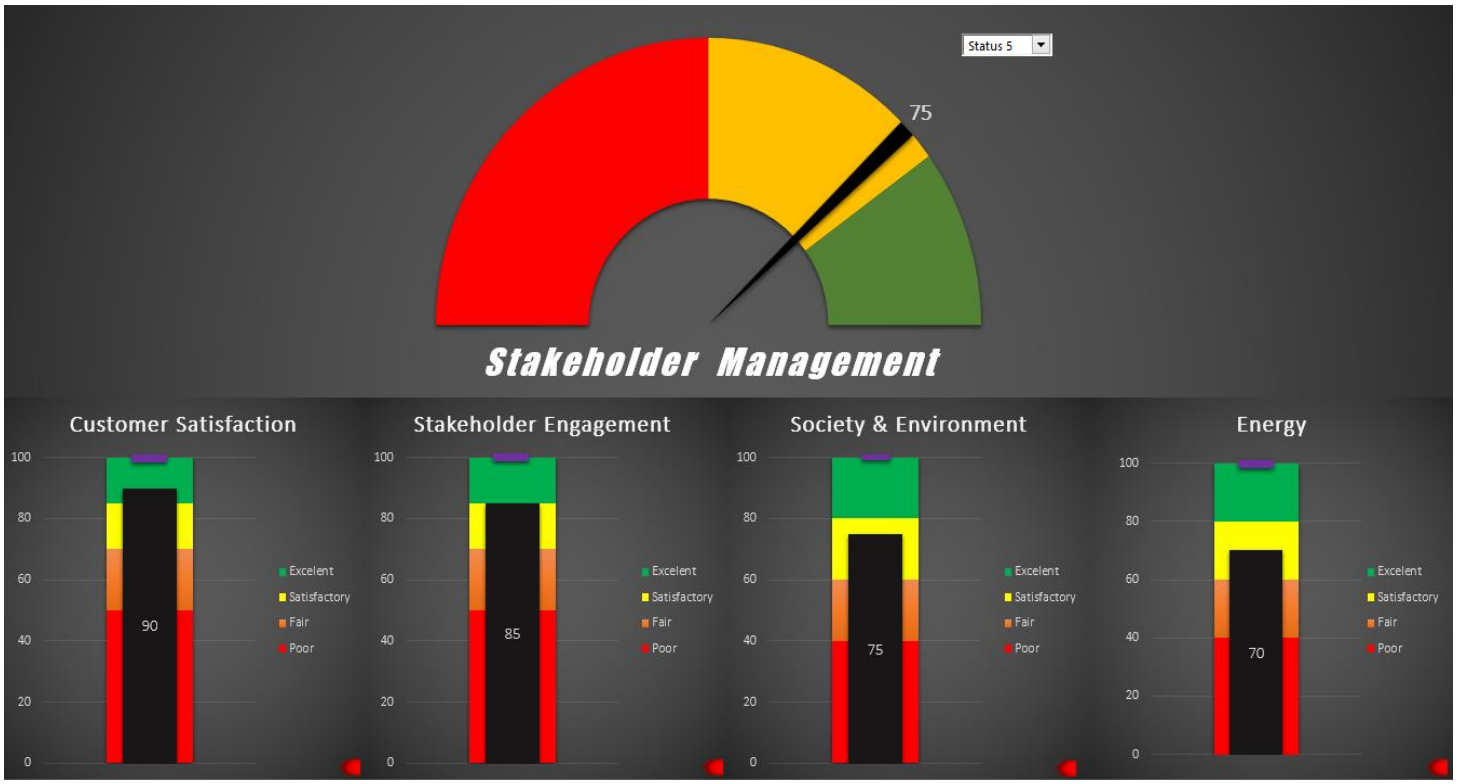


Figure 16 *Customer Satisfaction & Stakeholder Management Dashboard (MS Excel)*

5.4.2 Execution Performance Dashboard (MS Excel)

Figure 17 *Execution Performance Dashboard (MS Excel)*

5.4.3 Financial Results Dashboard (MS Excel)

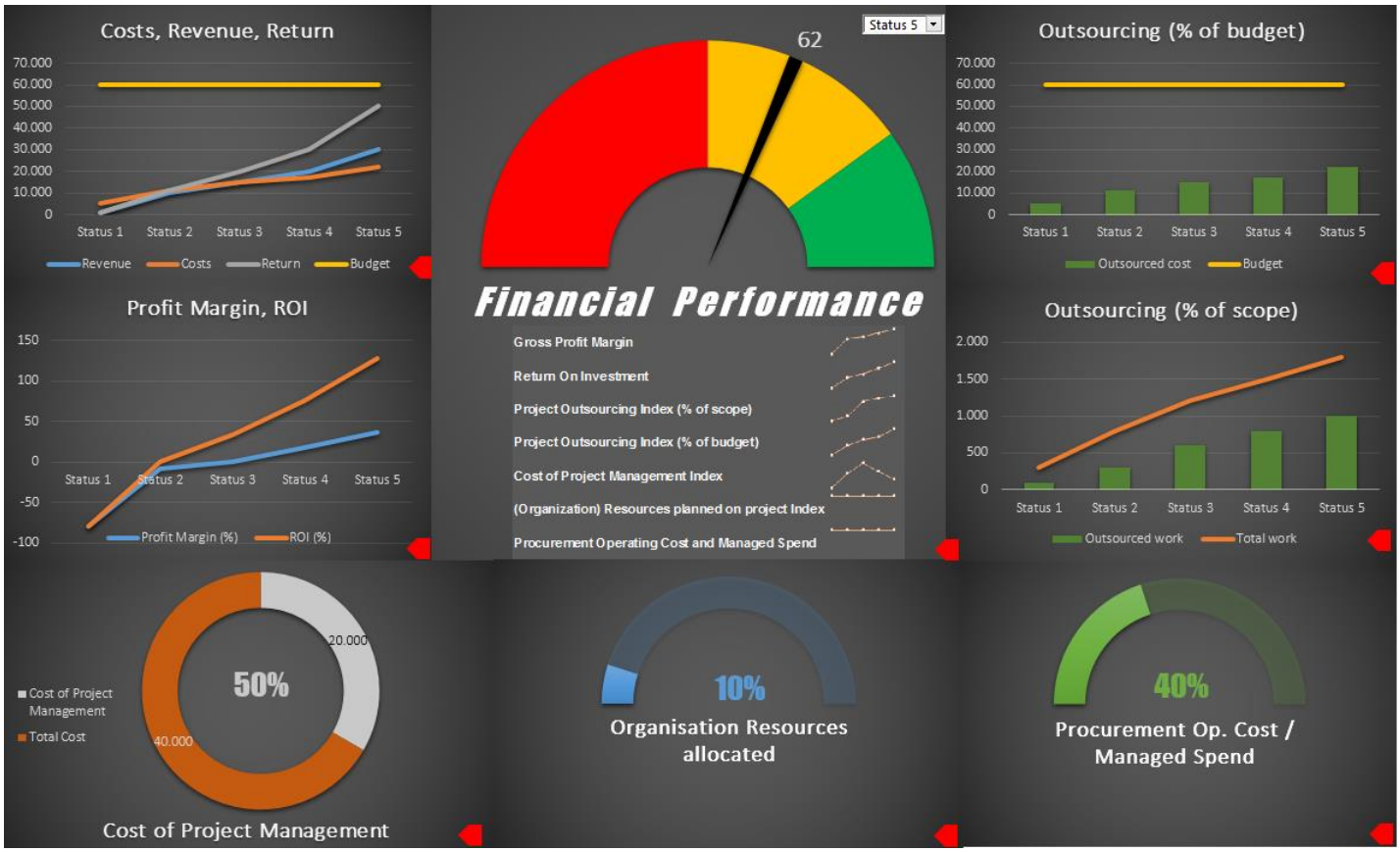


Figure 18 *Financial Results Dashboard (MS Excel)*

5.4.5 Process Efficiency Dashboard (MS Excel)

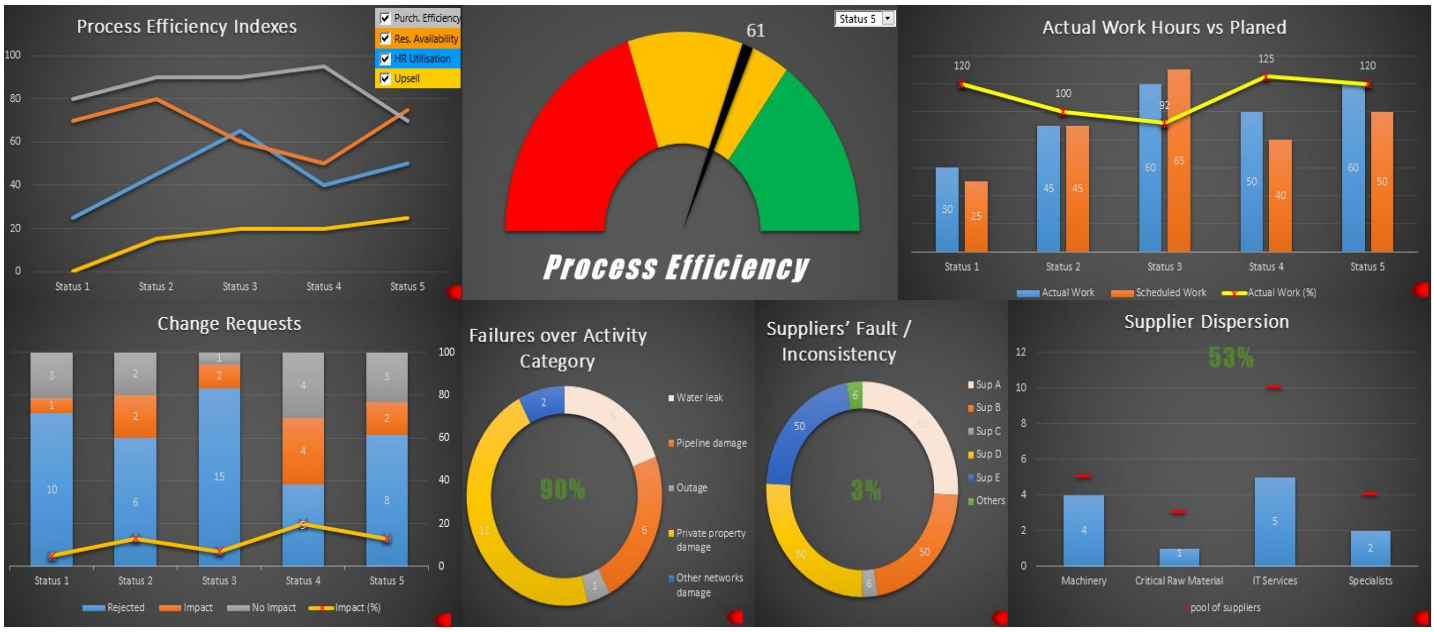


Figure 19 *Process Efficiency Dashboard (MS Excel)*

5.4.6 One Dashboard to rule them all

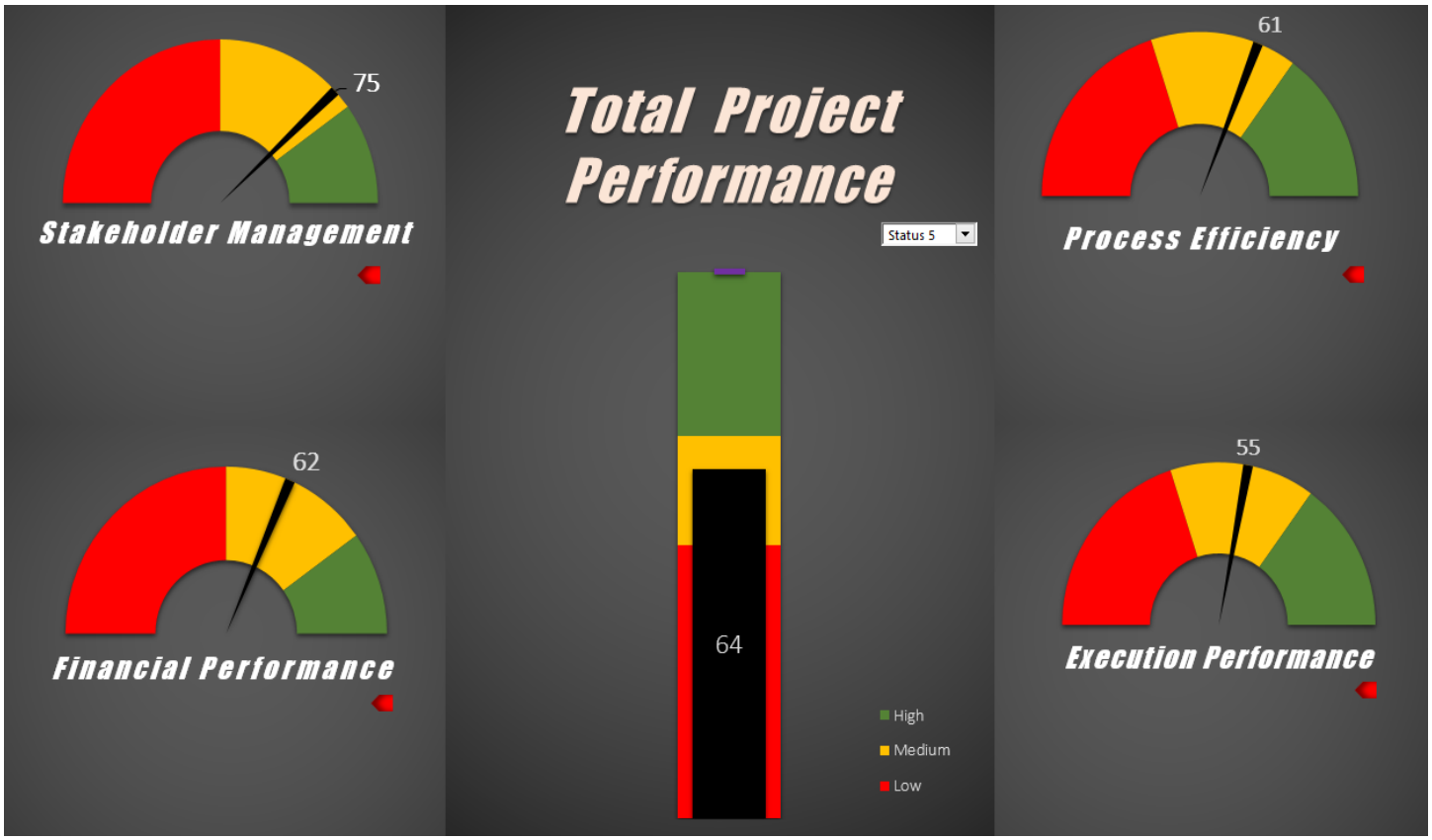


Figure 20 *Ultimate Project Performance Dashboard*

6. Conclusions

Beyond raw data, actual events, measurements and financial facts, this approach encapsulates a high degree of subjectivity. There are some widely used and commonly accepted KPIs, whereas others are sector specific, organization specific, even total unique and customized. However, it is the organizations' own responsibility to define, utilize and take proper decisions based on a certain set of KPIs that serves their interests best.

Raw data are subject to ETL processes from heterogeneous systems, therefore validation and normalization is of outmost importance. There might even be cases where input for KPIs is collected in very basic forms, like written text. Likewise, when raw data from different sources are processed simultaneously, this may not be feasible or formats may be totally incompatible. In most cases, we need to somehow adjust types and format of collected data in a common base for further processing.

When it comes to comparison or conjunction of several KPIs measurements, in order to deliver a meaningful conclusion, we should refer to the same point in time (snapshot). Also, when we have KPIs with different scales and logic, we have to transform them according to some normalization rules to enable further process.

Some aspects can be easily measured, while others cannot. This fact should not obscure our judgement on what we have to measure and communicate in order to facilitate proper decision making. Hence, business intelligence designed on KPIs should not be a tool for manipulating and misleading stakeholders.

Different recipients, require different levels of information and different forms of communication. Not every index may be of equal interest to every stakeholder. Dashboards' role is to highlight project's health under various perspectives. Also, to be able to customize and adjust the very same amount of information and present in a comprehensive, yet precise and clear manner.

Dashboard design should not fall in the trap of exaggerating and pretentious visualizations, obscuring a crystal clear message regarding the true status of a project. Neither dashboards should be overwhelming, cluttered excessive amounts of unnecessary and irrelevant information, defeating their purpose.

Different applications and tools are great for certain types of usage but less efficient in others. Flexibility and intelligent fusion, are important virtues for successful project management, especially in communication and stakeholder management.

Ideally, KPI scores should be accompanied with qualitative justification, shedding light on circumstances and adjacent factors that shaped numerical results. There is much interrelation in KPI analysis and no index should be examined merely in isolation. Project manager should be in position to thoroughly explain KPI logic and dashboard value, as well as clarify things, so that in the end, each stakeholder is in the same page and share a common understanding of the project's progress.

In addition to being measurable, KPIs need to be manageable too. Maintaining and analyzing numerous KPIs require time and effort, which is equivalent to resources allocation and additional cost. There is a tradeoff between number and variety of KPIs monitored from one side and efforts and resources needed in the other. A turning point beyond which, additional KPIs do not add more value to the project in comparison with the required cost and effort of maintenance. Therefore, we should be cautious and rational by tracking those and only those KPIs that really contribute to essential monitoring and proper decision making.

KPIs are rather dynamic than static administrative elements. Once defined and used within a certain context, they need regular supervision and validation whether they still serve their purpose or need to be updated or even to be completely suspended. After time of constant usage and results gathering and analysis, we should be in position to analyze historic information and evaluate each KPI contribution. The same holds for dashboards too. Recipients in this case are more and diverse, therefore it is essential to collect feedback and proceed with appropriate adjustments. Ultimately, KPIs and dashboards are volatile structures with uncertain life cycle.

Project performance measurement by using KPIs should be regarded by organisations more like an investment instead of a cost. Performance measurements are not for judgment and penalty impositions. Instead, they serve as timely triggers that prohibit from unwanted deviations and justify project need for continuation. In a broader perspective, they serve as learning tools and knowledge repository for future projects.

For a KPI based model of administration to succeed, it is crucial to acquire buy-in from most parts involved. Higher management must be convinced that the most effective set of KPIs is applied in each case. Involved departments, managers, employees and stakeholders should be

aware and supportive and constantly receive the right amount of information and updates regarding the progress of the project.

The described approach and accompanied model, with KPIs and dashboards, has been designed for project management. However, it is highly parametric and can be adjusted to serve as a template for other administrative activities that require measurement, monitor and control.

Project life cycle is a factor that may alter role and significance of a certain KPI, therefore it is important factor that we should take into consideration upon designing. Projects with predictive life cycles, permit for more distinct and unambiguous KPI's. This happens because project scope as well as the time and cost required to deliver that scope, are determined as early in the project life cycle as practically possible. Agile approach on the other hand which entail high levels of change and ongoing stakeholder involvement, will probably require modified measurements or interpret the same measurements in a different manner.

KPIs' scores and dashboards are not to substitute any kind of personal confirmation and project managers cannot rely blindly on them. Instead, they are valuable tools which support decisions in management. Measurements and findings have to be confirmed in person, in the same environment where actual events happen and activities take place.

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