FInest – **F**uture **In**ternet **e**nabled optimi**s**ation of **t**ransport and logistics networks

D2.4

INITIAL EXPERIMENTATION SPECIFICATION AND EVALUATION METHODOLOGIES FOR SELECTED USE CASE SCENARIOS

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Abstract

In phase II of the FI PPP, the purpose is to use scenario experimentation as a basis for evaluating the contribution of the FInest solution to improving collaboration and integration among business actors in the transport and logistics domain, and thereby business performance of the domain actors and supply chain performance.

The present deliverable D2.4 documents the initial outcome of Tasks T2.3 Experimentation Specification of the use case Scenarios, and T2.4 Evaluation Methodologies. After an introduction on the use cases and scenarios, and their role in the large-scale trials, the process and interrelation between the experimentation and evaluation are presented.

Thereafter, the scope of evaluation is presented, followed by a review of relevant evaluation theories and methodologies, and a proposal for generic FInest performance evaluation framework.

Finally, the experimentation specification of each of the five use case scenario is presented in accordance with the Experimentation Environment under design in WP4.

The next deliverable will present a final version of the experimentation specifications and the evaluation methodologies for the use case scenarios, as well as an experimentation plan for large scale trials.

Document History

Version	Date	Comments
V0.1	30/04/2012	Draft – deliverable structure
V0.2	23/08/2012	Introduction and scenario experimentation completed
V0.3	05/09/2012	Draft – methodology chapter
V0.4	16/09/2012	Final draft for internal review of Task 2.3
V0.5	23/09/2012	Final draft for internal review of Task 2.4
V0.7	25/09/2012	Corrections based on suggestions from internal reviewers
V1.0	28/09/2012	Deliverable submitted.

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Acronyms

Acronym	Explanation
EDI	Electronic Data Interchange
EE	Experimentation Environment
FI PPP	Future Internet Public Private Partnership
KPI	Key Performance Indicator
SCOR	Supply Chain Operations Reference
SME	Small- and Medium-sized Enterprise
T&L	Transport and Logistics

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1. Introduction

1.1. Background

The FInest project in the transport and logistics domain is one of the eight use case projects of the FI PPP Programme. Work package 2 is responsible for the specification of the use case scenarios adequate for experimenting FInest platform and future Internet technologies.

The Phase I of the FI PPP Program focuses on the description of the use cases and preparation for experimentation, while the Phase II serves to actually test FI capabilities and verify to what extent FInest addresses the challenges and needs of the domain. The experimentation of the scenarios defined in WP2 will enable the assessment of the FInest solution and of the potential improvement in supply chain performance and collaboration enabled by FInest.

The objective of WP2 during the period M13-24 is to prepare for this assessment. Ultimately, the business users of the FInest solution shall be able to make the following statements:

- "The FInest solution helps me to run my business better and more efficiently".
- "The FInest solution allows me to access new markets and approach new partners"

1.2. The Use Cases and Scenarios

The three use cases used as test ground in FInest are summarized in Figure 1 below. They correspond to three distinct logistics chains in which the FInest Domain Partners are central actors.

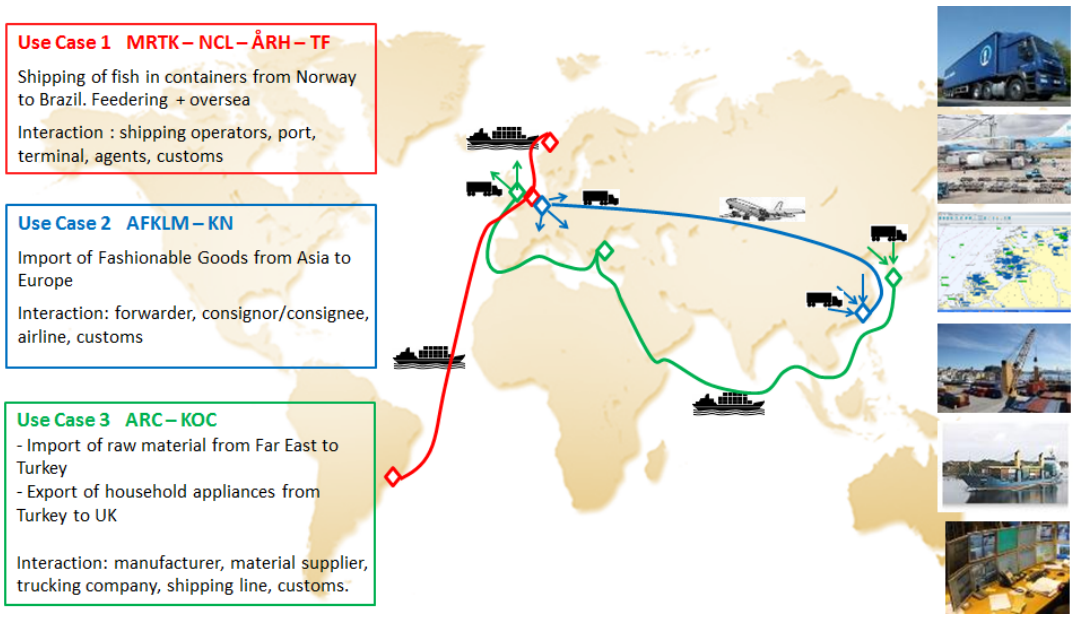


Figure 1: FInest's three use cases

The **period M7-12** has been focusing on identifying use case scenarios (identified in Task 2.2 and introduced in D2.3) for enabling the demonstration of Finest capabilities in real-life set ups. The five scenarios address most of the challenges identified by the domain partners and described in detail in D2.3. These are summarized in the table below:

To-be Scenario	Built on Use Case #	Main Challenges addressed
1 HANDLING OF LATE BOOKING CANCELLATION	UC1	Late booking cancellation Data exchange and quality
2 RESOURCE COORDINATION	UC1	Resource coordination at port Terminal Planning Loading and unloading scheduling Data exchange and quality
3 REAL-TIME EVENT HANDLING	UC2	Order Management Monitoring & Visibility of Shipments Deviation Management Data exchange and quality
4 E-PLANNING	UC3	Transport order creation Data exchange and quality
5 AUTOMATED SHIPMENT TRACKING	UC3	Cargo/shipment tracking Monitoring & Visibility of Shipments Data exchange and quality

Table 1: To-be use case scenarios

1.3. Purpose of the deliverable D2.4

Month 18 corresponds to Milestone 30 ("Initial experimentation specification completed"), and Deliverable D2.4 ("Initial experimentation specification and evaluation methodologies for selected use case scenarios"), which documents the initial outcome of Tasks T2.3 and T2.4.

- T2.3: "Experimentation Specification of Use Case Scenarios"

The M18 delivery includes a template for description of test scenario, and an initial description of the five scenarios so that they can be tested in the experimentation environment defined in WP4.

- T2.4: Evaluation Methodologies for Selected Use Case Scenarios

The M18 delivery includes an initial description of an evaluation system and evaluation criteria for assessing the business-relevant improvement for optimizing the integration and collaboration in T&L business networks enabled by use the FInest solution.

T2.3 and T2.4 are interdependent. Sub-goals include:

- Describe the use case scenarios in a way that they can be tested in the Experimentation Environment (in accordance with WP4: Common template)
- Refine the scenarios and described how the FInest solution is planned to be used (in cooperation with WP5-8: understanding the solution's capabilities and limitations)

- Define an evaluation framework for assessing improvements enabled by FInest.

The interaction between WP2 and the other WPs is illustrated in the figure below, showing the main alignment with WP4, responsible for the design of the Experimentation Environment in which the scenarios will be tested. The distinction between business user (perspective respresented by WP2) and tester (perspective introduced by WP4) is further described in Deliverable D4.3 (in section 2.4).

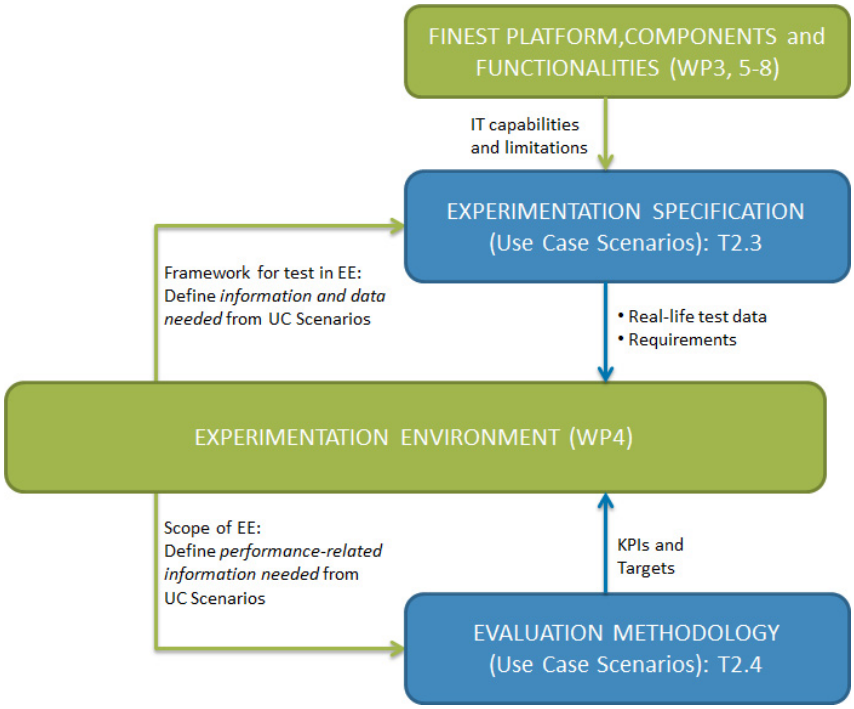


Figure 2: Interaction between WP2 and other WPs

1.4. Structure of the report

The Deliverable is structured as follows:

Chapter 1: Introduces the background and the purpose of D2.4

Chapter 2: Presents a framework for evaluation and experimentation

Chapter 3 Gives an overview of existing evaluations methodologies that are relevant for the evaluation of the use case scenarios

Chapter 4 Proposes an assessment of theoretical frameworks and alignment with FInest Performance Evaluation needs

Chapter 5: Describes an initial evaluation methodology for assessing business-relevant improvements enabled by FInest enabled new collaborations

Chapter 6: Describes the experimentation specification of each of the five scenarios

Chapter 7: Conclusion and next steps

2. Objective and Methodology Description

In the large-scale trials phase, the purpose is to use scenario experimentation as a basis for evaluating the contribution of the FInest solution to improving collaboration and integration among business actors in the transport and logistics domain, and thereby business performance of the domain actors and supply chain performance.

2.1. Objective of evaluation and experimentation

The goal of the evaluation, which is based on the results from the experimentation, is to (1) test FInest (whether new business processes are correctly supported), (2) verify how much FInest addresses the challenges and needs of the domain in terms of collaboration and integration, and (3) evaluate the potential improvement in corporate and supply chain performance enabled by FInest.

The development of the FInest technological capabilities are based on main assumptions regarding the role of collaboration and integration among business actors for achieving higher performance (ref. FInest Annex I "Description of Work", Part B), some of which are summarized below:

	Assumption/Envisioned improvement	**Problem**
Supply chain performance	• Collaboration and integration can contribute to goal congruence among business partners, thus improving alignment between individual and supply-chain peformance. • Improved collaboration among all actors in the supply chain leads to higher overall supply chain performance	SCP≠ individual corporate performances • Lack of integration of performance management across the supply chain. Individual and self-focused efforts for performance improvement leading to sub-optimal supply-chain performance • Integration requires collaboration among all stakeholders and across the entire supply chain
Corporate performance	• Improved interaction and collaboration among actors can lead to improvement in individual corporate performance for all actors • Facilitated EDI collaboration and improved information accessibility can contribute to better access to market for smaller actors.	• Many of today's challenges at process level are related to lack of communication, access to information, visibility, etc. (‘right information at the right time and right place’) • SMEs tend to be at a disadvantage because of the high level of service standardization in the T&L domain, but also face the difficulty of EDI integration with multiple systems of their various supply chain partners (limited investment capacity).
Transcorporate performance	Improved visibility and interaction can facilitate the development of new business models together with business partners.	Innovation in network depends greatly on effective communication among potential business partners.

The purpose of the evaluation is not to test assumptions, but assess the appropriateness of FInest to improve business performance. Therefore, a framework for evaluation has been established, based on these assumptions, in order to ensure that all relevant aspects of performance are

covered and linked together in a simple and yet in logical order. This is illustrated in Figure 3, which displays three levels of performance – supply chain performance, corporate (individual) performance, and transcorporate performance (collaboration and integration among business actors). The base of the three layers represents the effect of the FInest technical capabilities. It illustrates the potential contribution of the FInest capabilities to transcorporate, corporate and supply chain performance. The purpose of the evaluation will be to show where FInest is contributing to an improvement, both directly and indirectly. It is not expected that the use of FInest will contribute equally to all elements of performance, but from a business perspective, a complete picture of potential improvement is necessary for assessing not only fit-for-use, but also expected benefits.

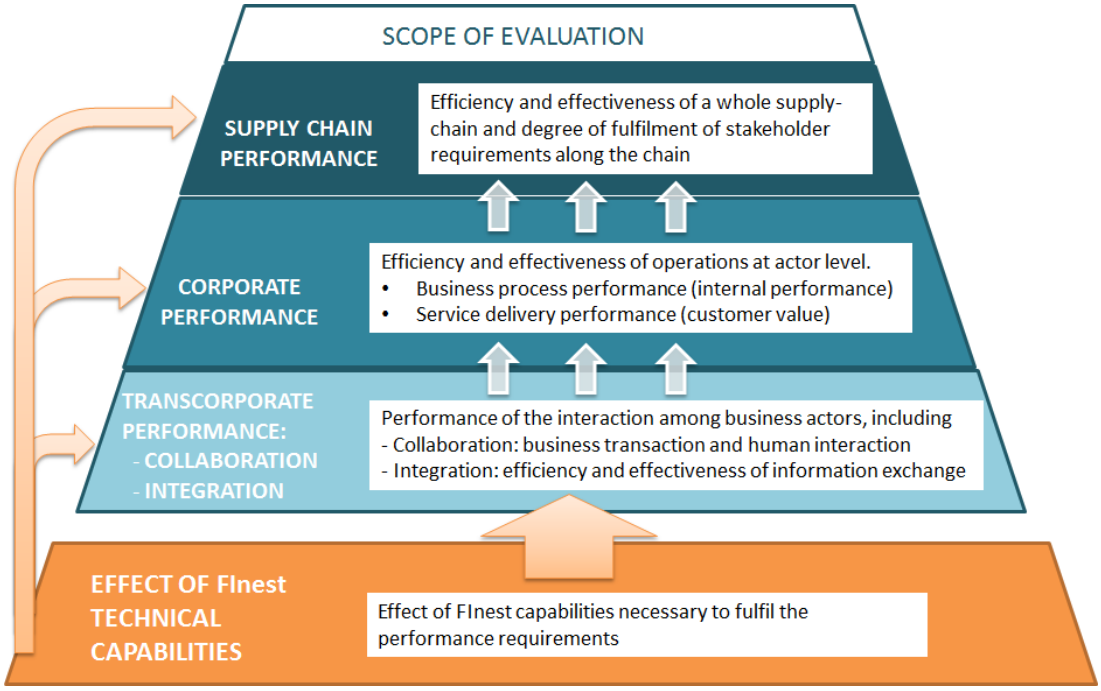


Figure 3: Scope of performance evaluation

This framework is further explained in the chapter 5.2.

2.2. Experimentation & evaluation process

The evaluation of potential performance improvement enabled by FInest will be based on the execution of use case scenarios (as defined in WP2) in the Experimentation Environment (EE), designed in WP4.

Several scenarios, including different contexts, expectations, set of KPIs, but also different configuration of variables, will be run/tested. From the perspective of the use cases (WP2), the evaluation will focus on two dimensions: *user acceptance* and *performance improvement*.

- **User acceptance** testing is "a form of testing to verify the system can support day-to-day business and user scenarios to validate rules, various workflows, data correctness,

and overall fit-for-use, and ensure the system is sufficient and correct for business usage" (Source: Bordo, 2010[1])

- **Performance improvement** assessment in FInest looks at the increase in business performance enabled by the use of the FIenst platform, measured as the difference between the performance achieved in the to-be scenarios compared to current performance.

Deliverable 4.3 presents the *experiment process* in the FInest EE, dividing it in four phases in which the roles of the business user and the tester are specifically defined: create test scenario, configure experiment, conduct experiment, and report. The c*reate test scenario* and the *report* phases are carried out by the business user, while the phases *configure* and *conduct experiments* are carried out by the tester (refer to D4.3 for further details).

From the perspective of the use cases, the *evaluation process* follows the same logic. Figure 4 illustrates the main steps.

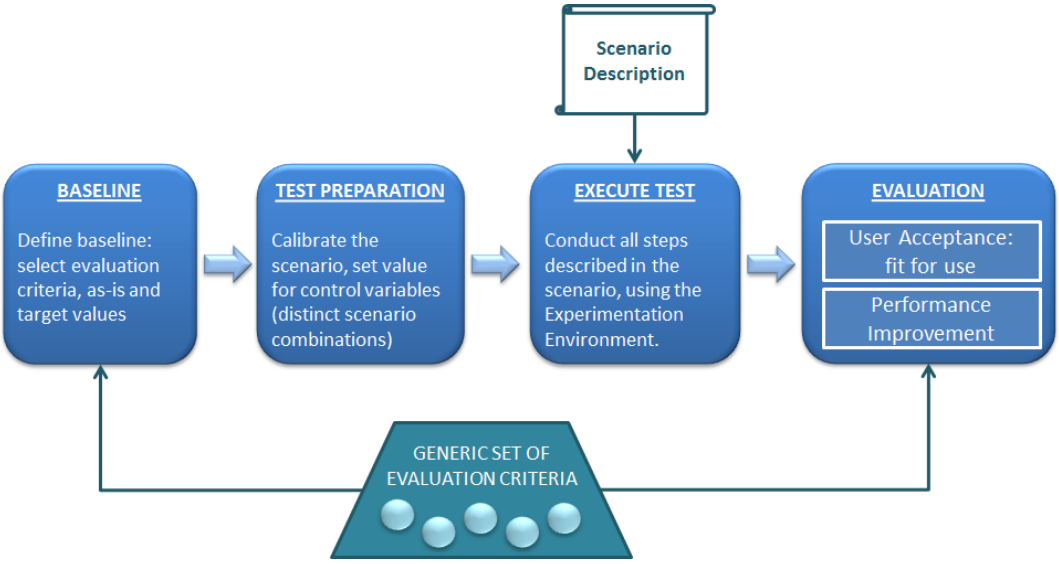


Figure 4: Basic description of experimentation and evaluation process

- **Baseline:** predetermining which performance criteria are of interest during experimentation and evaluation, and the current performance level.
  First, the scenario baseline must be defined. This includes the selection of a relevant set of evaluation criteria adapted to the given scenario, and selected from a pool of *general evaluation criteria (see next chapter)*. For each criteria, as-is performance description (a quantitative measure or a subjective assessment) will be provided (based on current practices). Furthermore, target values (a fixed figure, a percentage improvement, or a subjective description of desired improvement) will be set up.

- **Test Preparation:** configuring the experimentation environment in accordance with the scenario described. Before running each scenario test in the Experimentation Environment, *calibration* will be necessary. Indeed, to be able to explore improvement, distinct contexts and variants of scenarios will be used. The adequate set of data needs to be delivered so that the EE can be correctly set up for running the test.

[1] Bordo, V. 2010. Overview of User Acceptance Testing (UAT) for Business Analysts (Bas), A 60-minute webinar, Developmentor, March 2010

- **Execute test:** the scenario test is executed by a tester.All steps described in the scenario will be conducted/simulated using the FInest Experimentation Environment. The scenario description is provided in a written *scenario* to a tester, who refines it in order to make it executable in the EE. This step is described in detail in Deliverable D4.3, under step 2 (configure experiment) and step 3 (exceute experiment).

- **Evaluation:** assessment of the contribution of the FInest solution to improved collaboration and integration, and business performance.In order to assess whether FInest succeeds in addressing the needs expressed by domain actors, the evaluation will look at two dimensions:

  A. User acceptance: does the platform provide the functionalities, and the responses expected by the business user?
  Each step in the scenario will be checked to see if each business requirement (expectation about FInest capabilities to support the business processes described in the scenario) has been covered. This step is described in detail in the experiment process in D4.3.

  B. Contribution to performance improvement: performance improvement achieved in the to-be scenario.
  The test scenario (*to-be* scenario) will be assessed according to each evaluation criteria, and compared to the baseline (*as-is* performance) and / or the target value. The comparison will reveal a degree of improvement on multiple criteria (at transcorporate, corporate and supply chain level), in a given context (the scenario).

3. Overview on Evaluation Methodologies

In order to be able to develop an appropriate measurement methodology for proper evaluation of the business value and beneficial impact of the solution to be designed, reference projects and theoretical models are to be consulted and used for validation. These are presented hereafter.

3.1. Target for evaluation

As has been stated before, the evaluation refers to the business impact of the FInest solution on the actual processes in the domain, especially on those presented in the Use Case scenarios. More specifically, the evaluation process serves the goals of showing the capability of the FInest solutions and highlighting its benefits provided to the transport and logistics domain. This applies predominantly to the issues of collaboration and integration, but positive effects on corporate and supply chain performance are to be exhibited as well, covering important performance areas like cost, quality and environmental impact.

The evaluation is to highlight the considerable contribution of the solutions to be developed for the increase and improvement of collaboration and integration between different business entities (Transcorporate Performance) since such improvement is sought following the examination and analysis of current challenges in the domain (WP1) and in the selected Use Case scenarios (WP2).

Evaluation criteria are required for the proof of the usefulness of the solutions developed in the FInest project. These criteria must be designed in a way that show if the technology works towards the challenges and requirements that the different stakeholders have, including those of the individual companies (Corporate performance) as well as of the overall logistics domain (Supply Chain Performance). The two major requirements that are going to be supported by the FInest solution are collaboration and integration.

In order to generate viable evaluation criteria, the goals that the Future Internet technology should work towards should be identified. A practical starting point for identifying goals is the industry challenges that are observed in current situation.
It should be noted that the goals are not always universal since different stakeholder may have different goals, and these goals may sometimes even be contradictory or conflicting. Also, the goals identified for the overall system (Supply Chain performance) may also be in conflict with some of the goals identified for the individual stakeholders.
While the FInest project aims at creating technology that represents a better support for collaboration and integration of partners in the global transport and logistics domain (Transcorporate performance), the technology will need to evoke the feeling at each of the individual industry actors that the technology also makes improvements toward his/her very own challenges and goals (Corporate performance) in order to be easily adopted by the respective actor. So, the goals identified in the project work so far – collaboration and integration - both for the overall transport and logistics or supply chain process as well as for the individual stakeholders in the respective process stand in limelight in the evaluation of FInest.
Now that the most important goals are identified, KPIs that may be used to measure the improvements towards these goals should be found and defined.
The KPIs should be defined in a way that measures the effects of the FI technology without too much “noise” from other factors. They should also be robust against manipulation (e.g.

knowledge that a certain operation is measured may create an "unwanted" shift of focus towards that operation, thus generating skewed results).

Since an improvement in collaboration and integration and, thereby, ultimately in business/corporate performance and supply chain performance, will be the major argument in favour of the acceptance of novel solutions based on innovative technologies, the evaluation is to address exactly those aspects. From the view of corporate and supply chain performance, main areas shall be addressed by the evaluation process: *costs, quality* and *ecological impact*, which are three main relevant aspects for Transport and Logistics Services.

The reason for the confinement to this narrow array of performance areas is rooted in the general applicability to the domain and its adaptability to many different use case environments since they form a common problem throughout vast parts of the domain. The selected logistics-related key performance indicator should involve certain typical metrics, including cost and time, as well as service quality, but also the environmental impact. By focusing on these factors, the positive effect of improved collaboration and integration by means of the FInest solutions on corporate and supply chain performance can be illustrated.

Cost and **time** are two typical elements in supply chain operations since both are of the essence in logistics business. For a proper competitiveness, the participating actors must have the knowledge of the time of transit in certain locations in order to avoid delays in delivery which again are directly translated to operational inefficiencies. Such delay can also be costly and put you at an economic disadvantage. The longer the time of the delivery endures, the more costly the transaction and operation would become. So, cost is inherent in many businesses. For a logistics business to be competitive, it must minimize cost as much as possible. It must create shipping procedures that are quantifiable and that must be within the level of budget.

Apart from the time and cost perspectives, service **quality** are equally important to sustain and enhance the business. In transport and logistics, performance quality refers to the quality of service (on-time delivery) delivered as well as the way it is delivered (customer service)

The **ecological impact** of the processes cannot be neglected either since the importance of this factor has increased steadily over the past years. Not only due to strict legislation and fierce execution, but also because of the higher value for business initiation due to a stronger attention by customers, supply chain actors have to take the environmental effects of their actions and decisions into account.

Apart from the mentioned classic performance measurement, during the evaluation process, focus should be made on the issue of integrating small and medium-sized enterprises (SME) in particular. The measurement of these phenomena includes the concentration on aspects like interaction, communication and coordination and their positive effect on classic performance indicators. Besides, the integration of SME is caused by the better access of such small actors to formerly not disclosed parts of business initiation, esp. in large supply chain networks with many large and mighty actors.

3.2. KPIs in Supply Chain

The first task to be undertaken when considering the introduction of KPIs in the transport and logistics domain is to define the context in which the KPIs are to be used. The transport and logistics domain is characterised by several stakeholders (with different and in the worst case conflicting goals) and a range of different services that when combined constitute the supply

chain as a whole. In addition, there are several external factors affecting performance and potentially leading to a blurred picture regarding the interpretation of the KPI results.

Different requirements in the supply chain

In order to be able to define proper KPIs for a supply chain a gnosis is needed that KPIs must be defined by, and linked to, requirements. In a supply chain there are three primary sets of requirements:

- Overall requirements for the entire supply chain
  - Including the voice of the transport user/customer, society and other stakeholders
- Requirements per service performed in the supply chain
  - Normally derived from the overall requirements for the supply chain.
  - For the overall supply chain to fulfil the supply chain customer's requirements each service in the supply chain must fulfil a set of service-specific requirements.
- Service provider‘s internal requirements
  - Such internal requirements vary considerably between the different enterprises
  - Ensuring commercial sustainability for the service provider

The figure below depicts the relationship between these requirements.

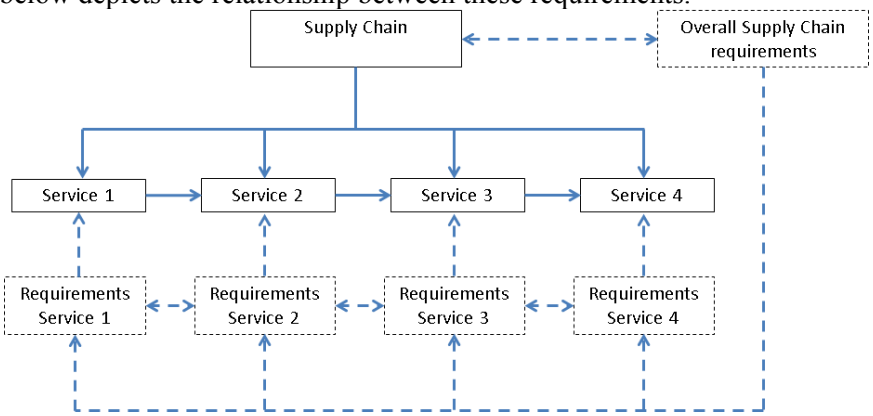


Figure 5 – Requirements in a supply chain

Overall requirements are imposed on the aggregate performance of the supply chain. This is what the customer sees: A black box of services fulfilling his/her needs from start to finish. Typical requirements will be related to lead time, costs, cargo volume, avoidance of delays, damages to cargo, and environmental issues such as carbon footprint, etc.

The customer generally does not care about how the individual steps in the supply chain are executed as long as overall requirements are fulfilled. The nature of the supply chain itself may impose restrictions as to whether all overall requirements can be fulfilled, hence the double headed arrow between the supply chain and the overall requirements. Such requirements can be codified in SLAs or further contractual agreements.

Once the overall requirements are agreed upon there is a need to define and agree on how the different services in the supply chain will have to perform to play their part in the fulfilment of the overall supply chain requirements[2]. Some of these service-specific requirements will be of the same nature as the overall requirements (such as cost, lead time and carbon footprint) while other requirements will be linked to the particularities of each service. In addition, each preceding and succeeding service will affect the requirements for the service in question and requirements may change on the basis of the actual execution of the supply chain (deviations from the plan).

[2] These requirements must not be confused with the service providers' requirements related to commercial sustainability

Once all requirements are agreed upon it is time to identify KPIs that express to which degree the requirements are to be fulfilled. It is in the nature of the concept of KPIs' that the selected KPIs will automatically create incentives: If a stakeholder is measured by a certain set of KPIs the stakeholder will aim at fulfilling these KPIs.

Benchmarking of supply chains

The first issue here is to understand what the benchmarks are to be used for. If the main focus is environmental friendliness, then focus should be on KPIs related to aspects such as greenhouse gas emissions, particulates, noise, etc. If the main focus lies on operational efficiency, then KPIs related to lead time, resource utilization and costs should be considered. There is nothing wrong about benchmarking several aspects jointly and simultaneously. Several projects have dealt with KPIs related to both environmental issues and operational efficiency, and this is more the norm than the exception. The crucial issue is to end up with nothing more and (as close as possible) nothing less than a set of KPIs that expresses what needs to be benchmarked.

The second issue is to make sure that the benchmarking process does not compare apples and oranges. It is more the rule than the exception that supply chains eligible for benchmarking do not share all the required attributes for direct comparison. This must be taken into account when designing the KPIs. An example will clarify: Considering a KPI measuring the total number of load units transported in a supply chain, it could be argued that the supply chain transporting the highest number of containers should be considered 'best in class'. However, if all supply chains do not have the same number of containers readily available for transport at the right place at the right time or rough seas increases the lead time from a port of loading to a port of discharge in one of the supply chains, the KPI does not express supply chain performance as such.

The third issue is to make sure that the KPIs are reported consistently across the relevant supply chains. This means that the KPIs must fulfil a certain set of validation criteria such as unambiguous definition, robustness against manipulation, measurability, etc. This issue is more related to the definition of the KPIs rather than their actual use.

Performance measurement in the transport and logistics domain

Referring to the typical KPIs in the transport and logistics domain, several different ways of categorization of the collected KPIs are possible.

Primarily, the collected KPIs can belong to different types, such as operationalization, motivation, target orientation, monitoring, and control, or areas (procurement production, distribution or disposal). Frequently, such KPIs are collected along different functions different functions, serving classic performance monitoring functions like operationalization, motivation, target, control, and monitoring. Also, they may represent different transfer functions (e.g. transport, storage, etc.), exhibit various degrees of compaction (local vs. global), as well as follow certain statistic forms, relate to different temporal dimensions (operative vs. strategic) and be generated in different directions (bottom-up vs. top-down). [UniKS 2010]

In general, logistics efficiency is said to consist of logistics performance and logistics costs while logistics performance is consolidated from performance volume, service level and quality and lead time. [UniKS 2010]

In today's practice, frequently collected logistics KPIs can be assigned to a certain area and follow a certain content structure. The respective area can be procurement, material flow and transport, warehousing and picking, production planning and scheduling, or distribution, whereas the content structure may refer to indicators directed at structure & framework, productivity, profitability, and quality. [Berndt 2008]

Speaking of generic performance measurement, there is a widely-spread differentiation of leading and lagging performance indicators.

Leading KPIs mainly refer to future developments and their drivers/causes (performance monitoring used for prediction) whereas lagging KPIs mainly refer to past developments and effects/results (historical performance analysis). Moreover, leading KPI are often related to the beginning of a value chain and provide a direction about which lagging KPIs require higher attention while lagging KPIs are often related to the end of a value chain and frequently relate to a monetary view on a performance and its results. [Gotts 2009, Smith n/a] Leading indicators are task-specific metrics and mostly indicate progress statuses whereas lagging KPI are result-oriented and are generated after one or several processes have taken place in order to make a statement about their final quality. [Smith n/a]

Conclusion:
Some basic tasks to conduct for identifying KPIs include:
> Identify requirement and translate into measurable goals.
> Identify KPIs that express to which degree the requirements are to be fulfilled
> Clarify the main purpose of the benchmark and select those KPIs that necessary
> Make sure the measures are not affected by additional factors during the measurement
> Clarify the type of KPIs to be used and the eventual causality among them (leading/lagging)

3.3. Performance measurement in the transport and logistics

Defining performance

Logistics research is frequently defined as the systematic and objective examination and analysis of information which again are relevant to the identification and solution of any problem in the transport and logistics domain. A large portion of logistics research, thus, is conducted around the proposition that a relationship exists between a particular set of actions and logistics performance or effectiveness. [cp. Chow et al. 1994, p. 17] However, the term performance is not uniformly defined in the research community but leaves plenty of room for interpretation, ranging from a pure measurement of profits to an orientation towards customer service or sales maximization. Accordingly, measuring performance is difficult since goals may be conflicting and the measures themselves have to be differentiated between hard (i.e. quantitatively measurable) and soft ones (i.e. qualitative measures).

Research papers refer to the term performance (or performance quality) either as a hard factor, such as vendor performance (including lead times, variability, fill rates and total purchases), or as a soft measure like quality (meaning total customer satisfaction, on-time deliveries, or reduction of cost of quality), logistics performance (i.e. length of promised cycle times, performance in meeting delivery dates, fill rates on in-stock items, or forecasting accuracy) and logistics efficiency (which highly varied regarding its actual content). [cp. Chow et al. 1994, p. 18, 19]

In order to be able to generically address the diverse challenges and the multitude of goals both in the transport and logistics domain and the Use Case scenarios of the FInest project, the general term “performance quality” is selected as a major performance measure and adapted and custom-designed to the requirements of the respective area of interest of a Use Case scenario. The quality of a performance may be determined by its mere results, but also by its effectiveness and efficiency.

A comprehensive performance measurement – like the one envisioned for the FInest solution – should this take into consideration. Moreover, the performance evaluation should be able to represent the large majority of the domain, if not the whole. This can be realized by covering above-mentioned categorization of KPIs largely. [UniKS 2010]

Logistics controlling in today's business

A recent study in Germany has highlighted the role of logistics controlling in the transport and logistics domain, concluding that there is actually a strong focus on logistics controlling and performance measurement. It can be stated that the role of logistics controlling has gained in importance and care among all supply chain actors, regardless of whether consignor or logistics service provider. Predominantly, financial figures are carefully watched whereas process-oriented developments have started to become monitored in a closer manner. However, the customer orientation and the monitoring of risks are underrepresented in many companies although both can be integral parts of supply chain performance evaluation. [Weber et al 2012, p. 42, 43]

Oftentimes, there is a too strong focus on financial performance indicators neglecting process- and customer-related aspects and, thus, not representing the actual condition of a performance. A focus on financial indicators may not reveal all potentials and risks evolving from a process and its performance. [Weber et al 2012, p. 42]

In general, the collected performance indicators (and the entire performance measurement system) require a high flexibility to incorporate changes in the dynamic environment they are situated in. According to the outcomes of the study, limited flexibility is enabled in most performance measurement systems only. [Weber et al 2012, p. 43]

The continuous use of operative performance indicators and their wise consolidation to strategic KPIs is of high importance both towards the internal organization and the external environment of a company. Nowadays, such consistency is not always given in the companies' performance measurement systems. [Weber et al 2012, p. 42]

Even worse is the situation of performance monitoring and measurement across company boundaries since a confinement to the very own processes and performance leads to suboptimal results and, thereby, prevent a holistic optimization of a supply chain. [Weber et al 2012, p. 42, 43]

Another topic of the study was about providing performance indicators promptly allowing supply chain managers take immediate action in case of deviation or emergency. Today's managers do have a wide range of (nearly) real-time indicators at their disposal. However, the huge quantity of indicators often needs to be cut down to the most crucial ones. [Weber et al 2012, p. 43]

Conclusion: In the FInest performance evaluation, the supply chain-oriented evaluation on an actor's performance, the focus on non-financial indicators and the consistency across various consolidation levels are important features to be included.

3.4. Reference projects

Further influences on the development of an evaluation methodology for the FInest project – and the Use Case scenarios therein – stem from the following projects related to evaluation and performance measurement in the domain, which have been examined and considered as worth being incorporated in the FInest approach.

Shipping KPI

Shipping KPI is a project that proposes a global shipping industry standard for defining, measuring, and reporting information on operational performance in order to boost performance improvements internally in companies engaged in the ship operation activities and provide an

efficient communication platform of ship operation performance to internal and external stakeholders.
The Shipping KPI Standard is built up hierarchically with 7 Shipping Performance Indexes (SPIs), 34 Key Performance Indicators and 66 Performance Indicators (PIs). This hierarchy is shown in Figure 6.

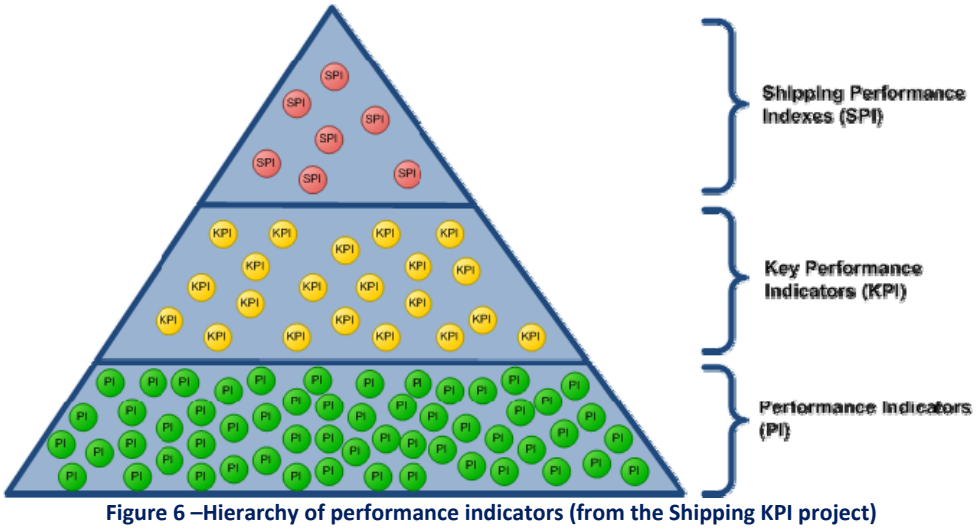


Figure 6 –Hierarchy of performance indicators (from the Shipping KPI project)

There is a mathematical relation between the high level SPIs which are calculated from Key Performance Indicators, and KPIs which are calculated from Performance Indicators. The PIs are based on data capture (measurements or counters) directly from a vessel or from the shipping management. The KPIs are scaled into a range from 0-100, where zero indicates unacceptable and 100 is outstanding performance. This makes it possible to compare vessels with different characteristics or amounts of data captured. The KPIs are then combined into Shipping Performance Indexes in order to express performance within specific areas.
While the Shipping KPI project has a focus on performance indicators for ship operation, it is expected that experiences with, and methods for, designing KPIs from the Shipping KPI project will be useful for generating evaluation criteria for the experimentation in the use cases in the FInest project.

LogiBEST
LogiBEST was a German national project in which the logistics performance of manufacturing companies has been made able to be described, measured and evaluated with the help of standardized performance indicators. The results in the project have also been compared with other companies as part of a benchmarking process (utilizing a catalogue of performance, cost and structural indicators as references). By this, a comparison of a company's performance with other industrial companies and a comparison with thresholds have been facilitated. [Cieminski 2004]
The definition of the individual indicators and their regulations regarding data collection and measurement has resulted in the issue of 'VDI 4400', an official guideline of the Association of German Engineers (VDI) for logistics indicators. So, LogiBEST has become a method for benchmarking logistics performance in procurement, production, distribution and even cross-company supply chain environments. As the focus in the project has been laid on SMEs with scarce resources, the method can be applied with little effort and time. [Gühring 2012]

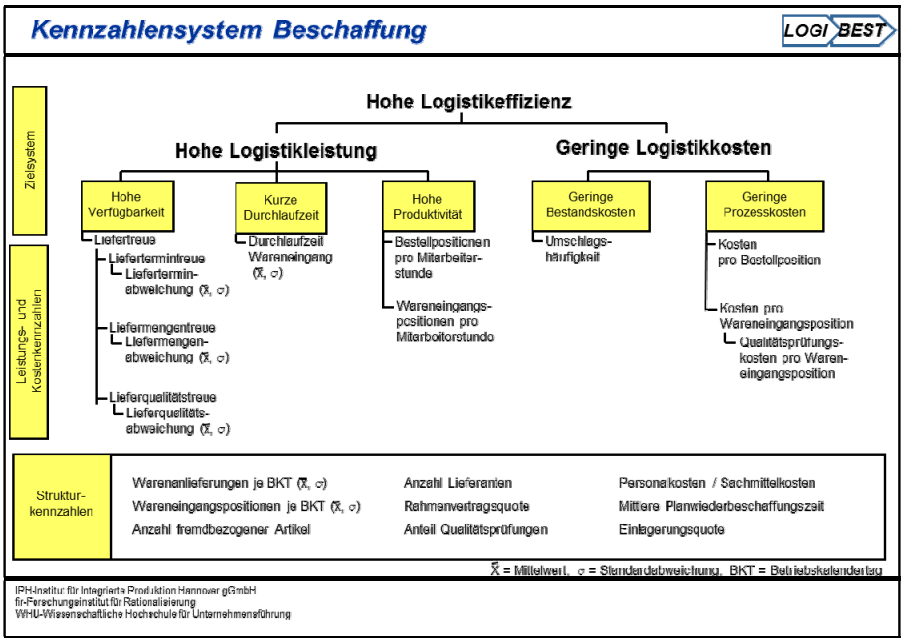


Figure 7 – LogiBEST Performance Indicator for procurement [Cieminski 2004]

For the FInest performance measurement, the VDI 4400 guideline will be analyzed and the appropriate indicators and their composition methods incorporated. Especially, the supply chain orientation of some of the indicators can be useful for the purpose.

SHAPE

SHAPE (Semantically-enabled Heterogeneous Service Architecture and Platforms Engineering) is a European Research Project under the 7th Framework Programme that developed an infrastructure for model-driven engineering for service-oriented landscapes. The technologies were tested, demonstrated, and evaluated by two industrial use case partners.

In SHAPE, the demonstration of technology concepts stood in the focus, esp. for consideration and further assessment for future real-life implementations. [Elvesæter et al 2010]

A challenging task of the project consisted of evaluating software w.r.t. its suitability for the envisioned scope of activity. Therefore, the system needs to be evaluated whether the offered solution actually works and really "helps to improve current IT infrastructure" [Elvesæter et al 2010, p. 8] For conducting the Technology Feasibility Study, the project developed a set of Performance Measures for assessing whether the technological innovations designed in the project fulfil the business challenges identified in the use case scenarios. So, "SHAPE is based on design science, whereby existing theories, methods and artefacts are incrementally improved based on analysis of current problems and defects identified in previous research and real-life cases." [Elvesæter et al 2009, p. 10]

The assessment of the technological innovations by means of a viable performance measurement required quantification or a qualitative assessment in order to express something meaningful about the technologies. In this regard, typical questions are like: *To what degree (in %) is the process x by use of y improved?*. In general, "this is not an easy question to answer and is quite often a complete project with a lot of effort on its own." [Elvesæter et al 2009, p. 20]

The performance measures and evaluation approaches are illustrated in the following figure. The performance measures (in the middle) are designed for achieving a set of goals. These goals are defined based on the business challenges (left hand side), and used to assess the technological innovations (right hand side).

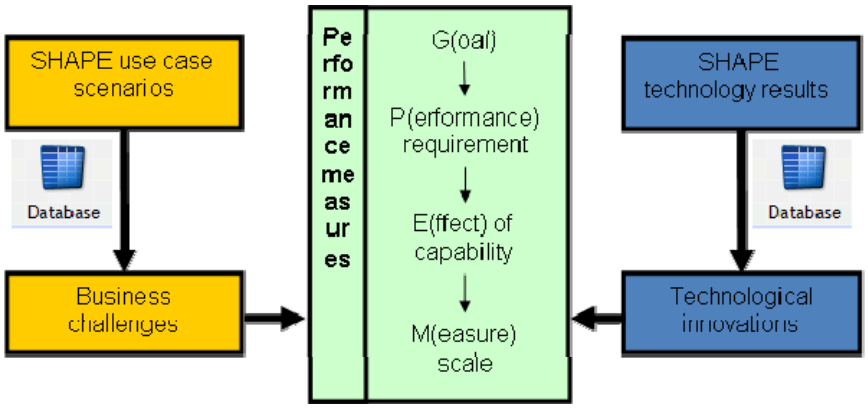


Figure 8 – Performance Measures development and application in the project SHAPE

Each performance measure is composed of a number and a unit of measure ("Measure Scale"). The number provides a magnitude (how much) and the unit gives the number a meaning (what). Performance measures are tied to a goal, and to performance requirements for achieving this goal, by enabling the measurement of the effect of a capability necessary to fulfil any performance requirement. The project has adopted adequate techniques in order to define performance measures for assessing technologies in later development stages.

Conclusion:
These three very distinct projects provide valuable insight for the development of a evaluation methodology for FInest.
> Shipping KPI provides a solid example of how to define KPIs and a KPI hierarchy.
> LogiBEST offers a useful method for benchmarking logistics performance.
> SHAPE offers a very relevant method for measuring the effect of technological capabilities on solving business challenges.

4. Theoretical Frameworks relevant for FInest Performance Evaluation Needs

Apart from today's practice, there exists a bunch of performance measurement and evaluation methodologies in the transport and logistics domain and the supply chain environment, respectively. After having examined many of these, some of the major and most relevant measurement and evaluation methodologies are to be presented briefly hereunder. Many of these are to be referred to and used for the fine-tuned development of an evaluation of the FInest solution with respect to the performance improvement enabled and its general impact, e.g. on the effects on flexibility or the business conduct.

4.1. Adapting the Balanced Scorecard concept to the needs of supply chains

The Balanced Scorecard concept, which has been developed by Kaplan and Norton at Harvard University in the United States in the early 1990s, is a controlling tool which is used for application or operationalization of strategies into business goals and pertaining action and consists of four steps for implementation. After translating vision and business strategy into operational goals and defining targets and indicators for the respective goals, measures to achieve the goals are to be developed and, eventually, the cause-effect relationships to be visualized. [Alicke 2005a, p. 193 – 195]
Exactly these cause-effect-relationships within the supply chain network are to be taken into account when adapting the Balanced Scorecard concept to supply chains and their respective requirements. [Alicke 2005a, p. 193 – 195; Stölzle and Bachmann 2006, p. 3 – 6]
That means the supply chain strategy needs to be broken down to goals and measures in every process section and of every supply chain partner which again may happen via a common decision-making process (referred to as heterarchic coordination) or by a target set by the dominant supply chain partner (nominated as hierarchic coordination). Moreover, it may make sense for the effective adoption of the Balanced Scorecard in a supply chain environment to extend the classic four perspectives (finance, processes, customers and potential) by a fifth one, cooperation, and introducing transcorporate performance indicators (besides individual company performance indicators). [Stölzle and Bachmann 2006, p. 3 – 6] Transcorporate performance measurement is further explained later in this chapter.

The philosophy of the Balanced Scorecard - e.g. breaking down an overall strategy to operationalized and measurable goals, as well as monitoring various features such as both financial and process-related indicators, and the structured approach towards it - can be transferred to the design the FInest evaluation framework.

4.2. Evaluating with the help of SCOR process model and performance metrics

A major approach to be considered for the determination of an appropriate evaluation methodology for the FInest project is the Supply Chain Operations Reference (SCOR) model.
Optimizing global value and logistics chains is an important prerequisite for ensuring competitiveness of business enterprises nowadays. Apart from transcorporate integration of suppliers and customers (see next chapter), the internal integration of material and information flow within an organization across divisional boundaries and regions pose a major task. The global availability of logistics data, such as orders, stocks and supplies, can be assumed. However, such data contain information about the business processes and operative course underneath, which again have experienced historical reasons and undergone local optimization. According to the philosophy of supply chain management, such optimization does not automatically lead to a global optimum for the company or even the entire supply network. Frequently, the objectives of local optimization initiatives are even contradictory to each other. A holistic and systematic business process improvement scheme thus requires an interdisciplinary team with process participators along the whole chain. The ultimate goal of process analysis and change is the increase in delivery service level and, simultaneously, the reduction of logistics costs and current assets. So, the communication between the process participators and the correct as-is process analysis are of essential importance. For this reason,

the SCOR model represents a viable reference model for the generalized description of processes. [Krissmann et al 2012]
Generally, the SCOR model – illustrated in the Figure 9 on next page – is known as a business management approach including various management processes and process focuses, best-practice recommendations for these and skills requirements and training contents to achieve excellence therein. Moreover, there exists a standard metrics to measure process performance that helps to follow up the processes and their quality level. [Alicke 2005a, p. 185; Stölzle and Bachmann 2006, p. 6, 7; Mayer et al 2010, p. 2]
The SCOR Model is said to have been developed with the aim of standardizing actions in a supply chain and enabling the consistent description of these actions by all involved individual partners along the supply chain. The working process resulted in a normative business process reference model providing a standard methodology for the description and analysis of supply chain and all its aspects. Generally, the difference between a process reference model and a typical process decomposition model is that the latter addresses one specific configuration of the process and its process elements. Contrarily, a normative model consists of predefined alternatives and describes how an element or object of the model is to be seen and acts. Hence, modelling becomes much easier due to the higher abstraction level used in such normative models. [Mayer et al 2010, p. 3, 4]

First level of SCOR model, also called Top Level, defines both scope and content of a supply chain. Therefore five process categories are specified briefly in the following:

- *Plan*: "contains processes which balance demand and supply regarding material procurement, product divisions and sales department, [e.g. evaluating supply chains, defining material, identifying demand requirements, or planning inventory. Apart from that,] the infrastructure of planning has to be defined at this stage, such as decision-making in terms of make-or-buy or commodity structure." [Mayer et al 2010, p. 21]
- *Source*: includes "processes that procure goods and services to meet planned or actual demand are of this process type. This includes, for example, the comparison of alternative sources of supply to assure supply guarantee in companies." [Mayer et al 2010, p. 21]
- *Make*: consists of such processes that transform a product to a finished state in order to meet planned or actual demand. Therefore, production processes have to be adjusted with their interfaces because a high quality of the products is essential for ensuring highly satisfaction among customers. [cp. Mayer et al 2010, p. 21]
- *Deliver*: comprehends "[a]ll processes that provide finished goods and services to meet planned or actual demand […]. Order management, transportation management and distribution management is typically included. Again final satisfaction of customer satisfaction plays the major role." [Mayer et al 2010, p. 21]
- *Return*: covers all processes "[w]henever goods are returned, either from suppliers or customer point of view, one of the processes out of this process category is needed. This core process covers both return of resources to suppliers and receipt of defective products from customers. Last-mentioned activities are united in the so called process category 'Deliver Return' on SCOR model's level 2, whereas first one belongs to process category 'Source Return'." [Mayer et al 2010, p. 21]

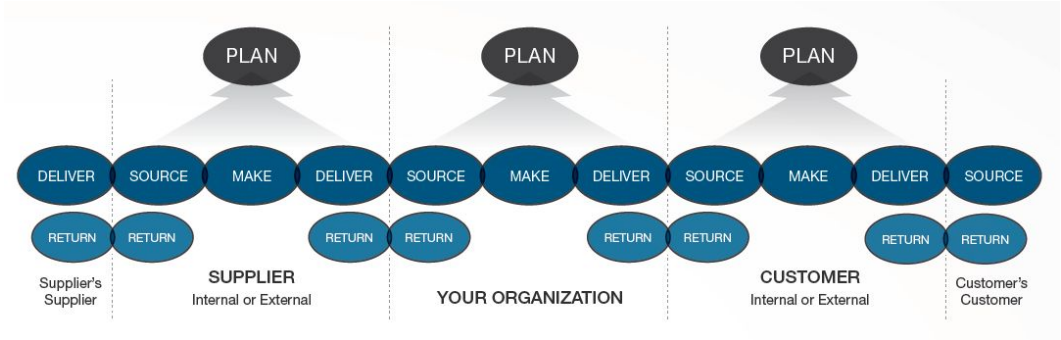


Figure 9 – SCOR model [cp. SCC 2010, p. 7]

Roughly, the SCOR metrics are composed of eight core attributes relating to supply chain performance. Furthermore, three dimensions underlie these eight core attributes. The three dimensions are attributes facing the customer, the ones facing internal use and those facing shareholder interests. To the first dimension belong the attributes 'delivery reliability', 'supply chain responsiveness', and 'flexibility & agility with respect to customers and suppliers' whereas the attributes 'costs occurring in the supply chain' and 'efficiency of asset management' are related to the second dimension. In addition, 'profitability of the supply chain', 'effectiveness of return', and 'share performance' is assigned to the third dimension. Especially, the first two dimensions and five core attributes form the so-called SCOR metrics whereas the third dimension and the residual three core attributes are not found consistently in literature. [cp. Alicke 2005a, p. 185; Stölzle and Bachmann 2006, p. 6, 7 ; Mayer et al 2010, p. 2]
Basically, an attribute can be decomposed into several single performance metrics so that – eventually – a group of single performance metrics form an attribute and, in a wider sense, a dimension. [cp. Bolstorff 2002, pp. 22-25]

The following five performance attributes belong to the SCOR performance metrics [cp. Mayer et al 2010, p. 33; Stölzle and Bachmann 2006, p. 6, 7]:

- *Supply Chain Agility* (AG): Information about if and how fast a supply chain responds to marketplace changes is being collected with this attribute.
- *Supply Chain Responsiveness* (RS): Information about the speed at which a supply chain provides products to the customer is being collected and recorded with this attribute.
- *Supply Chain Asset Management* (AM): supply chains can be analysed in terms of effectiveness in asset management and thus, demand satisfaction, with the help of this attribute.
- *Supply Chain Cost* (CO): All costs which incurring along a supply chain process is to be taken into account.
- *Supply Chain Reliability* (RL): This attribute looks at performance in product delivery and addresses topics such as whether the product, the place, the time or further features are correct.

Performance Attribute	Performance Attribute Definition	Level 1 Metric
Supply Chain Reliability	The performance of the supply chain in delivering: the correct product, to the correct place, at the correct time, in the correct condition and packaging, in the correct quantity, with the correct documentation, to the correct customer.	Perfect Order Fulfillment
Supply Chain Responsiveness	The speed at which a supply chain provides products to the customer.	Order Fulfillment Cycle Time
Supply Chain Flexibility	The agility of a supply chain in responding to marketplace changes to gain or maintain competitive advantage.	Upside Supply Chain Flexibility
		Upside Supply Chain Adaptability
		Downside Supply Chain Adaptability
Supply Chain Costs	The costs associated with operating the supply chain.	Supply Chain Management Cost
		Cost of Goods Sold
Supply Chain Asset Management	The effectiveness of an organization in managing assets to support demand satisfaction. This includes the management of all assets: fixed and working capital.	Cash-to-Cash Cycle Time
		Return on Supply Chain Fixed Assets
		Return on Working Capital

Figure 10 – SCOR metrics [cp. Bolstorff 2002, pp. 23]

To summarize, SCOR can contribute considerably to the mapping and analysis of critical processes along with their cost quantification and the identification of improvement and savings potentials creates a new level of transparency. [Krissmann et al 2012] Especially, the proposed approach could be the base for the design of a framework for measuring and evaluating the impact of the FInest solutions on the transport and logistics domain and the FInest Use Cases.

4.3. Extending the view on transcorporate performance measurement

Many performance evaluation methodologies focus on the individual company, and the few supply chain-oriented performance measurement methods often represent an aggregation of individual performance results. Hence, novel approaches for performance measurement methodologies across company boundaries must be sought, taking the interdependencies and synergies between the different supply chain actors and their respective performances into account.

One approach is suggested in a report from the University of St. Gallen, Switzerland, on **performance measurement in international value chains**, which is shortly presented here.

Multi-organizational performance is often considered as an addition of the individual performance measures of the isolated process sections, disregarding interdependencies and synergy effects between the different actors along the chain. However, the sum of the individual supply chain performance measures may not necessarily lead to the overall supply chain performance since additional effects may play a role. Frequently, the local optimization of the individual supply chain partner may lead the supply chain network to deviation from their global supply chain optimum. [Stölzle and Bachmann 2006, p. 1, 2, 9 – 11]

Especially consignors – in their role as the major process owners of large supply chain process – value an integrated view on the entire supply chain and on the overall end-to-end performance, which again requires both information availability and control capability across company boundaries. [cp. Stölzle and Bachmann 2006, p. 1]

Consequently, classic performance measurement focusing on the individual company must be expanded by connecting the various performance measurements and analysing transcorporate interdependencies.

One model in the afore-mentioned report is the so-called **'integral model of transcorporate performance evaluation'** which is an extension and adaptation of the SCOR model for a transcorporate performance measurement in supply chain networks. [Stölzle and Bachmann 2006, p. 8 – 10]
The model envisages an integrated framework for supply chain management, mainly consisting of common business procedures and methods for all participants and stakeholders in the value chain. Moreover, it utilizes the different corporate performance indicators with respect to quality, costs, delivery, flexibility and possibly even further aspects. Both serve and feed the integral model for transcorporate performance measurement which consists of two parts. The first one deals with 'enablers' and comprises generic performance indicators of transcorporate logistics, mainly belonging to the fields of cooperation, coordination and flexibility and allow for a statement about the degree of collaboration, transparency and trust in the value chain. The second one deals with 'results' and incorporate aggregated performance indicators of the respective corporate logistics performances, which are generated by consolidating the individual measures to network measures. [Stölzle and Bachmann 2006, p. 8, 9]
However, one has to take the limited applicability of the model in some real business environments into account because certain processes and process sections are oftentimes strongly predetermined by the consignor, leaving no room for flexibility and change/improvement to the residual supply chain actors. Additionally, the interdependencies between enablers and results may not always be obvious or traceable. [Stölzle and Bachmann 2006, p. 9, 10]

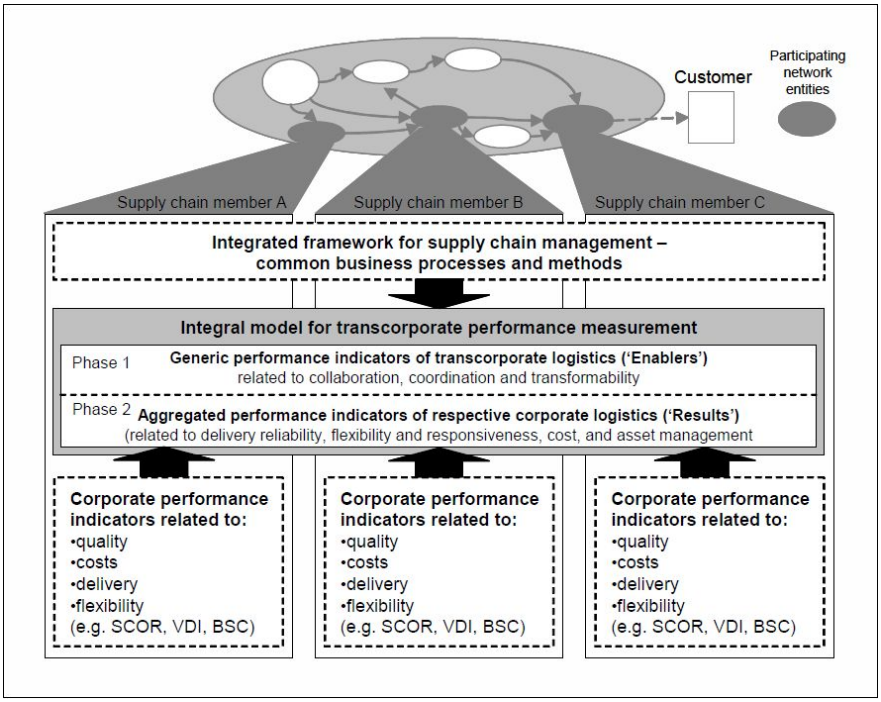


Figure 11 – Integral model of transcorporate performance evaluation [Stölzle and Bachmann 2006, p. 8]

To draw a conclusion, a supply chain-oriented view on performance can be highly significant since the evaluation of an end-to-end process may require different monitoring aspects than the monitoring of a single process. By taking interdependencies between the different performances within a supply chain into account, valuable insight can be gained.
A focus on business parameters is, thus, not wise and needs to be extended to the level of transcorporate logistics, i.e. to the topics of cooperation, coordination and flexibility.

4.4. Integrating SMEs into supply chain performance evaluation

Eventually, another model is to be presented in this section that relates to the matter of integrating SMEs in a transcorporate performance measurement approach.
Originally stemming from the idea of loosely coupled value nets which again resemble a common practice in computer science, the examined approach is applied to supply chains and outsourcing where a standardized process configuration is essential for the sustainable success of outsourcing (in contrast to the mere transfer of own processes to the new external party). [Muschik and Schuppener 2005, p. 247, 248]
Such a standardized process configuration may help to reduce transcorporate control and supervision and to confine oneself to a role as a "process orchestrator" who defines process standards, interfaces and targets. [Muschik and Schuppener 2005, p. 251, 252]
Precisely, since each partner is focusing on his core competencies and outsourcing residual functions. Standardized interfaces and reduced transcorporate control and supervision may help to conclude contracts to new SME partners flexibly at the best quality level or the lowest cost. By the use of formalized, loosely coupled processes and standardized information exchange, an easy integration of new partners, esp. SME, is enabled which again leads to shorter reaction times and higher flexibility. Consequently, a considerable reduction of coordination costs and transaction costs can be realized. [Muschik and Schuppener 2005, p. 247, 248, 251, 252]

FInest's solutions may address exactly such swift information exchange due to standardization (or easy customization to the maximum) and, thus, be able to exploit the envisioned advantages and benefits.

4.5. Further popular performance measurement approaches

KPIs used in Service level agreements

Originally stemming from the IT sector, Service Level Agreements (SLA) form a modern instrument of service controlling and have started to prevail over logistics and supply chain controlling as well.
SLA are KPI-based contractual agreements between a service provider and his/her customer on services and their performance and quality level. Frequently, SLA contain the specified and agreed KPI as the set goal for a certain service or range of services.

In the figure below, a random selection of various logistics performance dimensions is exhibited.

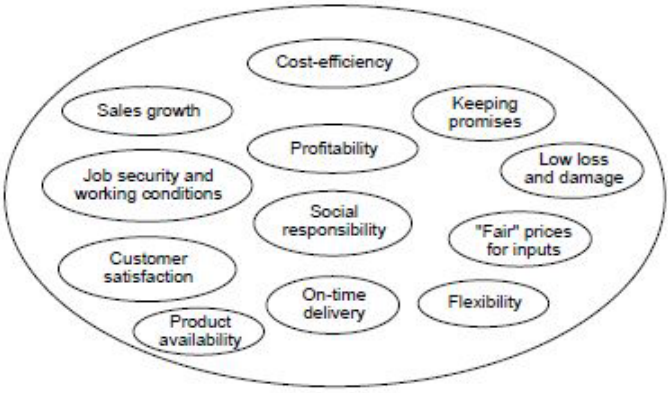


Figure 12 – Dimensions of Logistics Performance [cp. Chow et al. 1994, p. 23]

Oftentimes, the selection of service providers occurs on the basis of agreements on the performance level to be displayed during the service delivery. KPI are used to measure the effectiveness of the performance, and to assess whether the service level agreements have been fulfilled. In literature, SLAs are differentiated into input-oriented SLA, process-oriented SLA and output-oriented SLA. Input-oriented SLAs refer to the provision of capacities in order to perform a service whereas output-oriented SLAs operate with the usage of time- and quality-related KPI. Process-oriented SLAs make use of KPI which describe the process of service delivery itself. [cp. Pulverich & Schietinger 2007, p. 13, 14. 25]

Developing KPIs

In order to be able to generate the correct KPI in logistics, there exist various approaches. In the following figure 13, the bottom-up and the top-down approach for the generation of Logistics KPI are depicted.

- For a top-down approach of developing KPI, the company strategy has to be decomposed into a logistics strategy which again is differentiated in a service part and a cost part. The strategic KPI relate to these two parts.
- For a bottom-up approach, the various processes and process steps are considered. In the following, major goals and commonalities are identified which are then summarized in operative KPI.

Ideally, performance indicators of both the strategic and the operative level are aggregated to a comprehensive KPI system. [cp. Pulverich and Schietinger 2007, p. 29]

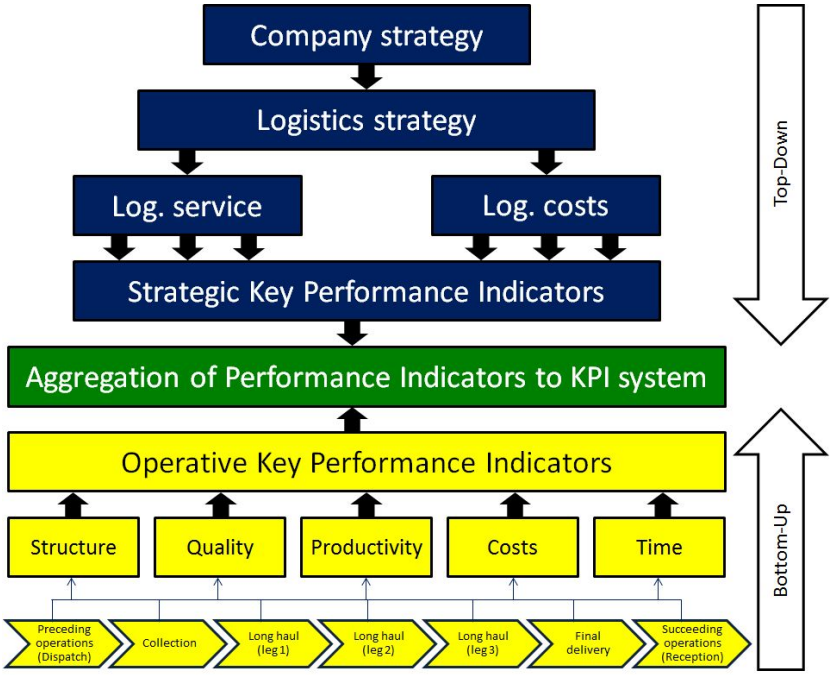


Figure 13 – Top-down and bottom-up approach of KPI generation [cp. Pulverich & Schietinger 2007, p. 29]

KPIs for selection of suppliers

An alternative way of performance measurement is the evaluation of suppliers in the selection phase (possibly, along with an early adoption of SLAs). The selection of logistics service providers (LSP) is based on a set of selection criteria which again are organized according to a company's preferences. Frequently, the selection criteria underlying that decision strongly correspond to the desired performance level at a later stage.

Jharkharia and Shankar propose a "comprehensive methodology for the selection of a logistics service provider" [cp. Jharkharia and Shankar 2007, p. 274], which consists of a two-step approach for the endeavour of selecting a LSP: (1) screening the available providers and (2) "analytic network process (ANP)-based final selection".
In the following figure 14, the hierarchical organization of the selection criteria is displayed:

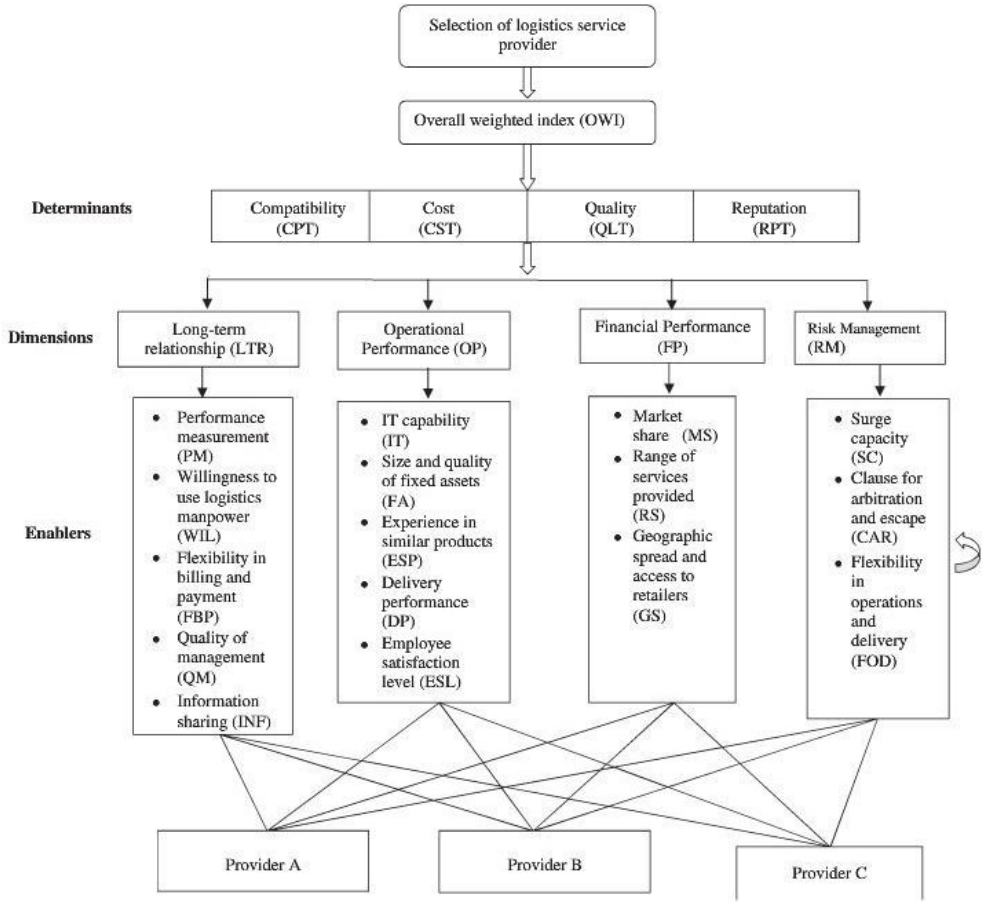


Figure 14 – Selection of a Logistics Service Provider [cp. Jharkharia and Shankar 2007, p. 275]

As can be seen in Figure 14, the four major determinants (compatibility, cost, quality and reputation) are superior criteria which are underpinned by the four dimensions (long-term relationship, operational performance, financial performance, and risk management) and, especially, by the various enablers. However, there is no reference to any planning interval, indicating whether a criterion is used for operative, tactical or strategic purposes. Nevertheless, the model exhibits an outline of the most significant criteria used for the performance-based selection of LSP and is, thus, appropriate to be used as a reference when designing the evaluation framework.

As a conclusion, performance-based evaluation oftentimes relates to the four determinants, compatibility, cost, quality and reputation, some of which need to be considered in the FInest evaluation framework as well. These are subdivided into different dimensions and multiple enablers. The above-mentioned methodology also gives hints at the composition of high-level KPIs out of several performance indicators from the lower level.

4.6. Conditions for an effective performance measurement system

Finally, a review and evaluation classification developed by MIT in the mid-1990s is to be presented here since it shows a different approach of performance measurement in logistics and supply chain management.
The authors did not focus on the development of yet another performance measurement metrics but concentrated on so-called "common characteristics of 'good' measurement systems" [Caplice and Sheffi 1995, p. 62] which can be used for the quality testing of logistics performance measurement systems in use in companies and organizations.
According to Caplice and Sheffi, systems for performance measurement in logistics should be *comprehensive*, *casually oriented*, *vertically integrated*, *horizontally integrated*, *internally comparable* and *useful*. These criteria are described in the table below.

Table 1
Evaluation Criteria Summary

Criterion	Description
Comprehensive	The measurement system captures all relevant constituencies and stakeholders for the process.
Causally Oriented	The measurement system tracks those activities and indicators that influence future, as well as current, performance.
Vertically Integrated	The measurement system translates the overall firm strategy to all decision makers within the organization and is connected to the proper reward system.
Horizontally Integrated	The measurement system includes all pertinent activities, functions, and departments along the process.
Internally Comparable	The measurement system recognizes and allows for trade-offs between the different dimensions of performance.
Useful	The measurement system is readily understandable by the decision makers and provides a guide for action to be taken.

Figure 15 – M.I.T. Logistics Performance Measurement - Evaluation Criteria Summary [cp. Caplice and Sheffi 1995, p. 63]

Whichever SLA and KPI system is agreed upon and possibly built in the future, the corresponding measurement taxonomy should fulfil these six criteria in order to ensure a useful and effective measurement and evaluation of logistics performance.

Further sources support the view of Caplice and Sheffi and name the following criteria requirements as essential for safeguarding a high quality of performance measurement: The indicators need to be *quantitative and measurable*, *multidimensional and hierarchical*, *clearly defined* and *commonly understood*, covering *all processes* and underlying an explicit *measurement process*, focusing on the *main issues*, allowing an *data collection with little effort* and providing *confidence in the results*. [Alicke 2005a, p. 188 - 193]

Following the detailed consideration of the diverse approaches and the careful selection of the suitable methodology, an adaptation to the FInest project will be realized, as well as a transfer of the generic evaluation methodology onto the Use Case scenarios in the FInest project. An initial methodology is presented in the chapter 5.

5. Generic FInest performance evaluation framework

The current deliverable (Deliverable D2.4) introduces the underlying philosophy and framework for evaluating and assessing the improvements in the transport and logistics business by optimized integration and collaboration. The optimized integration and collaboration in realized with the help of the FInest solution (and Future Internet technologies) as only the initial set-up of the evaluation of the selected Use Case scenarios in the FInest project is presented therein.
The detailed experimentation framework and plan for conducting large-scale trials will follow in the next deliverable (Deliverable D2.5) and allow for more specific evaluation methodologies for the selected use case scenarios (and potential new ones).

The goal of the evaluation is to test FInest, to verify in how far FInest helps to address the business challenges needs of the transport and logistics domain in terms of collaboration and integration, and to evaluate the potential improvement in corporate and supply chain performance enabled by the FInest solution.

Moreover, the evaluation aims at demonstrating that FInest will be useful to solve business challenges along the entire supply chain and, thereby, representatively showing the benefit of the FInest solutions to the transport and logistics domain. Different performance indicators are to be consulted in order to show the heterogeneous impact that can be generated by utilizing Future Internet technology as a general technological trend and the FInest solutions as a particular solution approach.
For achieving that, the collection of the appropriate performance measures on the 'lower' operative levels is as decisive as the correct consolidation to the meaningful key performance indicators on the superior strategic level, just as the reference project Shipping KPI suggests, for instance.
In addition, the adaptability and transferability of the generic FInest performance evaluation framework to the respective Use Case scenarios (and further process examples from the domain beyond the project boundaries) needs to be ensured. Related to that, the respective evaluation is to reveal FInest's support of the individual corporate and the common supply chain strategy and the contribution to the mitigation of the identified challenge in today's business and to the achievement of the expected improvement.

5.1. Deriving comprehension of the various theories and methodologies examined

The examined methodologies and theories have revealed several aspects that need to be considered when designing the evaluation framework for FInest.
As a result of the previous chapter, the relevance of the various methodologies to the FInest evaluation will be summarized in the following.

1. First of all, the **performance indicators collected on the various levels need to serve the overall supply chain goals**, even if conflicting with goals on lower levels. This is also the reason for adopting the SCOR process model as a base for the evaluation framework. Moreover, by taking a supply chain view, conflicting and corresponding goals can be linked with each other along the value-creation process.

   With the adoption of the SCOR model, another advantage is the representativeness of the evaluation framework for the entire domain (or at least large

parts of it) since individual supply chains may differ regarding their actors, processes and environmental conditions, so that the comparability between these processes may not be guaranteed. Same applies to the performance evaluation since it may be confined to the specific features of the respective supply chain.

However, by applying generic process models and evaluation patterns, such comparability is realized and a comparison between different supply chains enabled. The SCOR model with its process model and its performance metrics offers such a reference for the comparability of supply chains. By this, common goals and challenges can be revealed as much as common performance evaluation methods developed, if necessary and applicable. So, both a common process model to which the respective supply chains are mapped and a set of generic performance indicators that are applicable to all (or at least many) supply chain stakeholders are to be provided in the FInest evaluation framework.

2. Another important aspect is the decomposition of the supply chain parts into individual legs, not underestimating the links between the legs though. That means both the differentiation between the different parts and activities along the supply chain (which is also generally described in the SCOR model) and the identification of the respective supply chain partners involved with their very own goals and performance levels.

   As a consequence, **leg-wise performance evaluation will be a part of the FInest evaluation framework** since the benefit of the FInest solution has to be proved for each participant in the supply chain.

3. Moreover, the **interdependencies between the different performance goals and measures are to be taken into consideration**. Particularly, the supply chain visualization along with other aids, which already exist as interim results of the FInest, will help to pinpoint and highlight such interdependencies and the common and conflicting goals of the supply chain participants.

   Therefore, a focus has to be laid on the interaction and communication between the different partners of a supply chain. Such interaction and communication may be used as a characteristic and an indicator of the intensity of collaboration within the supply chain which again is exactly what the FInest solution is about to support and enhance. Enhanced collaboration can be based on *improved communication*, *prompter interaction*, *higher availability* and *better accessibility of required information*, and a *higher quality*, i.e. *reliability* and *accuracy*, for instance. Therefore, the evaluation framework should encompass the support by the FInest solution to any of these aspects. Particularly, the positive effects on the integrability of SMEs can be shown by this.

4. When selecting the set of generic performance indicators, the different **generally relevant corporate (and supply chain) performance indicators, such as those related quality, costs, delivery, and flexibility, are to be included**. Several model presented earlier exhibited an outline of the most significant criteria used for the performance measurement which, thus, are consulted and incorporated in the evaluation framework of this project. Moreover, they should include both **leading indicators** for a performance prospect and **lagging indicators** for an ex-post analysis of the results.

   Apart from that, supply chains oftentimes follow a certain strategy. This strategy needs to be identified, defined and, subsequently, operationalized into a measurable goal. So, by **matching strategic goals with operative measures, the relevant performance indicators are provided**. The mapping of these operationalized goals and measures then help to ensure the comparability of the evaluation results.

5. As has been stated earlier in the document, a focus is to be laid on the **beneficial impact of the FInest solution on the aspects of quality, cost and environmental impact by means of improved collaboration**. Most of the currently used performance indicators can be assigned to one of the categories presented in the generic performance metrics. Such performance metrics also take care of the necessity of incorporating various features of the performance of a supply chain, such as both financial and process-related indicators, in the evaluation framework. The restriction to financial measures only, as widely prevalent throughout the industry today, may not be sufficient to show the business benefit of the FInest solution.

6. So, in the end both a **bottom-up principle and a top-down approach** are being pursued when putting together the relevant performance indicators for evaluating the benefits of the FInest solution for the domain and the Use Cases. Even in the scientific discourse of performance evaluation, an aggregation of performance indicators of both the strategic and the operative level is considered to be ideal.

7. Last but not least, the **performance criteria themselves should fulfil certain quality criteria** which have been described earlier. Hence, the selected performance indicators need to be checked for their qualitative appropriateness before being incorporated in the generic FInest evaluation framework. However, it has to be stated that the performance indicators proposed in the presented theories and methodologies mostly fulfil the criteria.

5.2. FInest performance evaluation framework

The scope of performance evaluation is displayed and introduced in chapter 2 (Figure 3). It shows a hierarchy with distinct levels on which performance measurement is to take place in order to prove the beneficial impact of the FInest solutions on the transcorporate, corporate and supply chain performance.

- The **foundation** for all evaluation is the layer displaying the effect of the **technical capabilities of FInest** (and Future Internet technologies) to fulfil the performance requirements on the various superior levels. This can include the better availability of data and a prompter provision and transmission of real-time information as much as the higher accessibility of contact persons and a more direct interaction between the partners on a technical level.
- The next higher level shows the so-called **transcorporate performance level** in which collaboration and integration are being focused upon. Especially, the performance of the interaction and communication between the different actors participating in the supply chain will be measured and evaluated which again consists of the collaboration, i.e. the business transaction and human interaction, and the integration, that is the efficiency and effectiveness of communication and information exchange, among the parties involved.
- The next superior level is the **corporate performance level** on which the efficiency and effectiveness of the operations executed as part of the supply chain process is being evaluated. This can relate to both an internal view, e.g. to the business process performance, and an external view, such as the customer value on the basis of the service delivery performance. As stated earlier, indicators related to quality, cost and environmental impact of supply chain performances are going to be in the limelight of performance measurement and evaluation. It is important to note that the corporate

performance may be restricted to one specific process or several process steps along the SCOR process model, depending of the role of the respective company evaluated. Likewise, the SCOR performance metrics may be used for detailed evaluation of performance measures.

- The highest evaluation level is the **supply chain performance level** on which the efficiency and effectiveness of the entire supply chain is analysed. To this belongs the degree of fulfilment of the various stakeholder requirements along the supply chain, not neglecting the impact of interdependencies and conflicts between the individual corporate performance measures consolidated on the supply chain performance level. Similarly to the previous level, the key performance measurement criteria will be linked to quality, cost and environmental impact and it to be rooted in the SCOR model and its extensions to transcorporate performance measurements.

As an example, the adaptation of this performance evaluation framework to the various Use Cases is exhibited in the figure 16 below (on the basis of the To-Be Scenario 1 from FInest's Use Case 1). The figure displays a goal **hierarchy**, linking the performance elements and expected improvements at each of the three performance levels together, and with the required effects of FInest capabilities.

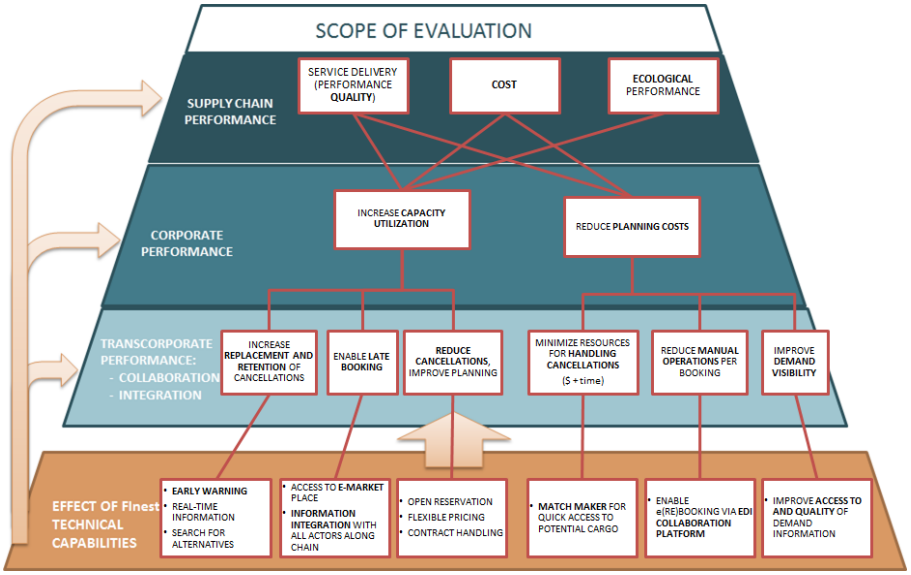


Figure 16 - Example of performance measurement structure for To-Be Scenario 1

1. To build the hierarchy, the first step consists of identifying the effect of the **technical capabilities** of FInest and its solutions and highlighting what has been enabled newly (from a technical point view), i.e. which new information or services are available and accessible.
2. Then, they are assigned to the improvements in performance on the **transcorporate performance level**, illustrating the impact on issues of improved collaboration, e.g. in the form of better communication or stronger interaction, and better integration of existing and new (and particularly smaller) partners. It should be noted that one technical effect can be linked to more than one performance measure on the transcorporate performance level. Similarly, one performance measure on the transcorporate performance level can consist of several effects of the technical capabilities of FInest (and Future Internet technologies).

3. These benefits are then considered as a basic cause for the improvement in the performance of a supply chain actor which is measured and evaluated on **corporate performance level**. Again, more than one transcorporate performance measure can be consolidated to one performance measure on the corporate performance level and vice versa.
4. Finally, the corporate performance of the various partners is consolidated on **supply chain performance level** in order to measure and evaluate the supply chain performance as an aggregation of the individual performance measures (and possibly some additional factor representing the interdependencies and synergies between the individual performance measures) and to compare these with the supply chain strategy and related goals. Once again, the measures on supply chain performance level may consist of several corporate performance measures and one corporate performance measure may serve different supply chain performance measures.

5.3. From requirements specification to performance measures identification

In order to put the evaluation framework described above in use, one need to specify which performance one needs to evaluate. What do we want to improve? What criteria for evaluation an we use. The present section describe a set of activities to be conducted in the next reporting period in order to help the identification of evaluation criteria for each scenarios.
The idea is to first provide a generic set of evaluation criteria adapted to the domain and relevant for the use cases, to be further selected and adapted by the scenarios.

Business Requirements and required FInest capabilities

The specification of required FInest Capabilities shall be based on a detailed examination of the business requirements identified in Month12 in the work packages WP1 and WP2 (see Figure 17 and Figure 18) as well as the Requirements Fulfilment Analysis presented in WP3 based on the general requirements identified in the Use Cases (Deliverable D3.2, p. 35 - 38). These requirements form the basic layer for performance evaluation since they are related to the domain and rooted across all Use Cases.

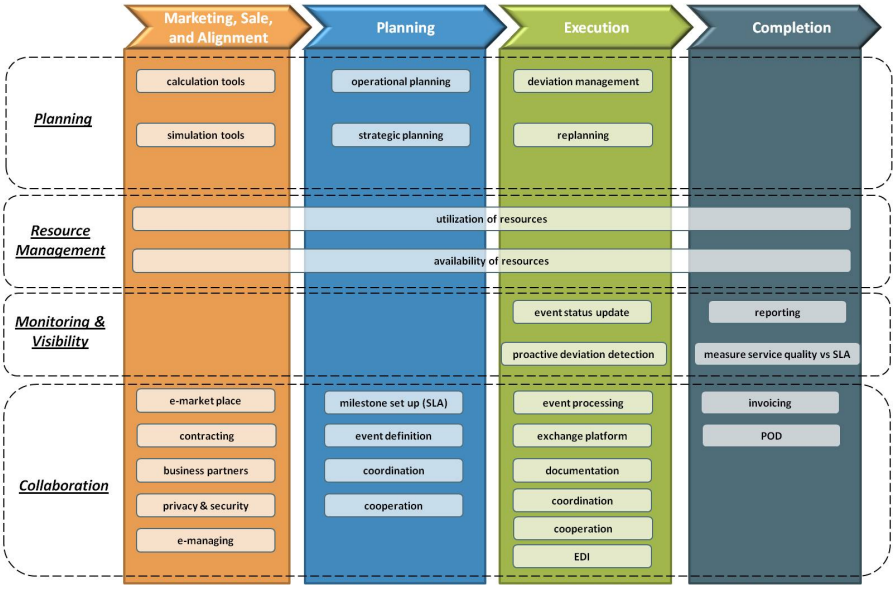


Figure 17 – Overview of Business Requirements identified in WP1

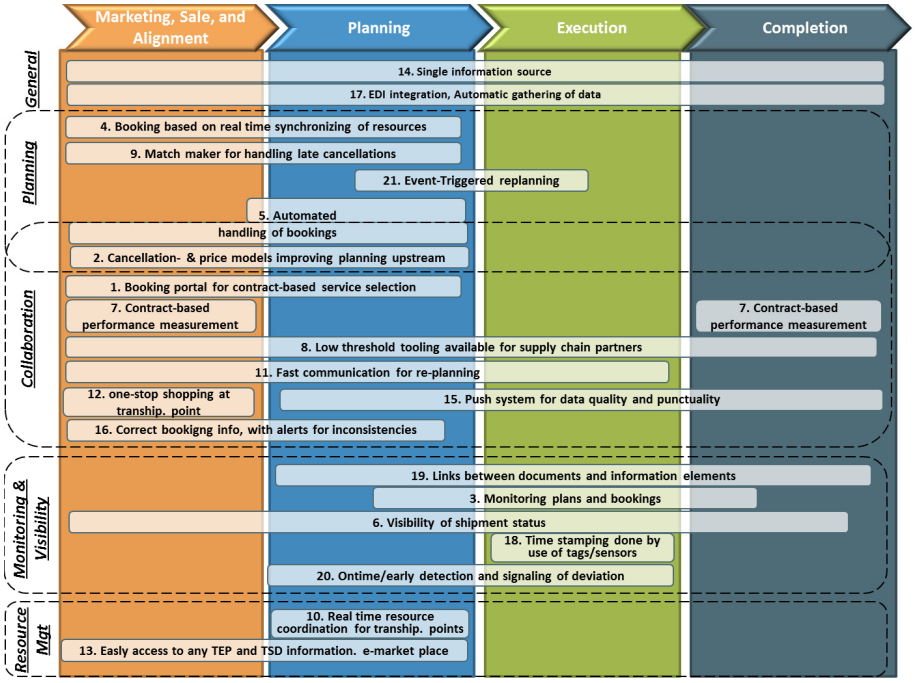


Figure 18 – Overview of Use Case Requirements identified in WP2

Expected improvements

Once the required capabilities for each scenario are clarified, expected improvements must be specified. Indeed, the evaluation aims at measuring the improvement of collaboration with the help of the FInest solutions and evaluating the contribution to the achievement of the expected improvements within the five use case scenarios. A summary of these expected improvements in each scenario is presented in the Figure 19 (source: D2.3).

To-Be Scenario \ Roles	CARRIER	PORT/AIRPORT	TERMINAL	FORWARDER	SHIPPER
1. Handling of Late Booking Cancellation	Higher capacity utilization Less cancellations	Less deviations in traffic schedule	Improved planning upstream	Higher flexibility	Better possibilities of late booking
2. Resource Coordination	Single window shopping, improved information reliability	More efficient handling of port calls, improved information reliability	More efficient planning	Improved information reliability for operational plans	Improved information reliability for operational plans
3. Real-Time Event Handling	Real time / early information enabling efficient replanning	Less deviations in traffic schedule	Real time / early information enabling efficient replanning	Real time / early information enabling efficient replanning	Real time / early information and improved delivery performance
4. E-Planning	More automatic handling of information	Less deviations in traffic schedule	Improved planning upstream	More efficient planning, and effective contract management	More efficient planning, and effective contract management
5. Automated Shipment Tracking	More efficient communication with customer	More reliability of information	More reliability of information	Real time, early information, better visibility efficient shipment tracking.	Real time, early information, better visibility efficient shipment tracking.

Figure 19 – Summary of the main improvements expected in each scenario

Performance measures

Once the expected improvements are specified, the performance indicators can be defined. First a set og generic performance measures will be established, serving as a basis for the scenarios to define own measures. A draft selection of generic performance indicators with an assignment to the SCOR performance metrics is presented in Figure 20.

	agility AG	responsive RS	asset mgmt AM	costs CO	reliability RL
(risk of) errors occurring (e.g. due to manual work and inefficient information flow)					■
degree of automation (manual work, data exchange)		■			
(risk of) delays in information flow (number and duration)		■			■
(risk of) delays in material flow (number and duration)		■			
effects on stock rotation		■			
utilization of assets (of qty. unit t.b.d.)			■		
cost per dispatch unit (e.g. container, vessel or other qty. unit t.b.d.)				■	
emission per dispatch unit (e.g. container, vessel or other qty. unit t.b.d.)				■	
number of bookings cancelled	■				
number of bookings cancelled lately	■				
amount of deviation from booking information to actual capacity required (in qty. unit t.b.d.)	■		■		
reduced time frame (e.g. time for loading, …)		■	■		
number of empty containers (per time unit t.b.d.)			■		
number of deviation from (OTIF) availability of information (waybill date punctual, poor communication re. changes)			■		■
number of deviation from OTIF availability of material/goods (departure/arrival punctual)					■
number of deviation from (OTIF) availability of money (payment punctual)				■	
number of deviation from OTIF availability of resources (deployment punctual)			■		■
need for additional effort and reworks (repeated actions, re-planning, new bookings, …)	■				
increased resource consumption (measure unit t.b.d., e.g. time, CO2 emission, …)	■				
inefficient planning (due to changes in conditions)	■				
inefficient resource coordination			■		
overall throughput time of the logistics process			■		
loss of income					
total value chain cost				■	

Figure 20 – First draft of possible performance indicators assigned to the SCOR performance metrics

Scenario-specific performance measures

To further translate the generic evaluation framework to scenario-specific settings, generic performance measures must be translated to scenario-specific measures.

A preliminary selection is already displayed in Figure 21. On the right side, a cross indicates whether the criteria are relevant for a Logistics Service Provider (LSP) or Logistics Service

Client (LSC). The criteria ones appearing useful for specific evaluation in one of the scenarios are highlighted in yellow colour).

Consolidated performance criteria	LSP	LSC
Accuracy of invoice	x	x
Available time frame	x	x
Capacity (asset) utilization	x	
Contract fulfilment	x	x
Cost of data exchange (time)	x	x
Cost of handling deviations (man-hours + info exchange)	x	x
CO2 unit per voyage or shipment	x	x
Cost per unit per voyage or shipment	x	x
Customer response	x	
Customer satisfaction	x	
Data collection speed	x	x
Data quality / accuracy (number of errors)	x	x
Efficiency of working processes	x	x
Flexibility	x	x
Loss of sales	x	x
Number of changes in bookings	x	x
On-time delivery performance in full (OTIF)	x	x
Payment date	x	x
Planning costs	x	x
Punctuality (departure/arrival)	x	x
Reaction time in case of deviation	x	x
Resource efficiency	x	x
Resource used for (re)planning	x	x
Resource used for finding service		x
Resources used to handle booking (man hours, messages)	x	x
Revenue / sales / volume	x	x
Shelf availability,		x
Stock rotation	x	x
Throughput time	x	x
Total value chain cost	x	x
Predictability / visibility	x	x

Figure 21 – Selection of performance criteria appropriate for evaluation (source: D2.3)

In order to fine-tune the description of performance measures for evaluating the contribution of FInest capabilities to improvements in the scenarios, we must look at the **expected improvement in each of the five scenarios**. A preliminary list of possible performance indicators (covering scenario 1 and 2) representing the expected improvements has been prepared (see Figure 22 on next page). In the next 6 months, this collection will be completed with the required performance indicators carefully selected according to the various restrictions described and explained earlier in this document.

Roles / To-be Scenario	CARRIER	PORT/AIRPORT	TERMINAL	FORWARDER	SHIPPER
1.Handling of Late Booking Cancellation	● Utilization per container/vessel/facility ● Cost per container ● Emission per container ● No. of empty containers ● No. of cancellations ● No. of empty containers ● Need for additional effort and reworks ● Decrease of resource consumption (and increase of resource efficiency) ● Reduced loss of income	● Accelerated information flow ● No. of errors occurring (w.r.t. traffic issues) ● No. of "delays in information flow" ● No. of "deviation from (OTIF) availability of information" ● No. of "delays in material flow" (e.g. late containers, late vessels) ● No. of "deviation from OTIF availability of material/goods ● Reduced total supply chain lead time ● Reduced total value chain cost	● Accelerated information flow ● Increased availability of data/information ● Enhanced communication channels ● No. of empty containers ● Improvement of (formerly inefficient) planning ● Enhanced time frame for action/reaction → leading to better decisions ● Reduced resource consumption (due to less re-planning required) ● No. of "deviation from (OTIF) availability of information" ● No. of "need for additional effort and reworks ● Accelerated overall throughput time ● Optimized resource coordination (and improved resource efficiency) ● Higher stock rotation ● Reduced total supply chain lead time ● Reduced total value chain cost	● Enhanced communication channels ● Enhanced time frame for action/reaction ● No. of "errors occurring" ● No. of bookings cancelled ● No. of bookings cancelled lately ● Amount of deviation from booking information to actual capacity required	● Accelerated information flow ● No. of bookings in the second run ● Lead time for finding new partner ● Reduced loss of income
2.Resource Coordination	● Reduced total value chain costs ● swifter reaction on deviation ● punctuality of information availability ● lower resource consumption based on need of re-planning ● Lower risk of errors ● availability of a multitude of communication channels	● Higher asset utilization ● Reduction of cost per container/vessel/facility ● Reduction of emission per container/vessel/facility ● Reduced total value chain costs ● swifter reaction on deviation ● punctuality of information availability ● lower resource consumption based on need of re-planning ● Lower risk of errors ● availability of a multitude of communication channels	● Reduced total value chain costs ● swifter reaction on deviation ● punctuality of information availability ● lower resource consumption based on need of re-planning ● Lower risk of errors ● availability of a multitude of communication channels	● No. of empty containers ● rate of stock rotation ● Reduced total value chain costs ● reduced loss of income ● lower resource consumption based on need of re-planning ● Less late changes in booking ● Lower risk of errors ● availability of a multitude of communication channels	● No. of empty containers ● rate of stock rotation ● Reduced total value chain costs ● reduced loss of income ● lower resource consumption based on need of re-planning ● Less late changes in booking ● Lower risk of errors ● availability of a multitude of communication channels

Figure 22 – Selection of possible performance indicators for the FInest To-Be scenarios

Enabling subjective evaluation

In order to enable subjective evaluation and collect feedback from a user perspective, the **mock-ups for the four Demonstrators** (corresponding to four of the five to-be scenarios) will be used in the evaluation. This will serve to graphically show the benefits of the FInest solution with respect to collaboration and integration and, thereby, the corporate and supply chain performance. For instance, the challenge of addressing late booking cancellation – identified as scenario 1 (in use case 1) – has been sketched in the Demonstrator Nr1 (see Deliverable D8.2, p. 12 - 24). Therein, the positive effects of the use of the FInest solutions are visible and, thus, easy to comprehend. As an example, the screens "Capacity and cancellation overview" (see Figure 23) and "Capacity based search for shipping demands per vessel" (see Figure 23) show such beneficial effects of the use of the FInest solutions since the new and novel features from the transcorporate performance level, that is replacing and retaining cancellations, enabling late bookings, reducing cancellations by improved planning as well as minimizing resources for handling cancellations, reducing manual operations per booking and improved demand visibility, are clearly visible in the demonstrator and its screenshots. Based on such transcorporate performance improvements, the following superior levels of performance evaluation can be composed and consolidated.

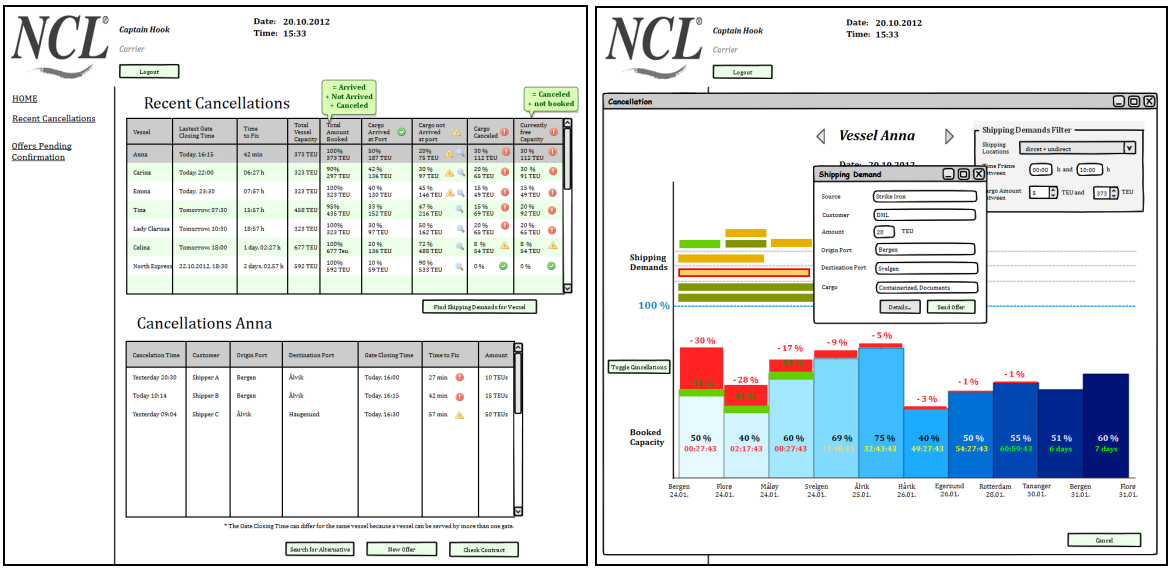


Figure 23 – Screenshots of Demonstrator 1 (Use Case 1, Late Booking Cancellation)

5.4. Initial Evaluation Methodology

To summarize the approach suggested in the previous chapters and the use of the evaluation framework, an initial draft of evaluation methodology is presented in this section.

This initial methodology consists of six steps (first described in text below) for conducting evaluation of performance improvement for each scenario, which input data and material should be used, the expected outcome of each step, as well as the theoretical foundation.

1. **Required Effects of FInest Capabilities**: In this first step, the business challenges are translated into goals and expected improvements, and expected effects of the technical capabilities. This work has been done by the Use Case partners and a set of use case requirements was presented in the Month12 deliverable. This specification must be further conducted for each scenario.
2. **Build an Evaluation Hierarchy**: This step focuses on mapping the expected improvements according to the three layers of the evaluation framework: transcorporate performance, corporate performance, supply chain performance. This is necessary for linking the effect of FInest capabilities to the envisioned business improvement. An example is given is chapter 5.2.
3. **Identify KPIs**: Here, the metrics for measuring performance belonging to each business goals related to the scenario, and thus measuring the effect of the FInest capabilities, are defined in order to be able to make a statement about achieved improvement through FInest. This step is introduced in chapter 5.3.
4. **Identify the Baseline**: This step focuses on defining the current performance level in the given scenario for each of the metrics. The current performance can be expressed as an average performance, possibly accompanied with target or benchmark performance level that could be used in the improvement assessment afterwards.
5. **Test the scenarios**: Here, the recording of the result data from the experimentation and further calculations of additional performance data necessary take place. Furthermore, feedback from users of the system will be collected.
6. **Consolidate and Analyze results**: Eventually, the results will be consolidated and the performance scores achieved in the scenario written down. Then, the results will be compared with the baseline figures. While going through each layer of the evaluation framework and assessing the link from the effects of the technical capabilities to collaboration and integration, corporate performance and, finally, supply chain performance.

The matrix on next page (Figure 24) summarizes this initial methodology, providing a description of the activity to be conducted for each step, the necessary input to the activity, and the required outcome. The last row displays the methods and theoretical foundation identified through the review in the previous chapters, on which the activities are based, and which will be further used to describe the final methodologies for evaluation of the use case scenarios in the next reporting period.

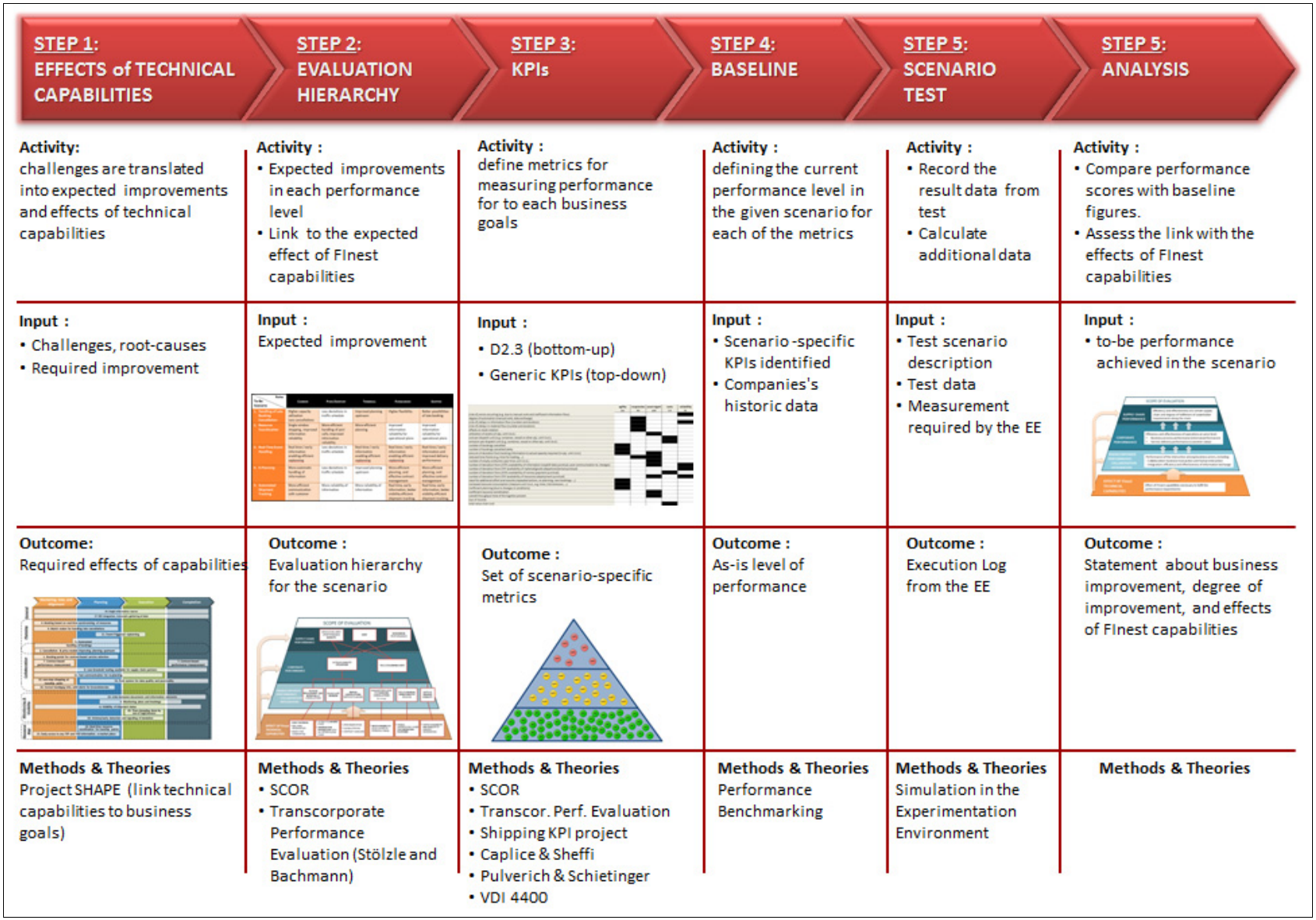


Figure 24: initial evaluation methodology for use cases scenarios

6. Experimentation specification

6.1. Introduction

FInest's Work Package 4 is concerned with the design of an Experimentation Environment (EE) for testing, demonstrating, and evaluating the technologies envisioned in FInest. This environment will serve to experiment the use case scenarios in phase 2 of the FI PPP program. The architecture of the EE as well as the Experimentation process are described in the Deliverable 4.3.

The task of WP2 is to provide experiment specifications for each scenario in a way that matches the experimentation process described in WP4.

A **common template** for experiment specification has been prepared in collaboration between WP2 and WP4. The aim is to help in the description of the scenarios from the perspective of the business user, by a set of events/steps to be performed during a test session.

In the following chapter, each of the five scenarios is described step-wise, with focus of the user interface of the platform, and from a user perspective: *how actors in the scenarios are interacting and doing business by using the FInest platform*.

An introduction provides the background of the scenario and the story that forms the core of the scenario, followed by a description of the main "protagonists" of the scenario (the domain actors/ business users represented), then a detailed table representing the *test scenario* as to be provided to a tester before it can be configured and prepared for test, and finally a short list of KPIs to be calculated out of the execution logs (see section 2.4.4 in Deliverable D4.3) in order for the business user to analyze the performance of the test execution.

The columns of the test scenario table (the template) are described below:

STEP	ACTOR	PROCESS DESCRIPTION	EXPECTED RESULT	TEST DATA (*)
Number of the step	The business user performing the action	Execution of step, description of the action of the user, as interaction with the system, with partners, or internal process.	What is expected by the user from the system in the way it responds to commands and data required	Input to the system

(*)Initial test data are provided in Annex 1.

The experimentation will serve as a basis for evaluating the contribution of the FInest solution to improving collaboration and integration in the use cases, and thereby business performance and supply chain performance. The measurement system for enabling this evaluation is described in chapter 3 (Evaluation Methodologies).

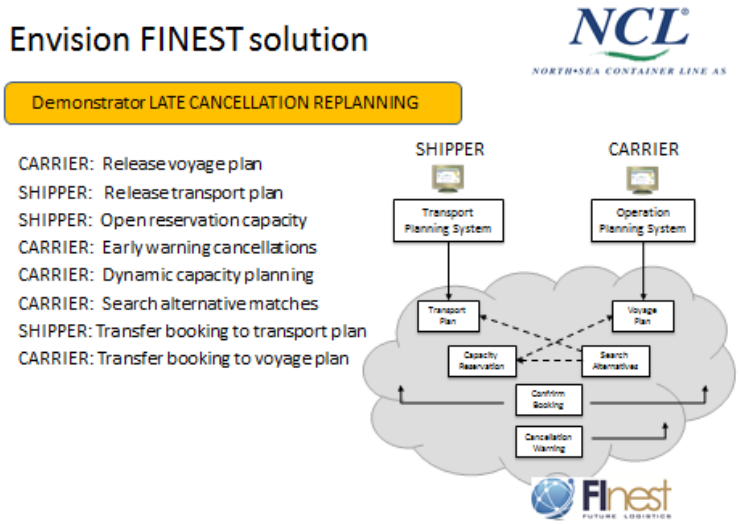
In order to assess the technical capabilities of the FInest solution, it is important to **test the scenarios in various contexts**, either various conjunctures or distinct set of events. To do so, variants of the scenarios proposed in the following chapters will be introduced in the next deliverable. Two examples of these multiple tests, listing the set of variables to be "played with" and the corresponding FInest functionality to be tested, are given in sections 4.2.5 (based on Scenario 1), and 4.3.5 (based on scenario 2) These two examples have distinct levels of details (the first is an extension of the example provided earlier in figure 4), but the idea is to show how distinct configurations can help testing distinct capabitities of the FInest platform.

6.2. Scenario 1: Handling of Late Booking Cancellation

Authors: MARINTEK, NCL

6.2.1. Introduction

The scenario illustrates how the challenge of dummy booking and late cancellations can be overcome thank to better information availability and exchange. The scenario features, on one side, a carrier (container feeder shipping operator) dealing with shipping reservations and late cancellations, and on the other side, shippers (fish exporters) posting transport need on e-market places, receiving offers, making reservations, confirming reservations, cancelling reservations.



6.2.2. The users of the system (actors represented in the test):

The business users represented in the test scenario are:

1. **NCL: the container ship operator** that provides feedering services from the Norwegian coast to Europe, including the voyage on focus in the scenario from Ålesund to Rotterdam (part of a multi-stop regular route), served by the vessel Clarissa.

2. **Norway Goodfish (NG): the fish exporter** that uses the FInest platform for sending reservations to sea carriers, confirm a specific booking to NCL for the Clarissa voyage (from Ålesund to Rotterdam), then cancel the shipment due to lack of export license.

3. **Fish4Life (F4L):** the fish exporter that registers a late need for transport, due to a recent deviation in own transport plan (booking on an oversea line confirmed an hour earlier, but requiring the cargo to leave Ålesund today in order to arrive on time.

6.2.3. Test scenario detailed description: Execution steps and expected results

STEP	ACTOR	PROCESS DESCRIPTION	EXPECTED RESULT	TEST DATA
Create shipping demand *The Fish Exporter NorwayGoodFish (NG) uses the FInest platform to publish a demand for container shipping on FInest and/or public marketplaces*				
1	NG	NG logs in and open the field "Shippings"	a list of current open reservations and confirmed/prepaid reservations is displayed	See appendix I
2	NG	Click on the icon "create a new shipping demand".	A window "create shipping demand" appears, containing a purchase number generated automatically by FInest	Purchase number "64511-AD415-45453-JS555"
3	NG	Fill up the fields "specify origin / destination address", then register the information about the shipment.		See appendix II
4	NG	In the box "Publish demand on the following marketplaces", cross the box "Finest platform" and "Public Market Place A"		
5	NG	Click on "create shipping demand"	The window disappear and the user is sent back to the initial page displaying an overview of planned shipments, reservations and confirmed reservations	
6	NG	Wait for offers	∞ ∞ Information processing / reply from other parties The shipping demand is registered on FInest and external market places, thus accessible by any carriers searching the e-market place for transport needs on a particular route. The carriers send booking offer to the shippers by answering the request. The offers are then communicated to the shippers via FInest.	
7	NCL	(part not illustrated in the demo; shall be rewritten, describing more steps on both the shipper and the carrier's sides) The shipping operator NCL has identified a demand for shipping as matching the NCL's schedule and capacity, and has sent an offer to the corresponding the fish exporter Norway Goodfish, and waits for reply.	∞ ∞ Information processing / reply from other parties ∞∞ The offer is received by NG.	
Receive offer(s) from carriers *NorwayGoodFish (NG) receive offers from carriers, accept or reject offers, make normal or confirm reservations.*				

8	NG	Go back to the field "shippings", select the shipment on focus (Nr 64511-AD415-45453-JS555 , Ålesund to Rotterdam, departure oct. 20th), and click on "View shipping details and bookings".	A window appears, showing three tables: (1) current binding or prepaid reservations (empty), (2) the non-binding reservations (empty), and (3) the received offers. The "Received offers" table contains 3 offers (from NCL, Eimskip, and ECL) with each 3 set of price levels (non-binding, binding post-paid, and pre-paid).	See appendix III for list of offers received.
9	NG	NG must select the offer from NCL, to which (s)he wishes to make a reservation. In this scenario, the fish exporter NG effectuates first a non-binding reservation, then later (s)he receives a request for confirmation, accepts the request and effectuate a pre-paid reservation.	A window opens and gives two alternatives: — Alternative A: non-binding reservation — Alternative B: binding reservation, choosing between pre-paid or post-paid reservation (subject to cancellation fees).	
10	NG	Go to the third table ("received offers") and accept the offer from carrier D as a non-binding reservation and click on "make a non-binding reservation".	The offer disappears from the "received offers" table, and appears in the "nonbinding reservation" table, with status "reserved".	
11	NG	Rejects the offers from Eimskip and ECL by first selecting the offer, then clicking on "decline offer"	The column "status" in the "received offers"-table is updated to "declined" for both carriers.	
12	NG	Logs off and continue other business	∞ ∞ Waiting for information processing / reply from other parties ∞∞ The reservations are communicated to the carrier(s).	
Treatment of incoming requests for shipping and reservations The carrier receives reservations, register it into own system. Later on the carrier request a confirmation of reservation. The shipper confirms by prepaying the shipment.				
13	NCL	Log in and open the field "offer pending confirmation".	The page displays a list of all offers that have been sent recently by NCL, and the response by the shippers (fish exporters). The status column shows whether the offer has been accepted by the fish exporter (thus reserved), rejected, or is waiting for reply. NCL can see that the offer sent to NGF has been "accepted as non-binding reservation".	Appendix IV
14	NCL	To transfer the information to the back end system Softship, click on "transfer all confirmed".	The system runs; connection is made with Softship.	
15	NCL	72 hours before departure, NCL needs the shipper NG to confirm the reservation, thus becoming a binding reservation. To do so, select the offer and click on "request for confirmation".	∞ ∞ information processing∞∞ The request is received by NGF and accepted as a pre-paid reservation.	
16	NG	NG receives a notification from FInest, logs is and open the page shipping.	The table "non binding reservations" is updated, and the column "status" for the given shipment displays "please confirm".	Appendix V

17	NG	Select "confirm booking"	A window opens, and gives the possibility to choose between pre-paid (with discount) or post-paid reservation.	
18	NG	Select "pre-paid".	[transaction effectuated through a other system].	
19	NG	Go back to the page "shipping"	The offer disappears from the table "non binding reservation", and appears in the "binding / prepaid reservation" table, with status "pre-paid"	
20	NG	Logs off and continue other business	∞ ∞ information processing ∞∞ The reservations are communicated to the carrier(s).	
21	NCL	NCL receives an notification from FInest, logs in , and updates the "offer pending confirmation" page	The table "offer pending confirmation" is updated and for the offer sent to NGF, the status is now "accepted and pre-paid".	
22	NCL	To transfer the information to the back end system Softship, click on "transfer all confirmed".	The info is received by the back end system, and NCL can update the operational plan for the given vessel / voyage.	
Cancellation of shipment by the fish exporter *6 hours before departure, because of problems with the Brasilian customs regarding the import license, NorwayGoodFish (NGF) needs to cancel the shipment from Ålesund to Rotterdam planned for the October 20th 2012, booked at NCL.*				
23	NG	Go back to the overview of planned and reserved shipments by clicking on the field "shippings".		
24	NG	Select the concerned shipment (Nr Nr 64511-AD415-45453-JS555 , Ålesund to Rotterdam, departure today), click on "View shipping details and bookings"	A window opens with a list of the current shipping reservations.	Appendix VI
25	NG	Find the shipment in the "binding and prepaid reservation", then click on "cancel prepaid booking".	A pop up window appears with a warning regarding cancellation penalties.	
26	NG	Click on "Cancel reservation".	∞ ∞ Waiting for information processing / reply from other parties ∞∞ The cancellation is communicated to the carrier via FInest. The carrier search for solutions to offer later departure time to the shipper.	
Sending new offer to rebook the late cancellation: *NCL receive notifications of cancellations of bookings (binding reservations) and handles these cancellations by first offering a new departure time to the shipper, and secondly by finding replacement cargo for filling up the capacity now available.*				
27	NCL	NCL receives an notification from FInest, logs in , and goes to "recent cancellations"	A table appears with a list of all the approaching departures (according to remaining time before gate closing).	Appendix VII
28	NCL	To view the status of cancellations of the vessel Anna,	A table appears below summarizing all the cancellations made to the voyage	Appendix VII

		leaving in xx hours, click on the vessel's raw in the table.	of the vessel Anna.	
29	NCL	In order to keep the customer's booking, NCL proposes to NG to rebook the cargo to a later departure on one of NCL's vessels. Select the cancellation from NG that has just arrived, and clicks on "new offer".	A new window showing the cancelled booking is displayed	
30	NCL	NCL select a new departure date and time, propose a discount for rebooking, and click on "send offer"	∞ Waiting for information processing / reply from other parties: ∞ The offer is received by NG.	
31	NG	(not illustrated in the demo; to be described more in details) NG received a notification from FInest. Go back to the overview of planned and reserved shipments by clicking on the field "shippings".	On the line corresponding to the recently cancelled shipment, the status is changed to "new offer received"	
32	NG	Open the offer, and click of accept	The list of "shippings" is updated with a new departure date/time, with the same carrier, and status is "reserved".	
Search for single cancellation replacements *The aim is to find the "100% match" for a cancelled reservation, which means from the same port to the same port and with the exact same amount*				
33	NCL	Go back to the "cancellations Anna" table, select the cancellation from NGF, and click on "search alternatives". In this scenario, the Alternative A is chosen.	A window " Search for single cancellation replacements" opens. The window displays the information about the booking being cancelled, together with a list of open demands that FInest has identified through e-market places, and that resemble the recent cancellation. This list of "candidates" for the given voyage also shows the % match between each candidate and the booking cancellation (quantity, origin, destination etc.). — Alternative A: 100% match. Sending direct offer — Alternative B: less than 100% match. Different origine & destination (additional transport needed). Sending offer using a Freight Forwarder.	Appendix VIII
34	NCL	Choose the one with 100% match, coming from the fish exporter Fish4Life, and click on "send an offer directly".	∞∞ Waiting for information processing / reply from other parties ∞∞ The offer is received by Fish4Life as a last minute booking offer, accepted as a binding booking.	
35	F4L	*Describe the shipper receiving the offer right before departure….and sending a confirmation to NCL*		

36	NCL	Open the offer pending confirmation	see the status from the offer made to Fish4Life as "accepted"	
37	NCL	Select it and click on "transfer selected",	∞∞ Information processing ∞∞ the booking is transferred to the back-end system (and the operational plan and discharge / loading list can be updated).	
Finding replacement cargo through capacity-based search for shipping demands per vessel *It is now 4 hours before departure, and NCL is now looking for replacement cargo for filling as much capacity as possible in the short time window remaining. The charts displays the capacities of a vessel between the single ports on the voyage and the capacity utilization rate for each part of the tour. The carrier finds the best possible matches (covering maximum capacity) and sends offers to the respective shipper(s).*				
38	NCL	Go back to the "recent cancellations" field, select the vessel Anna, and click on "find shipping demand for vessel".	A window opens, with a chart displaying the entire planned voyage of the vessel Anna, the ports of call, the scheduled departure date, the remaining time before gate closing, and the capacity utilization between each port. On the top, you can see a "shipping demand filter" enables the carrier to refine the search.	
39	NCL	Fill up the "filter window", by selecting "direct", between 2hours and 1.15 hours, and max TEU.	Above the chart, you see a list of shipping demands (retrieved by Finest on e-market places) matching the capacity offered by the voyage of the vessel Anna.	
40	NCL	Select the first shipping demand (clicking on it), and	A green bar appearing automatically on the voyage chart, showing that xx % of the capacity of Anna would be covered by that shipment on the stipulated intinerary.	
41	NCL	NCL all the shipping demand and click on "send offer" Repeat the same procedure for all the shipping demands identified.	∞ ∞ Information processing / reply from other parties ∞∞ The offer is received by NG. NCL waits for reply.	

6.2.4. Performance of the test execution

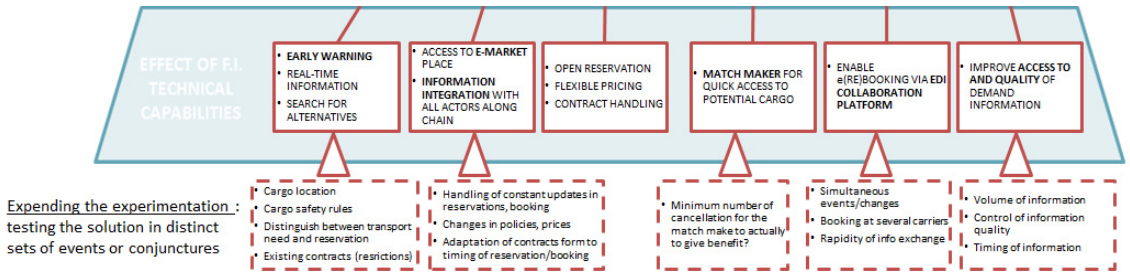
In order to analyze the performance of the test execution, the business user would require the following KPIs to be calculated out of the execution logs:

- Time to departure
- Available cargo (market demand)
- Number of cancellations
- Volume of cancellations
- Time and number of interactions to handle booking, cancellations, rebooking
- Time to find a match and replacement of cargo
- Percentage of re-booking of a cancellation on a later departure
- Percentage of replacement of cancelled cargo

6.2.5. Multiple tests

This scenario is one alternative among many combination of possible events. For evaluating the commercial benefit that can be achieved by using the FInest platform, in terms of facilitated collaboration and higher operational performance, distinct scenario combinations should be tested.

While the main user case being that of late booking cancellation, there are a set of factors/events that can affect the situation, and therefore can be used to test the usefulness of the FInest collaboration platform in distinct contexts. These are schematized in the figure below (the dotted quadrants), with a link to the FInest technical capability that can be tested by "playing" with these variables.



6.3. Scenario 2: Resource Coordination at Port & Terminal

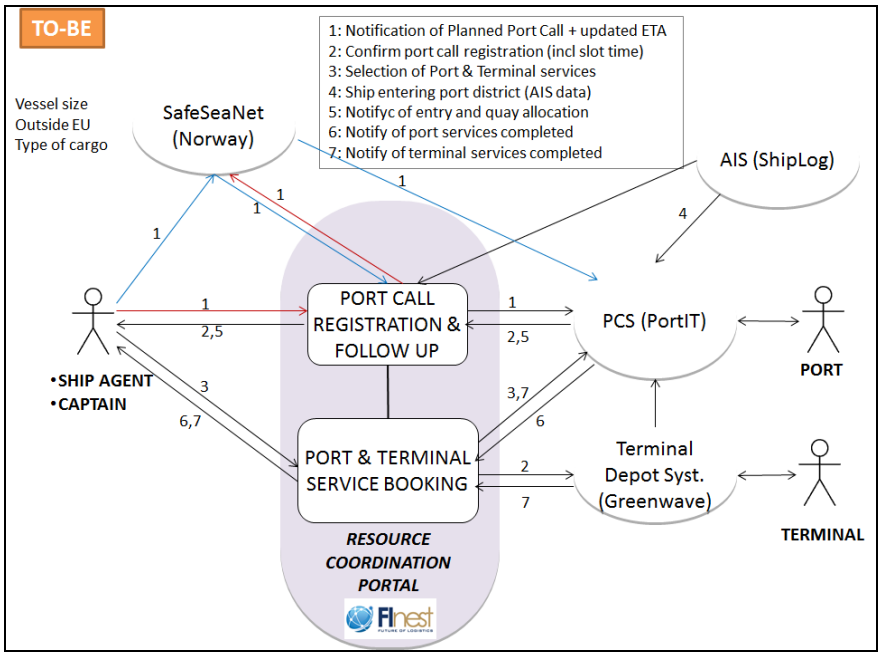
Authors: MARINTEK, Port of Ålesund, Tyrholm & Farstad

6.3.1. Introduction:

The scenario illustrates how the challenge to achieve an effective handling operation in port and terminal can be overcome by getting the right information at the right time from a carrier to the port and the terminal, and made available for all stakeholders.

This shall be supported by a common system for resources and services management for the whole port and terminal community, to facilitate coordination and cooperation across organization boundaries and support vessel voyage and port call planning.

The scenario features, on one side, a vessel representatives (vessel captain or ship agent) responsible for planning the call at each port along the route, and on the other side, a port, terminal and other services providers offering ship and cargo handling services to incoming vessels.



The **business model** supported by the FInest platform is *the semi- automatic handling of port call based on real-time information enabled by synchronization of resource planning at among the port and terminal service suppliers*. The ship can register its port call and book services through the platform that display real-time information about resource availabilities, while the port and terminal service providers can coordinate their services and resources based on real-time information provided by the platform regarding bookings and resources available.

The main **expected benefit** is the coordination of information among multiple actors based on automatic exchange of real-time data, enabling more efficient planning of services at port and terminals as well as support for optimization of ship voyage.

The scenario starts when a ship (vessel Tina) is sailing on its regular route, and is preparing for port calls.

The captain prepares for port call by registering it on SSN 3 days before arrival. 2 days before approaching port, the captain/ship agent confirm ETA / ETD to port, reserve a quay, book ship services from port and services providers, as well as cargo handling services from the terminal. When booking the quay, real time information indicate an unavailability of berth at the time slot, which enables the ship to reschedule its slot slightly.

The resource coordination platform establish the most appropriate and precise resource plan possible based on, on one side, information about the ship's ETA/ETD and services needed (some service require different amount of time), and on the other side, the port's and terminal's resource availability.
This draft of optimized resource plan is transferred to the port and terminal service providers simultaneously. After verification of these service reservations and available capacity / contracts / special cases, they can confirm the bookings directly via the platform.

The day of the port call, 3 hours before the planned arrival of the vessel Tina, a deviation is detected by FInest, based on automatic cross-check of AIS data with the voyage plan of another vessel, Clarissa, which has a planned port call right before Tina at the same port/quay. The vessel Clarissa location indicates a delay (because of bad weather) in schedule, and FInest calculate a probable arrival at Ålesund with 3 hours delay. A warning is sent by FInest to the port and the terminal, together with an indication of potential resource conflict because the two ships are likely to arrive at the same time.
The service booking list for Clarissa is updated based on new ETA, and indicate that the departure time also must be postponed by one hours. The port and terminal service providers check for a solution ad hoc, but reach the same conclusion. The updated booking list is transferred to Clarissa.

This change in port call slot time of Clarissa will also disrupt the next port call, Tina. A warning is therefore sent automatically to Tina, so that the vessel can adapt its speed and postpone its ETA by one hour, in order not to have to queue at the port. The resource plan is updated according to the new slot time of Tina.

Finally, reschedule information is transferred to cargo agents who have cargo aimed for the two concerned ships, so that they can re-plan accordingly if necessary.
Information on updated vessel voyage is made available in the collaboration space so that handling of late cancellations of shipments (scenario 1) are able to use real-time information to update time-to-departure, thus affecting the remaining time for finding replacement cargo.

6.3.2. The users of the system (actors represented in the test):

The business users represented in the test scenario are:

Type of Actor	Users represented in the Scenario	Role in the scenario
Shipping Agent and/or Captain	Vessel Tina	The agent and the captain of the Vessel Tina. This user is the main actor of the scenario, conducting the following events: register the port call on SSN, book resources and adapt ETA-ETD based on availability of quay, and finally receive a notification of change in quay availability right before arrival
	Vessel Clarissa	Captain of Vessel Clarissa. This user is creating an event (delay in arrival) that affects the planning of port call, and lead to re-planning of the port & terminal service both for Clarissa, but also for Tina
Port service provider	Ålesund Port, "ARH"	This user is the handling the port call and coordinating port services and resources based on real-time information about resources needs and resources availability at the port and terminal area.
Terminal service provider	Tyrholm og Farstad, "TF"	This user receives info about ship arrival and need for cargo handling services, while gets access to real-time information about resources needs and resources availability at the port and terminal area in order to coordinate own resources.
Other service provider, Dockworkers	Administrative office of cargo handling crew	
Public	Local authorities Local community	

6.3.3. Test scenario detailed description: Execution steps and expected results

STEP	ACTOR	PROCESS DESCRIPTION	EXPECTED RESULT	TEST DATA
Planning voyage The ship agent Tina-agent, 3 days before planned arrival at the Port of Ålesund, notify of Port Call in Safe Sea Net for vessel Tina				
1	Tina-agent	Log in and access own menu	On the Menu window, the ship agent / captain can see "Planning Voygage", "Port Call Administration", "Port & Terminal Services", Destination information", and "Locations and Vessels"	
2	Tina-agent	Choose "Planning Voyage"	The Safe Sea Net Portal opens	
3	Tina-agent	Registration of port call notification in Safe Sea Net	∞ ∞ Operation done outside FInest ∞∞ The data registered in SSN are automatically stored in FInest, and transferred to the Ports concerned.	Ship name, IMO nr; last 10 ports, ETA-ETD, ISPS info, crew information. See appendix I
Port Call Administration *2 days before* planned arrival at the Port of Ålesund, NCL confirms port call, book a quay for vessel Tina, as well as all services and resources needed from the port/terminal				
4	Tina-capt	Log in and go to "Port Call Administration"	A window entitled "My Vessels" opens, corresponding to the vessels operated by NCL, as well as their voyage status, next destination, E-ATD/E-ATD	List of "my vessels" Appendix II
5	Tina-capt	Select Tina on the list by double-clicking	A window entitled "Port Call Administration" opens with information on the vessel Tina (same as registered in SSN)	
6	Tina-capt	On the drop-down list, select "Port of Ålesund / 02/02/12 (data of next port call)"	The drop down list displays all the ports at which the vessel is schedule to call during the actual voyage. When a specific port call is selected, the system runs and retrieve information registered earlier on the Safe Sea Net portal. A window appears, including: 1) General Information (SSN info including security documents), 2) Time Slot (ETD/ETD) and quay availability (displaying only quays adequates for the cargo to be discharge), 3) Positions (to see the vessel on a map)	
7	Tina-capt	In the box "Time slot", go to the "select a quay" drop-down list and select Skutvika.	The system compares the berth capacity available (information retrieved from the Port Community System) to the slot time of the vessel, and a warning is generated informing about mismatch. A chart is displayed showing the time slot and quay availability. This means that either the ship must update its ETA / ETD, or choose another quay.	Quays availability information in appendix III
8	Tina-	Choose the other quay "Flatholmen"		

	capt			
9	Tina-capt	In the field "Cargo", upload discharge and loading list.		
10	Tina-capt	Click on "send for confirmation"	∞ ∞ information processing ∞∞ The system runs, connects to the Port's back end system, which confirms the booking of quay for the vessel Tina. A message appear "Quay Booking Confirmed"	
11	Tina-capt	Continue on "Book Port/Terminal Services" (in the main menu)	A window entitled "Port and Terminal Services" appears. On the top, summary of the actual port call is displayed, followed by a field containing a long list of services and resources available at the destination.	
12	Tina-capt	Fill out the list of services and resources needed for Tina for the actual port call by clicking of the followings: weather information, mooring assistance, fresh water, unloading, loading		AppendixIV
13	Tina-capt	Click on "send for confirmation"	∞ ∞ information processing ∞∞ The system runs. Based on the booking information as well as information about capacity availability at port and terminal (based on information from the Port Community System PortIT and the Terminal Depot System Greenwave), the system establish a resource schedule (draft) showing which resource is planned to be used and at what time period. This is shown in a new window entitled "Service booking confirmation" that appears when the draft is ready. The status of booking is also displayed as "waiting for reply" or "confirmed" so that the captain knows the status. This plan is communicated through Finest to the corresponding service providers with request for confirmation.	Appendix V
14	Tina-capt	Log off and continue other business	…	
Booking Confirmation by Port and Terminal Services All bookings are sent to the service suppliers, who confirm or propose another time. The system updates the resource plan progressively as service suppliers confirm the booking				
15	ÅRH	Receive booking request (email). Login, and go to "resource status"	see a chart displaying the overview of vessels visiting the port.	Appendix VI
16	ÅRH	Click on the vessel Tina and "confirm booking"	The vessel box changes from red to green. And a window with the draft resource plan appears, indicating the resources booked and time-period. The user can confirm or edit the propose schedule (based on more ad hoc information).	

17	ÅRH	Confirm all resource/service booked by click on "confirm"	The services/resources change status to "confirmed"	
18	TF	Receive booking request (email) for unloading and loading services. Login, go to "resource status"	see a chart displaying the overview of vessels visiting the terminal Skutvika.	Appendix VI
19	TF	Select vessel Tina and click on "confirm"		
20	Tina-capt	NCL receives a notification of update is the service booking status. Log on the platform and go to the " Port & Terminal Services" field and Select Tina, voyage 09ff, and port call Ålesund 02/02/12.	The "service booking confirmation" list appears showing all status as "confirmed"	Appendix V
21	Tina-capt	Log off and continue voyage.		
Deviation: ship Clarissa is delayed => need for re-planning of port call for Clarissa and the next port call (Tina) FInest compares information from AIS with vessel schedules, and detect a deviation from plan for the vessel Clarissa. A re-planning is generated.				
22		FInest detects a deviation	∞ ∞ information processing ∞∞ The resource plan for Clarissa is updated. A warning to the port and terminal is sent announcing the delay of Clarissa of 3 hours, together with suggested new resource plan, highlighting the conflict in availability (two vessels at port at the same time, same berth)	
23	ÅRH / TF	Receive warning by FInest. Log in and go to "Resource status". The system proposes a new plan (based on new ETA)	The new plan proposed appears for Clarissa, highlighting the conflict with Tina (because ETD of Clarissa needs to be postponed, which overlaps with Tina's slot time) and need to reschedule Tina's call.	Appendix VI
24	ÅRH	The port and the terminal check with other port community members if services can be carried out in a shorter time	A chat window is open, connecting ÅRH, TF, another terminal, an mooring crew. The parties check whether another quay can be used, but no match in found between availability of terminal facilities, mooring crew and quay availability.	
25	ÅRH	The conclusion is that Clarissa must also update its ETD; ÅRH click on "accept the new schedule"	∞ ∞ information processing ∞∞ Clarissa receives notification of new slot (ETA+ ETD)	
26	ÅRH	Open the resource plan to Tina and click	The resource plan is updated with latest info on ETA-ETD, and matched to port quay availability.	

		on update		
27	ÅRH	Click on "accept" Announce to Tina that services are postponed	∞ ∞ information processing ∞∞ Tina receives a message of changes in slot time, so that the ETA must be postponed by one hour, but that the ETD is unchanged.	
28	Tina-capt	The vessel receives the warning about change of slot time. Opens the message and logs on directly on FInest and the vessel call page for Tina at Ålesund 02/02/12.	The quay schedule chart shows a mismatch of one hour between the current slot time and quay availability. A message requiring to postpone ETA by one hours appears, together with a suggestion for updated resource/service plan	
29	Tina-capt	Click on OK, and adapt the vessel's speed accordingly		
Information spreading *Updated information on re-schedule is sent to other actors depending on that information, and made available in the collaboration platform*				
30	KN	The deviations detected and re-schedules are notified by FInest to the cargo-agents and other actors, so that they can adapt and if necessary reorganize transport in order to best utilize time and the transport assets available.		
31	NCL	The information about the changes in Slot time of both vessels is made available of the collaboration space, so that "gate-closing time" for the vessel is updated. This real-time information, translated into "time-to-departure", is used by the ship operator in the case of handling of late cancellations of shipments (scenario 1) and defines the remaining time for finding replacement cargo.		

6.3.4. Performance of the test execution

In order to analyze the performance of the test execution, the business user would require the following KPIs to be calculated out of the execution logs:

- Number of port calls
- Number of changes per port call
- Number of interaction for booking a quay
- Time to plan port call (from notification to confirmation of services booked)
- Number of interactions and time used to reschedule port call
- Case of waiting a port
- Port and terminal resource utilization factor

6.3.5. Multiple tests

This scenario is one of many combinations of possible events. For evaluating the commercial benefit that can be achieved by using the FInest platform, in terms of facilitated collaboration and higher operational performance, distinct scenario combinations should be tested.

While the main user case being that of planning of port call, including booking of quay and all port and terminal services related, the following factors/events are the one affecting most the port and terminal operations, and can be used to test the usefulness of the FInest collaboration platform in distinct contexts.

Type of event or test variable:	**FInest functionality tested:**
Deviation: -Vessel delayed (weather, delay at previous port, technical problem…) -Vessel ahead of schedule	Detection of deviation based on multiple data sources and communication to stakeholders in good time
Amplitude of change in service booking	Capacity to build draft resource plans that take into account resources available based on real-time information, but with a margin of action allowing changes in bookings without affecting the scheduling of resources every time.
Number of changes in service booking	Capacity to build draft resource plans that can anticipate possible future deviations (based on statistics).
Non announced ship arrival, quay visit	Intelligent use of AIS system and port traffic statistics to anticipate unannounced arrival, and notify the port so that contact can be made with the ship
Port & Terminal resource non-availability	Rapid analysis of resource situation and identification of alternative resources to replace the missing one - resource at port area, but also in neighbors areas if necessary.
Timing of deviation	Capacity to analyse the reaction time for different stakeholders and use this information as a filter to find alternative solutions or evaluate the need to generate a warning of deviation.
Type of event, and prioritization based on qualitative criteria	An optimal human-technology interface enabling full user discretion on the resource coordination activity, based on subjective evaluation or internal information.

6.4. Scenario 3: Real-time event handling

Authors: Air France KLM, Kuehne+Nagel

6.4.1. Introduction

The scenario explains how the challenge of gaps between the original booking and the actual shipment can be reduced or managed as good as possible. In this scenario, the shipper, trucker, forwarder and air carrier are working together in one supply chain. The demonstrator focuses this time only on the execution of a freight transport and shows how deviations can be managed.

6.4.2. The users of the system (actors represented in the test)

Shipper: Is triggering the freight transport and "causing" the deviations in the shipment because they want to ship more after the original booking is made. The shipper has asked the forward to organize the whole transport, from end to end.

Trucker: The trucker is asked by the forward to pick up the goods to be shipped at the shipper and bring it to the forwarders warehouse.

Forwarder: The forwarder is arranging the whole transport and made a agreement with the air carrier for the shipments.

Air carrier: The airline is execution the air transport.

6.4.3. Test scenario detailed description: Execution steps and expected results

STEP	ACTOR	PROCESS DESCRIPTION	EXPECTED RESULT	TEST DATA
Change request from shipper				
1	*Shipper*	*Logs in into the finest platform*	*His basic booking window is displayed*	*See demonstrator 3*
2	*Shipper*	*Goes to the booking he wants to change*	*He sees the booking he wants to change*	
3	Shipper	*Changes booking from 3-5 pallets*	*A change request is set up*	
4	Shipper	*Submits booking*	*A change request is being sent toward the forwarder and carrier*	
Change assessment and proposal from air carrier				
1	*Carrier*	*Carrier logs in into the Finest platform*	*He sees the standard Finest screen with different opportunities*	
2	*Carrier*	*The carrier goes to "my bookings"*	*The carrier has an overview of his bookings and where the changes are*	
3	*Carrier*	*The carriers selects the booking to investigate the changes*	*The carrier get all the details from the booking*	
1	*Carrier*	*BLACK BOX*	*Start up replanning*	
2	*Carrier*	*The carrier enters the new proposal into the system*	*The carrier gets a screen where he can fill in the changed offer. Flight nr. Date, time of departure and arrival, freight dimensions to be transported and price*	
3	*Carrier*	*The carrier confirms his new offer*	*He gets a confirmation button to push on.* *The proposal is sent to the forwarder*	
2	*Carrier*	*The carrier logs off*		
Change assessment and proposal from forwarder				
1	*FWD*	*Log in to FInest*	*Access granted to myFInest*	
2	*FWD*	*Go to my bookings*	*Booking App will opened*	
3	FWD	*Select booking to be changed*	*Record selection and details provided*	
4	FWD	*Enters new values*	*Booking details are amended*	
5	FWD	*Recalculating charges*	*According to changes the charges will changed based on the agreement with the shipper or general freight tariffs (as set up somewhere in the business partner/ contact management app)*	
6	FWD	*Submits changes to shipper for confirmation*	*Send notification to shipper for change confirmation/ booking is highlighted as waiting for approval from client*	

7	SHP	*Shipper receives and confirms changes*	*Change notification appears as urgent in INBOX Crosschecks and approves changes. Submits change confirmation*	
8	FWD	*Confirms approval*	*Automatic update of the booking* *Status change to confirmed*	
9	FInest	*Send change notification to carrier*	*Carrier receives change notification from Finest* *Booking details is automatically updated*	
Change assessment from shipper including submission				
1	*SHP*	*Log in to FInest*	*Access granted*	
2	*SHP*	*Open current shipment panel*	*Shipment app / ERP is opened*	
3	SHP	*Select shipment*	*Shipment overview displayed*	
4	SHP	*Open shipment details*	*Details of selected details are shown*	
5	SHP	*Change shipment details*	*Details are changed*	
6	SHP	*Submit changes to FWD*	*Submit button is engaged message is displayed "changes submitted"*	
7	SHP	*Receive new proposal from FWD*	*message received / INBOX highlighted*	
8	SHP	*Confirm or reject new proposal*		
8.a1	SHP	*confirm new proposal* *submit confirmation to FWD*	*Submit button is engaged message is displayed "changes confirmed"*	
8.a.2	FInest	*Send Notification to carrier*	*Carrier notification message is send automatically*	
8.b.1	SHP	*Reject new proposal* *Submit rejection to FWD*	*Shipment changes to open* *Booking at forwarder cancelled*	
8.b.2	Finest	*Send notification to carrier*	*Carrier notification message is send automatically*	
8.b.3	SHP	*Got o e-market place*	*e-market place app is opened*	
8.b.4	SHP	*Drop service demand*	*Service request is entered*	

6.4.4. Performance of the test execution

In order to analyze the performance of the test execution, the business user would require the following KPIs to be calculated out of the execution logs:

- Number and type of deviations (difference booking vs. actual)
- Time lap between a change in plan occurs until the forwarder and carrier are notified.
- Percentage of deviations handled by the carrier before departure
- Percentage of deviations handled by the forwarder before departure
- Time and effort (man hour) to handle deviations

6.5. Scenario 4: ePlanning (Transport Order Management)

Authors: Arcelik

6.5.1. Introduction

The scenario illustrates the planning of a transport for import of parts to Turkey.

1. The supplier starts describing the shipment. The suggested shipment is sent to the FInest transport demand description. This triggers a notification to Arcelik, and corrections to the shipment and transport plans are done by Arcelik by updating the demand descriptions. If the supplier needs to change something (or approve changes done by Arcelik), the system will send him a notification.

2. The planning may start when the demand description is ready for this, for a well-defined description, this may be done by a click of a button. The planning consist of several stages that are automated:

    a. The planning system starts by fetching Arcelik's long-term contracts from the ECM. This is used both for prioritizing the search for transport services, and for modifying the terms in the transport service descriptions.

    b. The planning system then fetches information from the parties with long-term contracts, and starts building a network of transport chains from this.

    c. If the network cannot be completed by parties having long-term contracts with Arcelik, the system will search for spot market contracts. The service requests for these are added to the transport chain network.

    d. An optimization function reduces the network to a set of "best fit" transport chains, and configures these chains to a "best possible" configuration (with regards to timing, cost, quality of services etc.)

3. The resulting transport chains are presented to the planner. The planner may now select and configure plans, including:

    a. Selecting the preferred transport chain and preferred providers for each leg of the chain. Several choices may be made; this is useful both for the cases when one provider is unable to carry the entire demand, and may also be used by an automated booking process to automatically try alternatives if a booking fails.

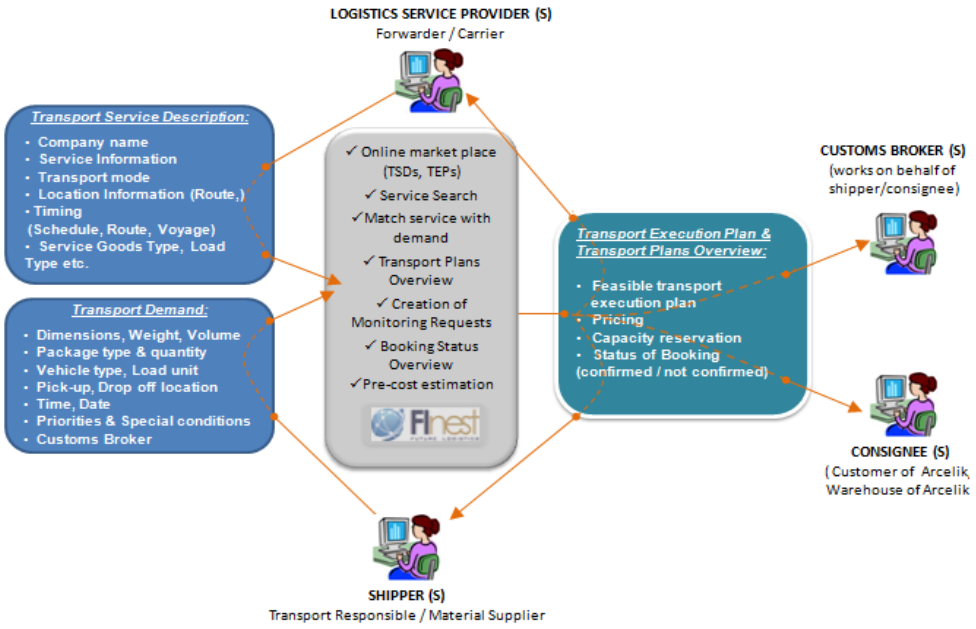
    b. Configuring the transports. This may include changing the timing, suggestions to new pricing, adding monitoring requests etc.

    c. Adding new services (i.e. services not included in the automatic transport plan). This may include agent services (customs etc)

    d. Enter collaboration with providers. This may be useful for getting approval to transport configurations before booking, and making sure that the described service found by the system is valid (i.e. bookable)

4. When the transport plan is finished, the system tries to book the services in the plan. For a Future Internet system, it is assumed that the booking can be done online using services accessible by the TPM. The system should however also have functionality to handle "old fashioned, manual" booking.

At any time, the planner has the possibility to view transport plans at any stage of planning (e.g. during planning, during booking of plan, during execution of plan), including statuses, warnings and deviations.



6.5.2. The users of the system (actors represented in the test)

The users presented in the scenario are:

Transport Planner (Logistics Responsible from Arçelik): the person in charge of shipment planning, deciding on the final transport plan and booking. In the current scenario Arçelik is responsible from shipment planning (due to the agreed Incoterms) hence the Transport Planner is the Logistics responsible from Arçelik.

Logistics Service Provider: the person in charge of planning and execution of shipment. Confirms/Rejects bookings

Material Supplier (Cargo Shipper): is the actual owner of the goods to be transported. Responsible for preparing the goods for the transport and creating the packing list information to describe the transport demand.

6.5.3. Test scenario detailed description: Execution steps and expected results

STEP	ACTOR	PROCESS DESCRIPTION	EXPECTED RESULT	TEST DATA
Describe the shipping demand *Supplier of Goods (SOG) start to describe the shipping demand*				
1	SOG	Log in and open the field of "Transport Demand"	A list of purchase orders/sales orders that are under his responsibility and are /will be ready for shipment is displayed	See Appendix I
2	SOG	Select the orders of whose transport demand he is willing to describe	Overview of the selection is displayed	See Appendix II
3	SOG	Click on "Create Shipment from Selected Orders"	Packing list information is displayed. Packing list is created automatically (transfer from legacy system). The screen should also include fields for manual entry of the packing list (in case no automatic transfer is possible)	See Appendix III
4	SOG	Click on " Store Shipment Creation"	A unique transport demand number will be assigned by FInest and displayed for the stored transport demand	See Appendix III
5	SOG	Click on " Finish Shipment Creation"	System sends notification to the Transport Planner (TP)	See Appendix III
6	TP	Log in and Open the field of "Transport Demand"	A list of transport demands are overviewed	See Appendix IV-I
7	TP	Selects 1617129 from the list	Overview of Selection is displayed on the screen	See Appendix IV-II
8	TP	Click on "Publish on marketplace"		See Appendix IV-II
Plan transport *Transport Planner*				
9	TP	Open the field of "Transport Demand"	A list of transport demands are overviewed	See Appendix IV-I
10	TP	Selects 1617129 from the list	Overview of Selection is displayed on the screen	See Appendix IV-II
11	TP	Click "Plan Transport"	Overview of Transport Alternatives is displayed	See Appendix V-I
12	TP	Click on "Details"	Detail of the Transport Service is overviewed	See Appendix V-I
13	TP	Click "Monitoring Requests"	A list of Expected Notifications are displayed	See Appendix VI
14	TP	Selects the transport alternatives and Click on "Customs and Agents"	A window opens which includes some fields to be filled	See Appendix VII
15	TP	Selects customs agency from the predefined list and Click on "Back"	The address and contact details of the customs is overviewed	See Appendix V-II

16	TP	Click on "Book Selected Transports"	Responses from different logistics service providers are displayed	See Appendix VIII
Monitor Booking *Transport Planner*				
17	TP	Click on "View Transport Plans"	Screen showing the status of the bookings is displayed.	See Appendix IX

6.5.4. Performance of the test execution

In order to analyze the performance of the test execution, the business user would require the following KPIs to be calculated out of the execution logs:

- Time and efforts (man hours) used for planning shipment
- Time and efforts (man hours) to build a "best possible" configurationNumber of configurations necessary for the planner to complete the transport plan
- Time and effort to complete the transport plan (include configuration and new services)
- Percentage of services not "bookable" when sending booking requests to service providers.

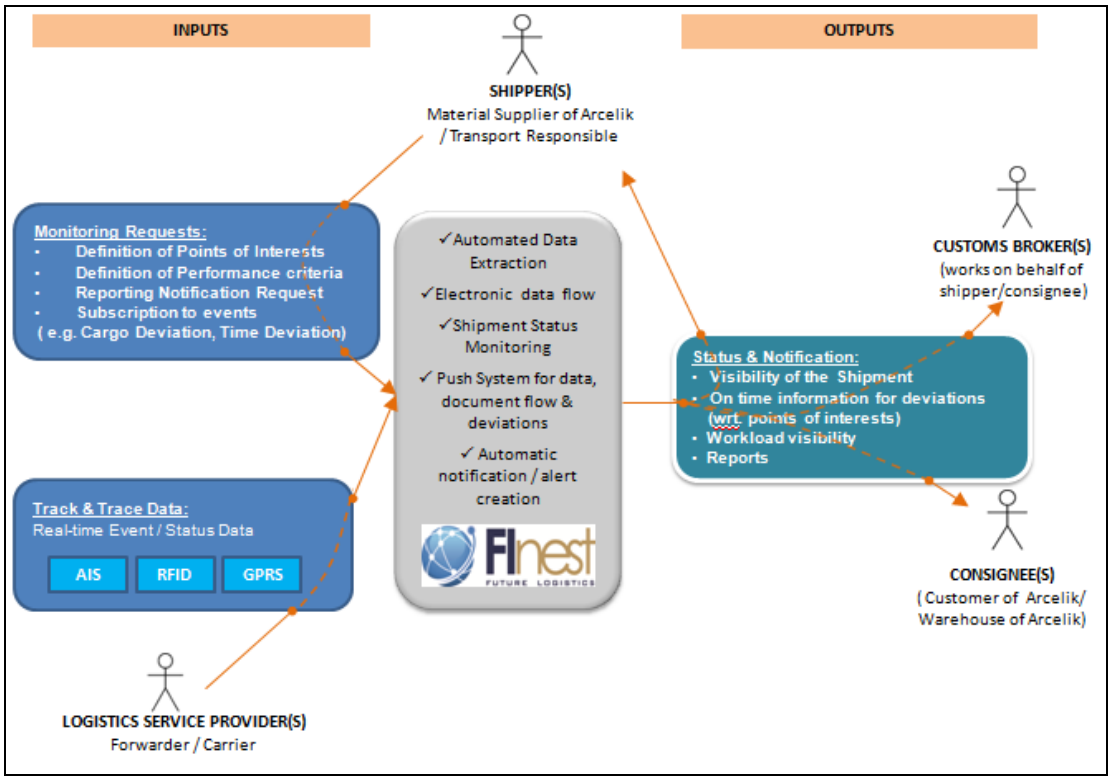
6.6. Scenario 5: Automated Shipment Tracking for Export to UK

Authors: Arcelik

6.6.1. Introduction:

The scenario illustrates automated shipment tracking both for the planning and execution of an export process from Turkey to UK.

- ✓ LSP has real-time tracking systems available and accepts to share it with the FInest platform.
- ✓ Real-time data on shipment status (event) is extracted from information sources electronically.
- ✓ Actors can define their points of interests and performance criteria (e.g. agreed duration) for their monitoring requests (alert rules) and can subscribe to the events that they are interested.
- ✓ After the execution phase of the shipment is started, according to the monitoring requests they defined, actors receive notifications/alerts. Cargo deviations and time deviations are informed to the parties when they happen (within a very short notice).
- ✓ The shipment status is visible to the all parties involved (who have authorization to see it) from one source.
- ✓ By using sorting/reporting features, users can form lists/reports including information about the shipments that they would like to monitor if they have authorization; hence can manage their workload effectively by planning current & proceeding operations based on more reliable data.



6.6.2. The users of the system (actors represented in the test)

The users presented in the scenario are:

- ✓ **Transport Planner:** the person in charge of shipment planning, deciding on the final transport plan and booking. In the current scenario Arçelik is responsible from shipment planning (due to the agreed Incoterms) hence the Transport Planner is the Logistics responsible from Arçelik for both Import and Export use case scenarios. Transport planner either can act as a "Supplier" (export case) or "Receiver" (import case).
- ✓ **Supplier:** the person who is responsible from supplying the goods to be transported.
- ✓ **Export Customs Agency:** the person in charge of execution of the customs operations in the exporter country.
- ✓ **Inland Transporter at exporter country:** the person in charge of execution of inland shipment in Turkey. Confirms/Rejects bookings.
- ✓ **Carrier:** the person in charge of execution international leg of the shipment. Confirms/Rejects bookings.
- ✓ **Import Customs Agency:** the person in charge of execution of the customs operations in the importer country.
- ✓ **Inland Transporter at the importer country:** the person in charge of execution of inland shipment in UK. Confirms/Rejects bookings.
- ✓ **Customer**: the person who will receive the goods.

6.6.3. Test scenario detailed description: Execution steps and expected results

STEP	ACTOR	PROCESS DESCRIPTION	EXPECTED RESULT	TEST DATA
Monitoring requests definition *Logistics responsible from Arçelik defines his points of interests*				
1	*TP*	*Transport Planner opens the field of "Monitoring Requests"*	*Monitoring requests definition list displayed*	*Appendix I*
2	*TP*	*Transport planner updates the list of Monitoring Requests*	*List of subscribed monitoring requests are displayed*	*Appendix I*
Monitor the status of the shipment *Transport Planner monitors the status of the shipment*				
3	TP	*Transport Planner opens the field of "Transport Plans"*	*List of transport plans (both planned and not planned) is overview together with the notifications received.*	*Appendix II - Appendix III*
4	TP	*Transport Planner clicks the details for the notification*	*The content of the notification is displayed*	*Appendix IV-I and Appendix IV-II and Appendix IV-III*
5	TP	*Transport Planner clicks the notification to start re-planning*	*Transport planner starts re-planning*	
Monitor his workload by sorting the defined transport *Transport Planner*				
	TP	*Transport Planner opens the field of work plan.*	*Selects the event type he is interested and the list of related events are displayed.*	*Appendix V*

6.6.4. Performance of the test execution

In order to analyze the performance of the test execution, the following KPIs would be required from the execution logs:

- Number of deviations from plan detected automatically
- Number of deviations not detected.
- Time between a deviation registered at a point of interest and notified to the transport planner
- Time and effort used for monitoring (per shipment)

7. Conclusion

The present deliverable D2.4 documents the initial outcome of Tasks T2.3 (Experimentation Specification) and T2.4 (Evaluation Methodologies). A framework for evaluation of the contribution of the FInest solution to improving collaboration and integration is presented together with a description of the experimentation and evaluation process envisioned.

The phase II of the FI PPP program will focuses on conducting trial experiments of use case scenarios showing how FI WARE services and applications can enhance business performance and sustainability. The work will include identification of appropriate test sites, development of test protocol, development of domain specific applications, reporting of the performance of the tests and preparing for large-scale trials in Phase III of the FI PPP.

The last 6 months of the FInest project will serve to prepare for Phase II, by producing an Experimentation Plan, covering both the Business Target (assessment of Performance Improvement) and the technical target (relevance of the FInest solution and FI Ware).

The last deliverable (D2.5 "Final use case specification and Phase 2 experimentation plan") will provide the detailed plan for conducting large-scale trails in phase 2 of the FI PPP program, including refined experimentation specifications (T2.3) and individual evaluation methodologies for the selected use case scenarios (whose initial version are introduced in the present deliverable), along with possibilities for extending the set of scenarios as well as for the exploration of synergies with other FI PPP use cases.

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Annex 1. Data for test scenarios (separate file)

Annex 1.1: data for scenario 1 *Late booking cancellation*

Annex 1.2: data for scenario 2 *Resource coordination*

Annex 1.4: data for scenario 4 *e-Planning*

Annex 1.5: data for scenario5 *Automatic shipment tracking*