Case Study on the future development of technologies for CAR INTERIORS

INTRODUCTION

This document presents a complete, but brief, overview of the technology forecasting case study on the different technologies or materials which concur in making the car interiors a pleasurable place for the passengers. The case study has been run according to the overall structure of the FORMAT Methodology as shown in Figure 1.

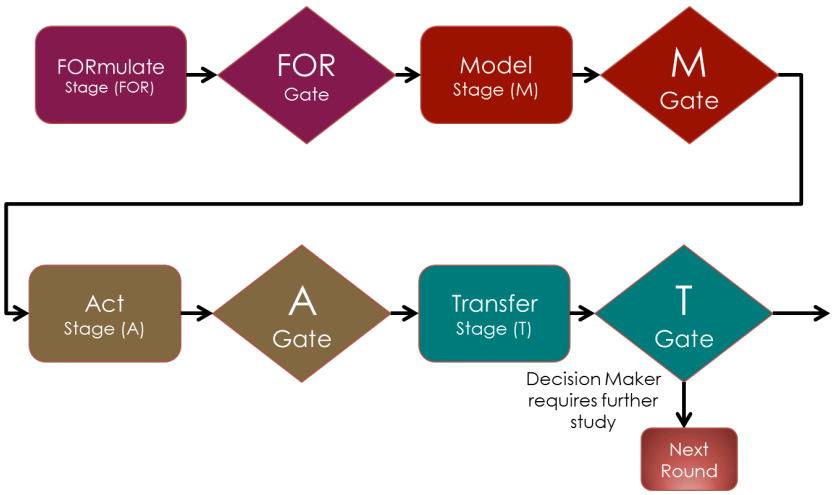


Figure 1: The FORMAT Methodology Stage-Gate process

The case study was carried out along nine working sessions. All the meetings were coached by a case study leader (from Politecnico di Milano) among the developers of the FORMAT methodology, which coordinated the work of the team with a web platform that allowed the different people to be connected from different place and share information on a common screen. The initial and the final meetings were the only exceptions. Those two were live meetings involving decision makers interested in the outcomes of such an investigation. The case study has been proposed by a network of companies producing goods of different nature (plastic or aluminum components, silk-printing decorations, …). These goods can be (or are currently) used in order to improve the functionality and the aesthetics of car interiors.

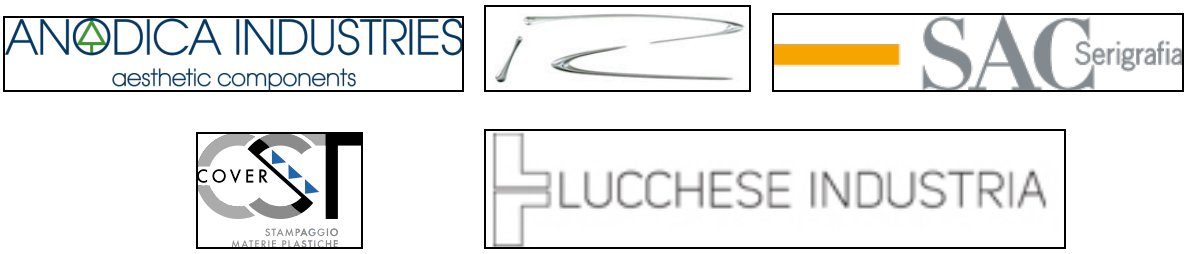


Figure 2: Logos of the 5 companies participating the case study

The case study started April 11th 2014 and ended July 18th 2014. The overall objective of such an investigation is to provide decision makers about novel insights and evidences about the future evolution of car interiors components, in order to better evaluate the suitability of their in-house technologies to produce also future products or, in turn, substitute them with more performing ones.

None of the participants, except the team leader, had previous experiences in technology forecasting.

1. FORMULATE STAGE

This stage aims at preparing the whole forecasting study in terms of objectives, questions to be answered about the future of the System To be Forecast (STF) as well as resources to be allocated along the defined agenda/workplan.

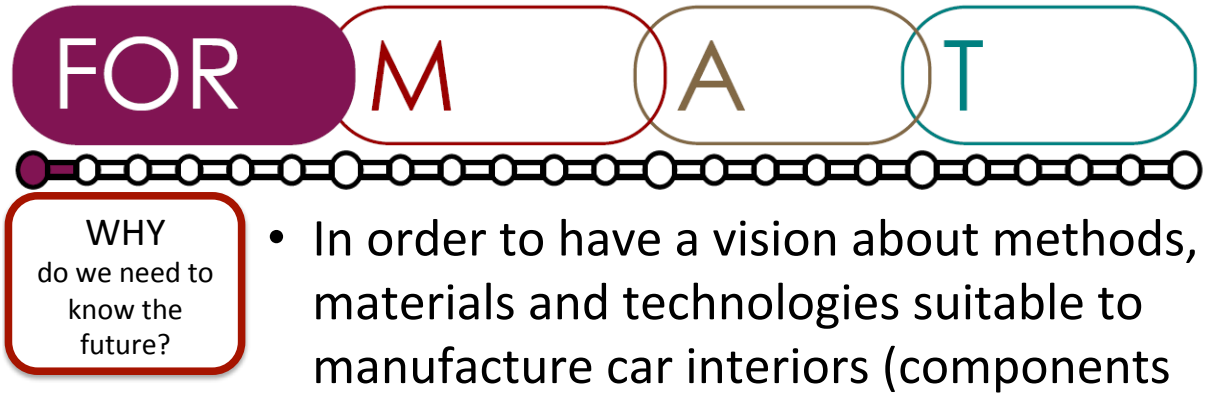
FOR_1: FORMULATE OBJECTIVES

What was done?

The team answered the question "Why do we need to know the future?" in order to set the overall objectives of the study. Every team member introduced its viewpoint that has been reconciled into the following set of concise objectives. The overall objective has been further focused on more specific objectives which are more directly linked to the way the outcomes of the forecasting study will be used by decision makers.

Why?

In order to start aligning the viewpoint from which the forecasting study has to be tackled, between the decision makers (beneficiaries of the forecast) and the team.



FOR_2: DEFINE EXPECTED OUTPUT

What was done?

The team performed this step quite quickly, because along the previous step the objectives were already defined so that a link between "why do we need to know the future" and "*WHAT do we need to know about the future (I)?*" is already clear to the mind of the participants. The team decided to focus on the evolution of future products to check the adequateness of current manufacturing technologies and potentially plan future investments.

Why?

In order to start clarifying how decision makers will use the outcomes of the forecasting study and how they will apply it in their decision processes. The explicit declaration about the application of forecasting outcomes, on the one hand, allows to both check the agreement about the objectives defined along the previous step (FOR_1) and support the identification of critical questions to be treated along the study (step FOR_4)

FOR_3: TO FORECAST OR NOT TO FORECAST?

What was done?

The team, given the previous objectives and their related application purposes, unanimously decided that, to satisfy the above targets (see steps FOR_1 and FOR_2), it is required to run a technology forecasting analysis. In other words, the question "Can we satisfy the formulated requests without Technological Forecasting?" was answered "No", suggesting to proceed with the application of the FORMAT Methodology.

Why?

In order to distinguish situations in which it is possible to address the overall objectives by means of problem solving from those that really require a technology forecasting investigation. It helps resources for R&D to be used for the application of a tailored methodological tool, being they forecasting or problem-solving oriented.

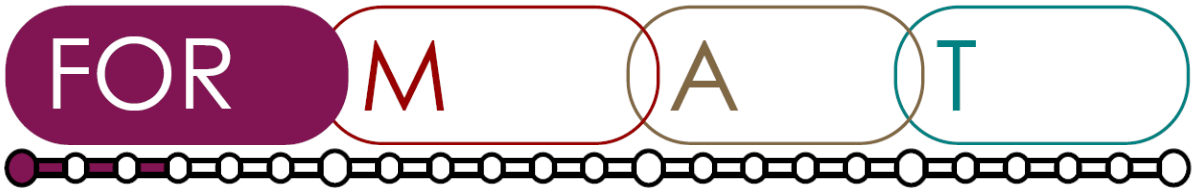
FOR_4: FORMULATE QUESTIONS

What was done?

Consistently with the decision of the previous step (FOR_3), the team answered the questions "*What do we need to know about the future?*" in a more precise way. In details the question(s) for the forecast has been formulated with an explicit reference to the System To be Forecast (STF). Moreover and consistently with the methodology, the team defined boundaries to limit the overall scope of the analysis. The time horizon has been set in accordance with the already experienced evolution of car interiors, whose cycle should last approximately ten years to recognize radical changes. Moreover, the geographical scope was reduced by considering cars to be sold in Europe. Convertible cars, given their very particular nature and their very small market share, were overlooked. The following slide collects the relevant questions for the forecast and the boundaries for the analysis as the team set them.

Why?

In order to let the team univocally describe the specific objective of the investigation. Indeed, it helps the team to share a common vision about the specific characteristics to be measured or considered to answer the questions of forecast and, thus, carry out more effectively and efficiently the activities along Stages M and A.



WHAT
do we need to know about the future?

- The evolution of <materials for car interiors (STF)> in order to satisfy the demands of
  - Safety
  - Aesthetics
  - Ecological/economical sustainability

Considering the variety due to:

- Market segment (costs, quality,..)

Given the following boundaries for the context

- Time span (when?): 2015-2025
- Geographical area (where?): Europa
- Exceptions: No convertible cars

For the benefits of

- Small and Medium Enterprises

FOR_5: PROJECT PLANNING

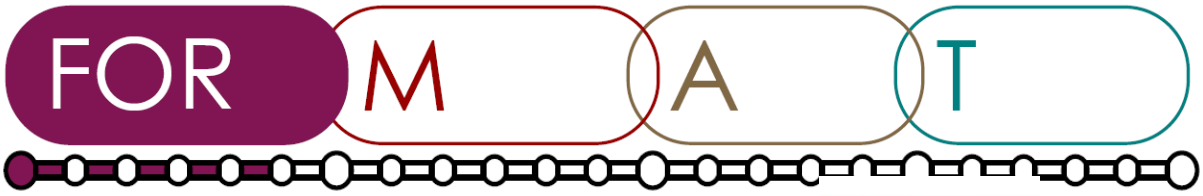
What was done?

The teamwork agreed on an agenda of online meetings in the time span of approximately 3 months. The first and the last meeting, respectively to start and to close the forecasting project, unlikely have been planned as live meetings gathering the whole team for a roundtable. The team agreed on a set of activities to be run during the meetings that have been organized in a Gantt chart.

Beyond human resources, the team identified a relevant set of sources of knowledge to draw from in order to enrich the study. Considering the nature of this study, the team defined the sources in order to map the characteristics of real technical systems. For this reason, the items in the list of knowledge sources range from technical and scientific journals to recreational ones (where information can be extracted by pictures), brochures as well as publications of automotive associations. Technical offices of partner companies have been considered as well.

Why?

In order to organize the work from the beginning to the end of the project, with a shared vision of the involved resources. This helps avoid inefficiencies along the process, as well as planning the activities both in and in-between team meetings.



HOW
do we plan to learn about future?

- Agenda for Meetings
- Webex
- Sources:
  - PlastLab Orbassano
  - Bonura (buyer VW south EU)
  - AutoTecnica (special issues)
  - Journals on plastic materials
  - Material Connexion
  - ANFIA
  - ATA
  - SAE
  - MaTech ➔ Start Innovation
  - SOLE (PRIMA)

GATE FOR

What was done?

In order to move ahead to the next stage, the team analyzed the items of the following checklist to verify if all the required activities were performed as requested by the FORMAT Methodology:

- *Main objectives of forecast (Project)* - done in step FOR_1
- *Definition of knowledge elements for the application of the forecasting results* - done in step FOR_1
- *Main outputs for Decision Makers (DM)* - done in step FOR_1
- *How the outputs will be applied by DM* - done in step FOR_1 and FOR_2
- *INTERIM CHECK: Can we get the required results without forecast?* - done in step FOR_3
- *Definition of preliminary constraints for the project*
    - *System (Process) to be forecasted (STF) from technological, economics, environmental and social (TEES) perspectives* - done in step FOR_4
    - *Time horizon* - done in step FOR_4
    - *Market scope and geographical context* - done in step FOR_4
- *List of "Questions" for Forecast* - done in step FOR_4
- *Plan of Project (How?)* - done in step FOR_5
- *Time diagram (Gantt or similar)* - done in step FOR_5
- *Resources for the activity (People, knowledge, IT instruments)* - done in step FOR_5

Why?

This gate allows the team to double check if the activities proposed by the FORMAT methodology have produced the expected output. Given the nature of the "Gate", in case of missing or partially satisfactory outputs, the team is asked to re-work along the Stage FOR in order to make its outputs compliant with what is required in order to step ahead to the Stage M.

2. MODEL STAGE

This stage aims at reviewing the existing knowledge about the STF. It is shared among participant and organized into convenient models which are both suitable to harmonize different viewpoints and provide a structured set of information for the next stage of the methodology.

M_1: DEFINE SYSTEM TO FORECAST

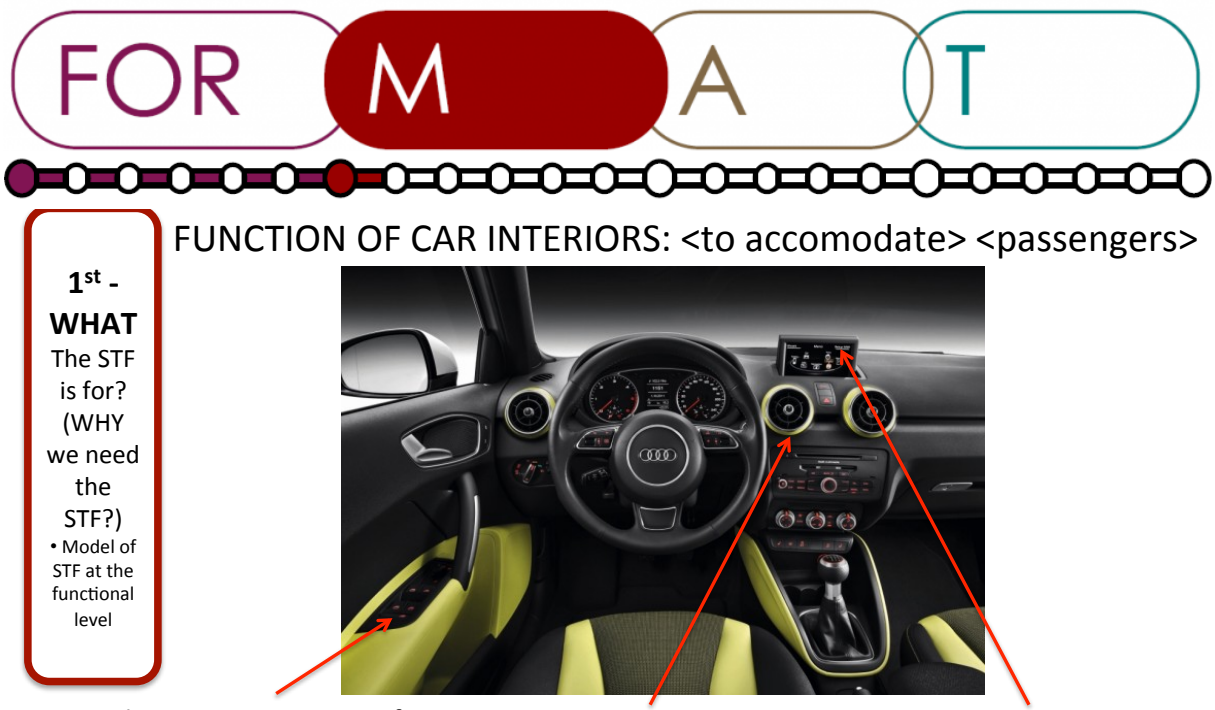
What was done?

This step aims at understanding what is the function of the STF, by answering the question "*What is the STF for?*". The Main function of car interiors has been summarized at the top of the slide. This function, even if formally correct, was considered too general to characterize the STF. Thus, it has been further detailed into sub-functions (lower part of the slide).

Please note that the functions are written according to the logic <the STF>+<action verb>+<object>. This is also compliant with the suggested scheme <the STF make(s)>+<object>+<changed feature>. (E.g: <the car interiors make>+<the small on-board devices>+<supported>).

Why?

In order to set a uniform detail level to describe the STF and ease the definition of related parameters to carry out evaluation between alternative solutions and extrapolate future trends.



M_2: IDENTIFY ALTERNATIVES

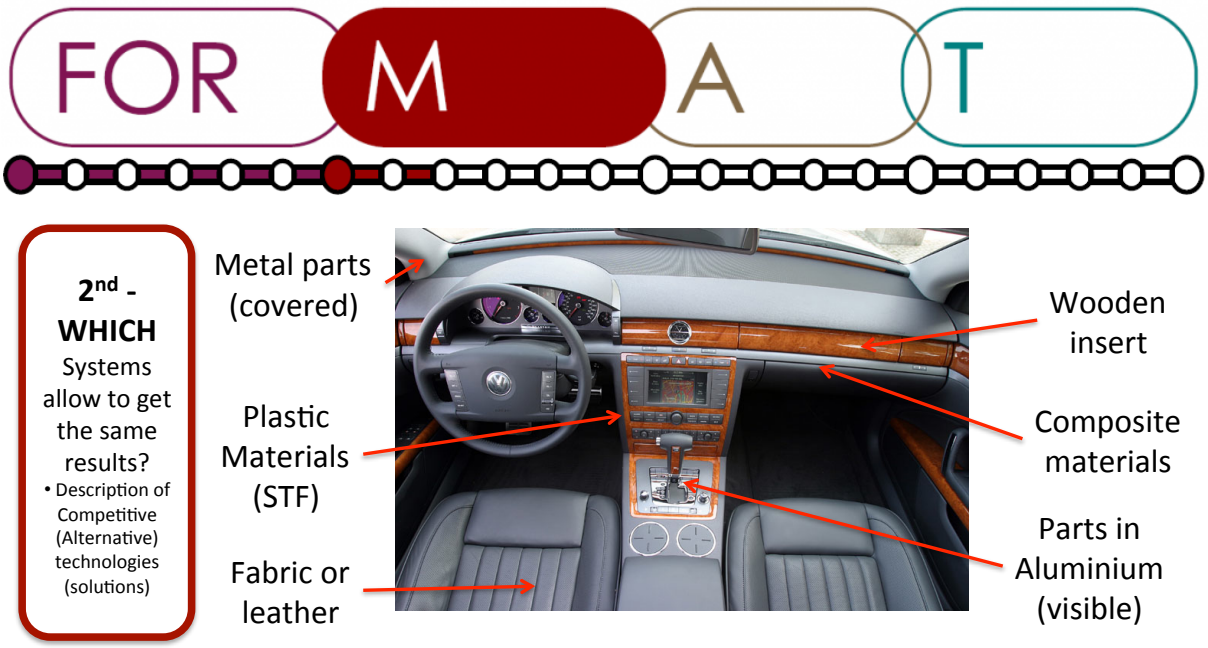
What was done?

This step aims at identifying the alternative technologies or solutions that address the functions described along the previous step (M_1). This is done by answering the question: "*which systems allow to get the same results*?" The list of alternative technologies is summarized in the slide below reported. The STF here are plastic materials, consistently with the overall stake of the team participants' companies.

The discussion about the competitive solutions looked for the completeness of alternatives. The discussion also allowed the team to conclude that plastic parts cannot be replaced by other technologies within car interiors at the current moment.

Why?

In order to enlarge the forecasting perspective to the context in which the STF and its alternative compete. This enables a more accurate definition of parameters for the competition (to be defined in step M_3) and a less biased setting for trending features as to be identified along step M_5.



The alternative technologies are not self-sufficient to replace plastic parts. Indeed, plastic components are currently necessary also to allow the installation of parts made with the above materials.

M_3: MEASURE PERFORMANCE

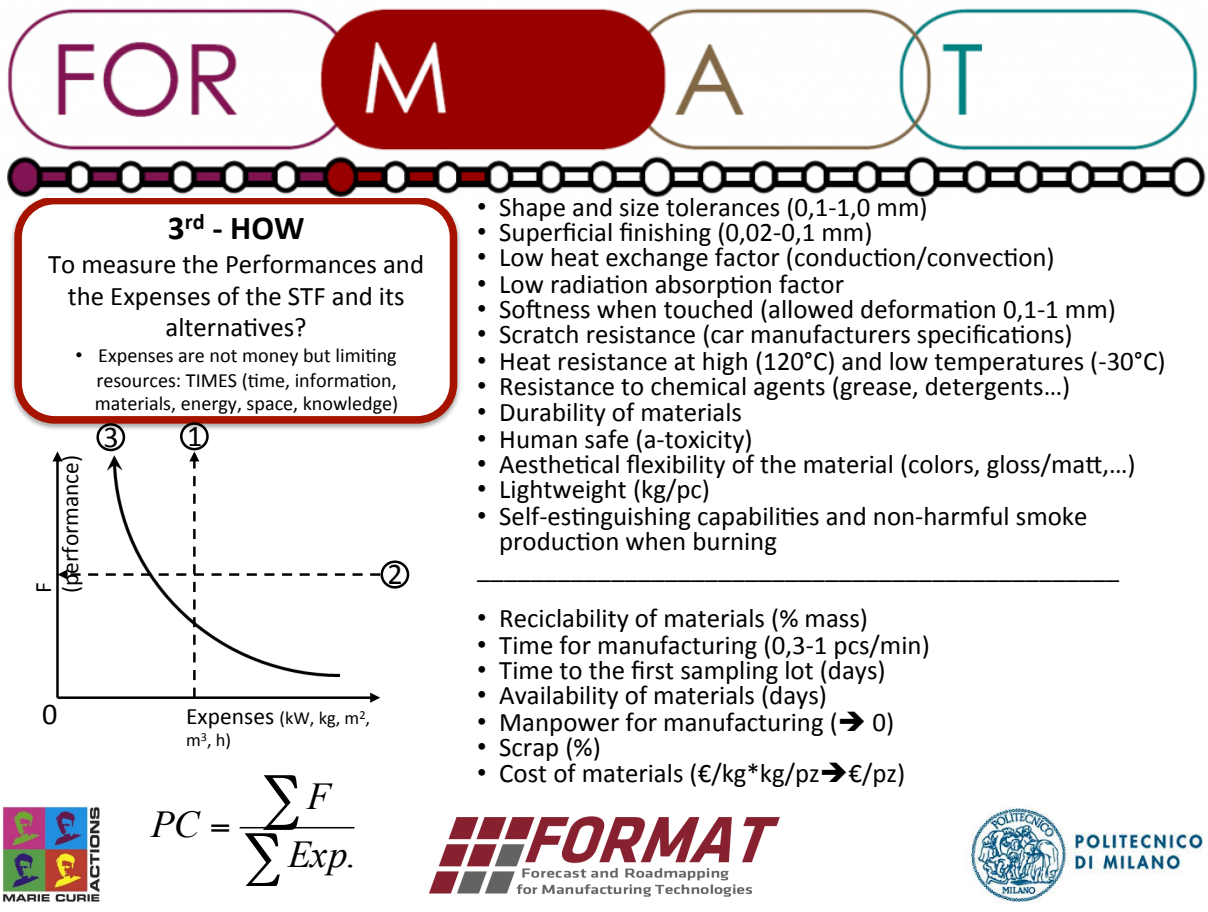
What was done?

This step focuses on the definition of characteristics (parameters, requirements,…) to measure, and thus compare, the STF and its alternative solutions. The measurement has to be carried out considering the performances and the quantity of resources the STF (and its alternatives) respectively delivers and consumes. The teamwork has defined the parameters reported in the slide below in order to answer the question "*how to measure performances and expenses of the STF and its alternatives?*". They are divided into performances (above) and expenses (as consumptions of time, information, materials, energy, space and knowledge; below).

In some cases the current standard values are reported in brackets.

Why?

In order to define the factors on which the competition among alternative solutions occurs. Thus, this helps the selection of the most promising competing solution to be considered with higher priority along the remaining of the study (step M_4).



M_4: SELECT ALTERNATIVES

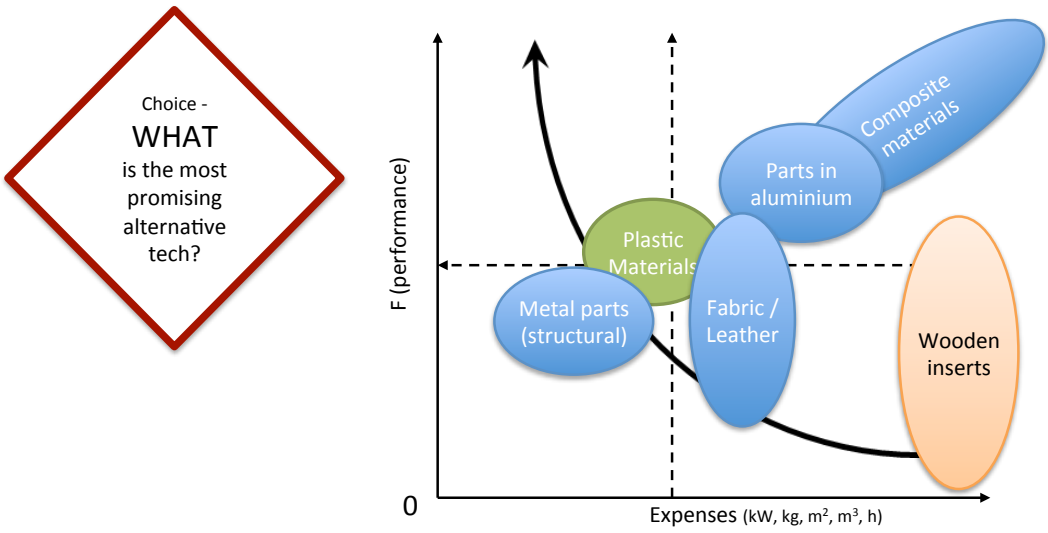
What was done?

This step aims at answering the question "*WHAT is the most promising alternative technology?*". The team discussed about the most promising alternative solution, but decided to continue the rest of the analysis by considering more than one alternative. To support this choice, the team compared the alternative solutions into a performance-expenses graph as shown below. The evaluation has been done qualitatively by team members, but according to the parameters defined in the previous M_3 step of the methodology.

Most of the alternatives to plastic materials has similar performances, or achieve better performances at higher expenses. The team decided to exclude from the analysis wooden inserts, since they were considered outliers in the overall scope of the investigation.

Why?

In order to both reduce the analysis to a meaningful set of alternatives to the STF and speed up the next steps of the methodology, with a reduced loss of completeness. This also allows the team to reduce biases towards the factors that are more relevant in the competition and, thus, keep a more context-oriented perspective in considering the historical evolution of the STF, its parts and the circumstances in which it existed/exists/will exist (M_5).



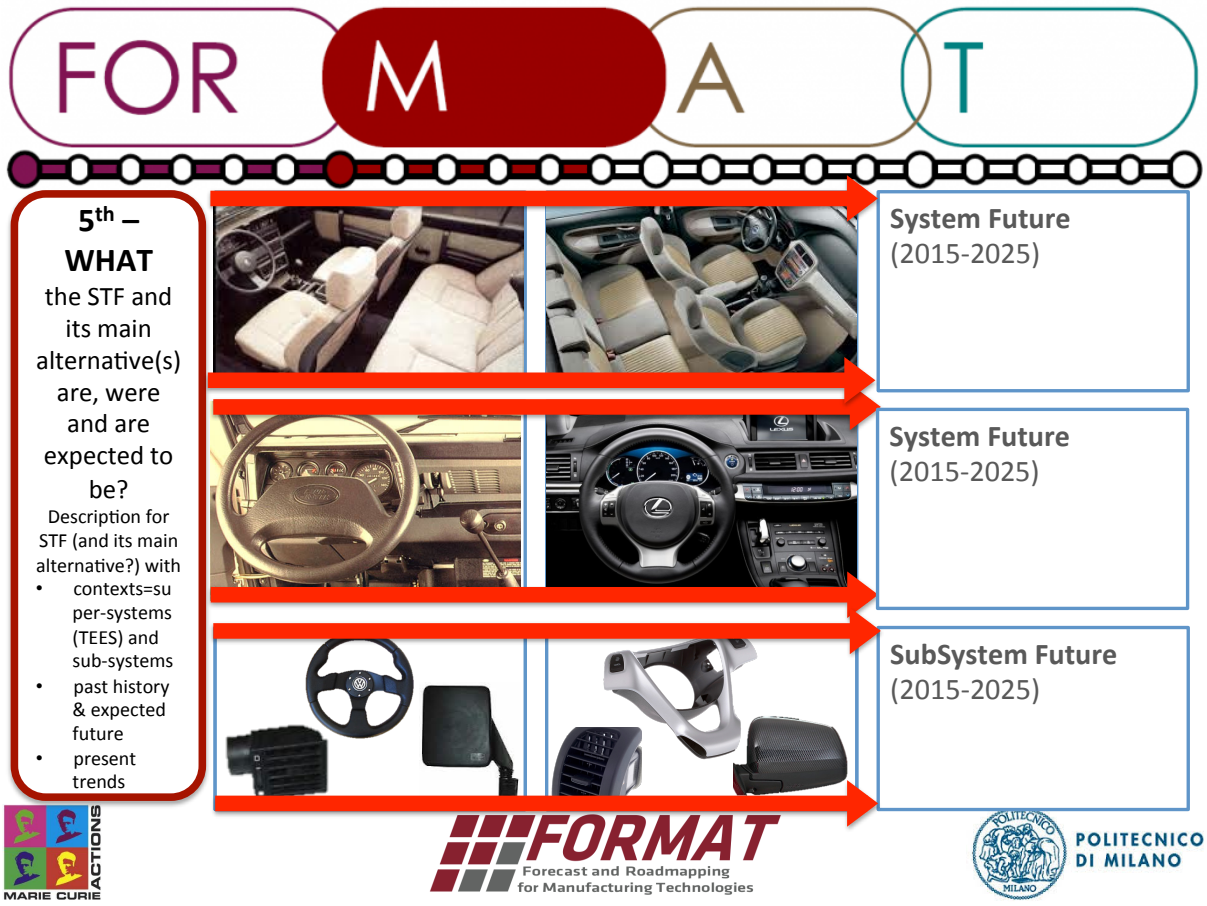
M_5: STUDY CONTEXT

What was done?

The team approached the System Operator analysis starting from the definition of the elements characterizing the hierarchy (e.g.,refer to the central column of the slide below) as follows:

- the System level ➔ The characteristics of the whole STF (i.e. the "cockpit" as a whole, with reference to the functions described in the Step M_1);
- the Sub-System level ➔ The single plastic parts composing the cockpit (e.g. the steering wheel, the air blowers,… ; and
- the Super-System level ➔ The systems interacting with the cockpit considering social, economic, environmental and technological aspects (e.g. the car chassis, the passengers' comfort of driving and using a car, the connectivity to external services as GPS, Wi-Fi,…)

For what concerns the time span, the time-horizon from present to future has already been defined along the step FOR_4 (2015-2025, right column in the slide below). The team, consistently with the instructions of the FORMAT Methodology, chose to characterize the past situation of the items in the above bullet list starting from a date that approximately doubles the time horizon of the forecast (i.e. 1990-2010, left column in the slide below).



The team has defined the characteristics of the expected future situation for the three hierarchical levels by:

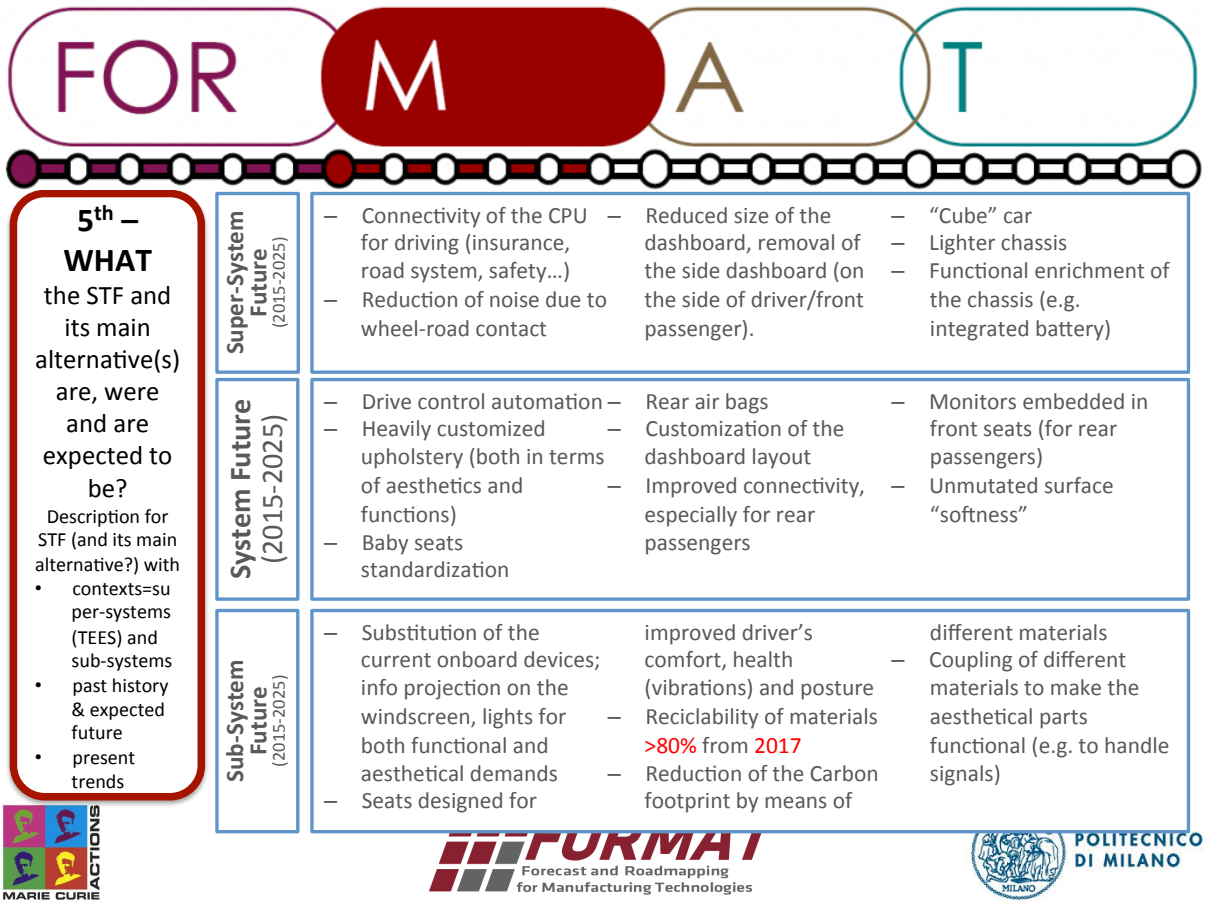
1. Characterizing the current (present) situation for the three hierarchical levels (both with quantitative and qualitative data support);

2. Finding data to describe the situation in the past for the same characteristics that are distinctive of the current situations (please note that characterizing features that are now irrelevant have been considered as well);

3. Identify trends from past to the current situation

4. Intuitively project the trends to the future to depict expectable conditions for, respectively, the Super-System, the System, the Sub-System levels.

The outcomes of this investigation are summarized in the below reported slide, collecting the items referring to the future situation (right column of the System Operator) for the System, its parts, and the different contexts it works in.



Why?

In order to organize the team knowledge in a unique framework capable of harmonizing the different viewpoints. Beyond this, it helps the team to carry out the next steps of the methodology in the A Stage (e.g.: drivers and barriers, as well as problems, can be more easily analyzed considering what pushes towards the evolution of technical systems and what hampers it, e.g. in step A_1; overarching trends (not necessarily technological) might also support the identification of evolutionary patterns for the STF, e.g. in step A_2).

GATE M

What was done?

In order to complete the Stage M and move to the next stage, you must complete the following items:

- *Model of STF at the functional level (logic similar to IDEF0)* - done in Step M_1
- *Description of Competitive (Alternative) technologies (solutions)* - done in step M_2
- *Measure of Performance & Expenses for STF and for Competitive Solutions* - done in step M_3
- Description for STF
    - *Contexts = super-systems (Technological, Economic, Environmental, Social) and sub-systems; (super-system and TEES cross-check in to-do)* - done in step M_5
    - past history & expected future - done in step M_5
    - present trends - done in step M_5

Why?

As for the previous Gate, the M Gate allows the team to double check the correctness and the completeness of the outputs produced along the related Stage. For the effectiveness of the methodology, the gate conditions have to be fully satisfied before moving to the next Stage.

3. ACT STAGE

This stage aims at producing novel knowledge elements about the future of the STF, so that what was non-obvious in the previous stages can more clearly emerge or being identified with the methodological techniques here involved. The overall objective is to provide elements which are relevant to answer the question for the forecast defined along the FOR Stage.

A_1: IDENTIFY LIMITING RESOURCES

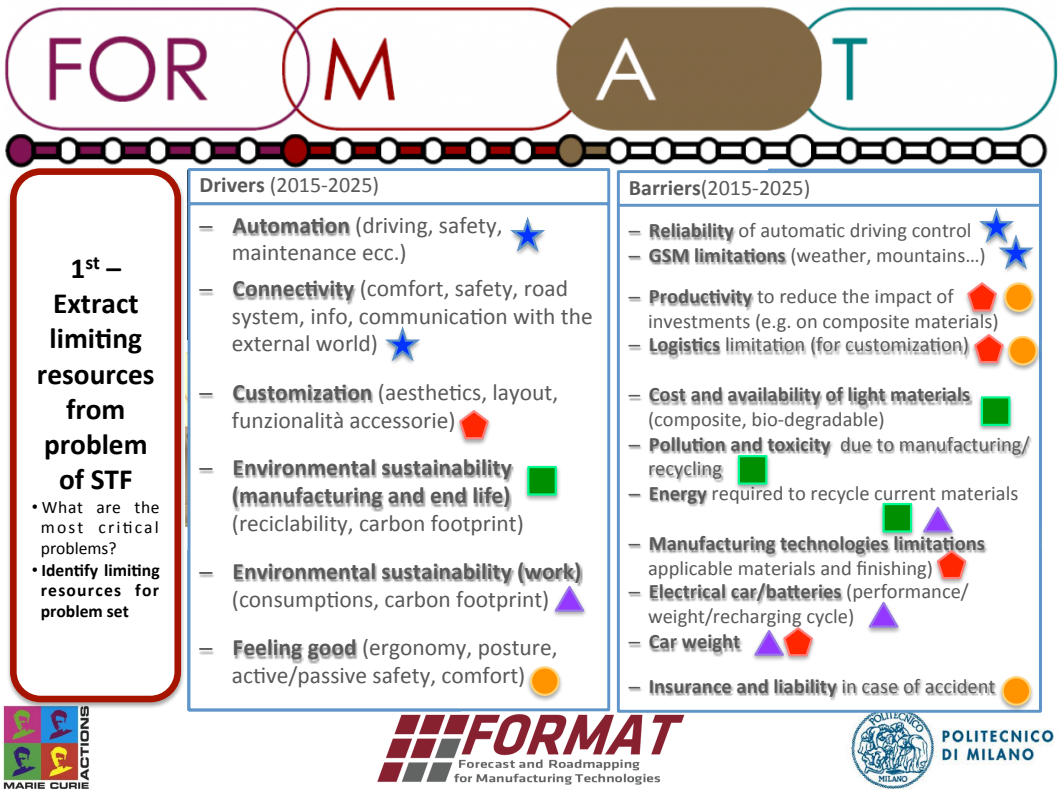
What was done?

In order to identify the resources which limit the evolution of the STF, the forecasting team agreed to proceed as follows:

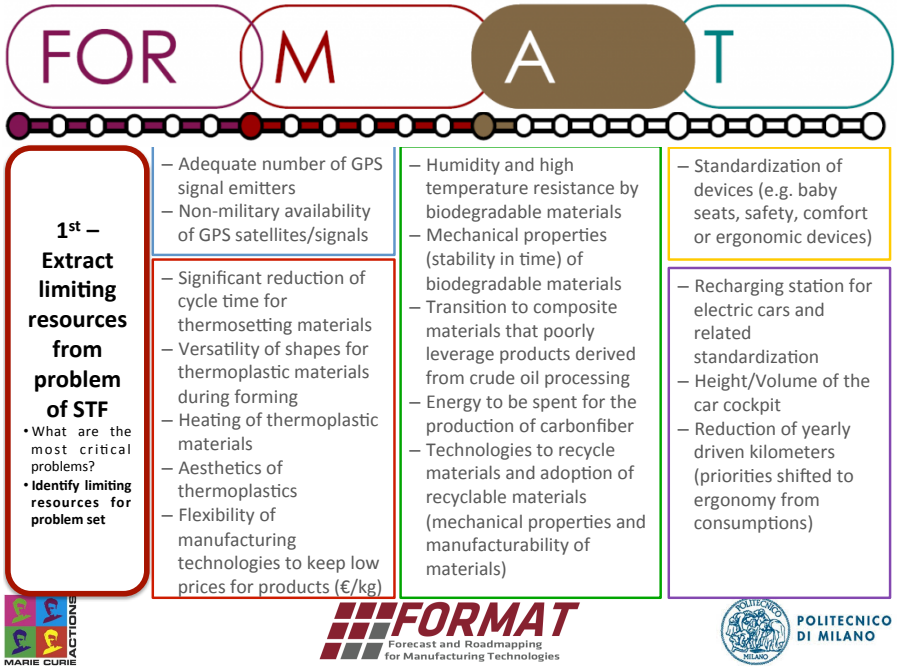
1. Extraction of trending factors from the System Operator prepared in the previous step of the methodology (M_5)

2. Distinction of the trending factors into drivers (what pushes or pulls the STF evolution) and barriers (what hampers the STF evolution) as reported in the following slide.

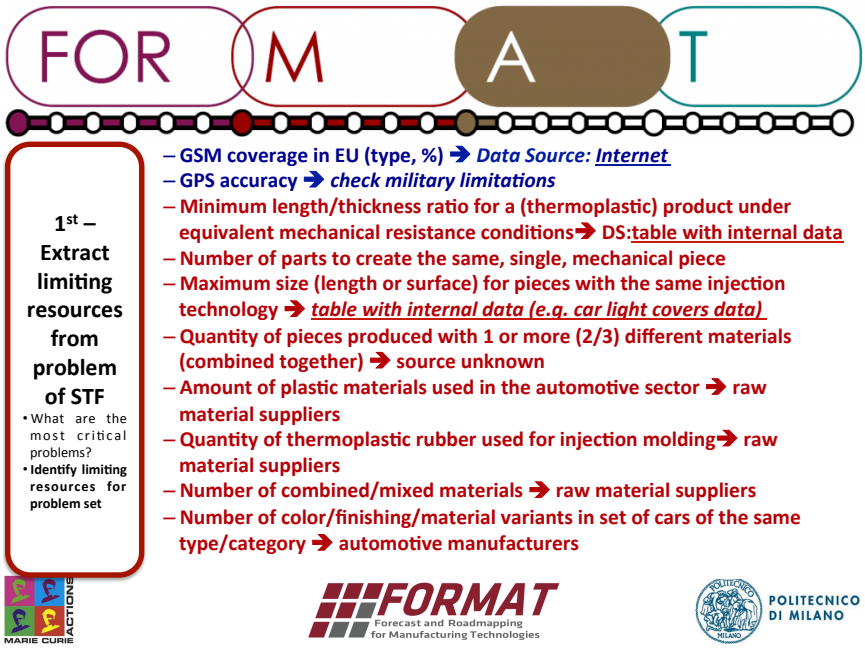
3. Identification of conflicts between couples of drivers and barriers. In the slide below, when the same symbols appear in the list of drivers and barriers, the interested items are in conflict against each other. E.g. the further increase of *automation* (driver) is currently prevented by the *reliability of automatic driving control* (barrier).



4. Preliminary definition of limiting resources (intuitive definition). The following slide summarizes the list of limiting resources. Colors of square borders refer to the colors of the symbols in the previous slide.



5. Refinement of limiting resources definitions. The team revised the initial definition of limiting resources, so as to formulate them as measurable and quantifiable with adequate units of measurement. According to the purposes of the project and the stakes of the different companies involved, the team decided to focus the investigation on the limiting resources surrounded by the red and the blue rectangle in the slide above (left side). The next slide collects the definition of limiting resources as measurable quantities.



Why?

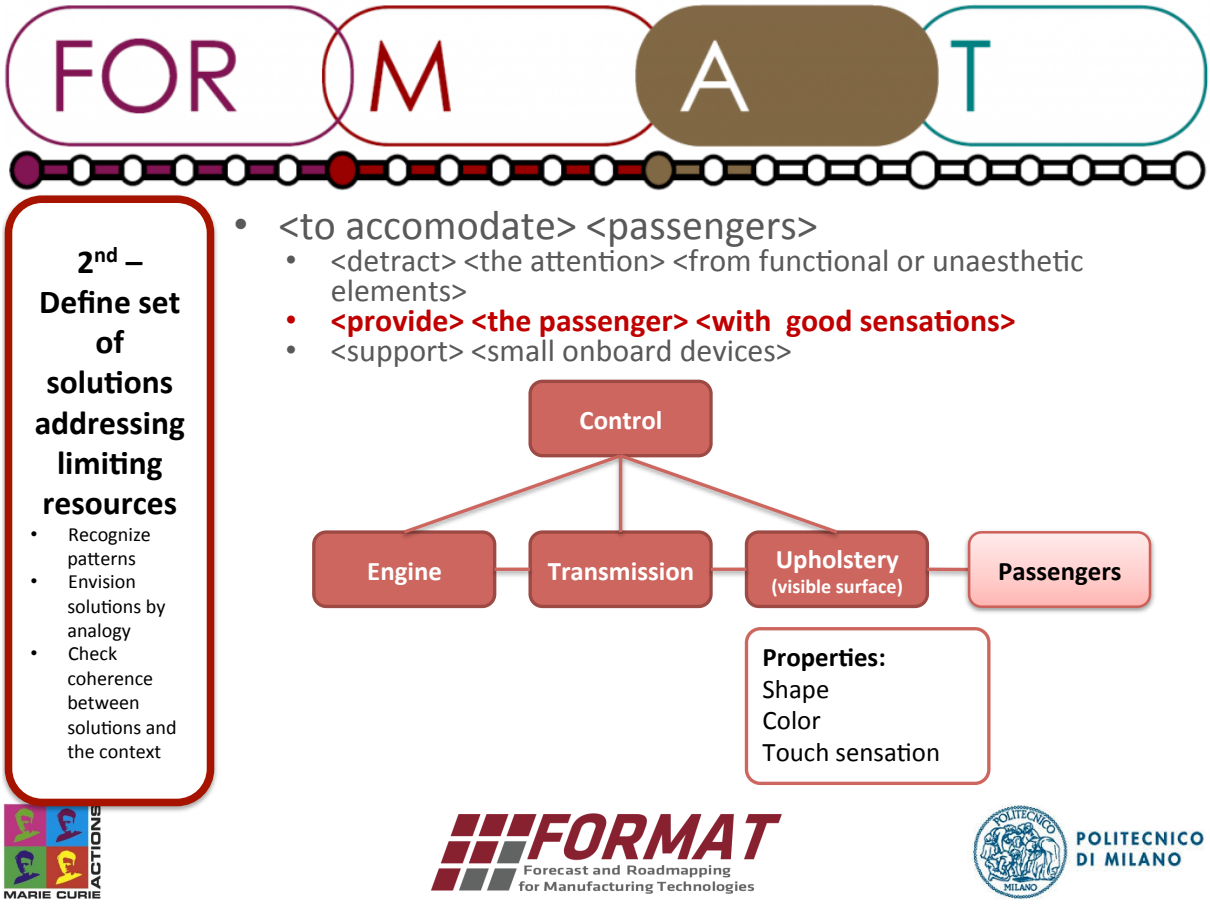
In order to define a set of limiting resources which should be monitored also beyond the duration of the forecasting project and have margins to proactively work to attain the desired future. This step also helps the team to envision new future solutions with improved focus on critical problems to be addressed and the resources that limit their overcoming (step A_2). Moreover it also drives the retrieval of data and information during the step A_3.

A_2: RECOGNIZE EVOLUTION PATTERNS

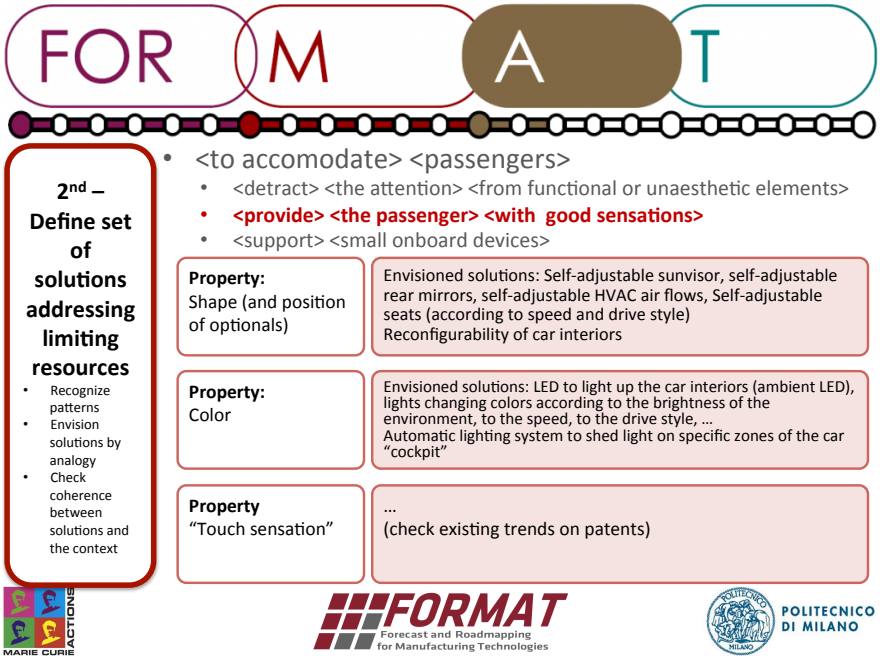
What was done?

The team started this step by creating an overall model of the STF expressed in terms of the TRIZ first law of engineering systems evolution, as prescribed by the FORMAT methodology. In order to do this, the team started selecting the most relevant sub-function among the ones defined along the stage M_1 (highlighted in red in the next slide). The four-elements model (TRIZ law of system completeness) is also shown in red rounded boxes. The STF "to provide the passenger with good sensations" appears to be an incomplete one, since the properties of "Shape", "Color" and "Touch sensation" (e.g.: the perceived tactile feeling due to roughness, stiffness,…) are intrinsic to the upholstery and no other elements (e.g. nor Engine nor Transmission) concur in delivering the function.

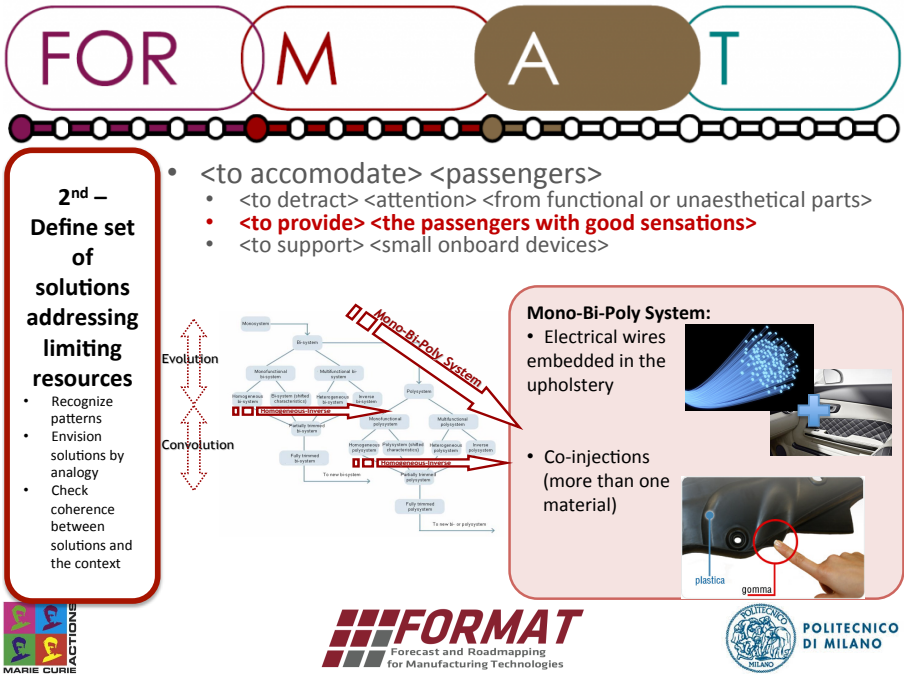
This model constitutes the starting point for the team to envision future solutions. The team, then, considered the model by focusing on a specific property at a time, checking more or less pronounced tendencies towards completeness.



The team started applying analogical reasoning to contextualize the meaning the law of system completeness gets into the specific situation. This allowed the team to realize that, depending on the property at hand and the specific car interior part considered, the model can show different degrees of completeness (e.g.: seats are at least controllable in shape, with human or motor provided energy). The set of envisioned solutions generated by analogy with TRIZ law of completeness is reported in the following slide.



Further solutions have been also identified by means of analogies with the general trend of evolution that in TRIZ is known as Mono-Bi-Poly trend (i.e.: a system progressively evolve towards embedding or joining complementary or auxiliary systems, the growth of complexity stops and the new bi- or poly-system gets progressively simplified until its integration in a super-system).



The team considered the set of envisioned solutions aligned to the drivers (e.g. customization) identified along the previous step (A_1). Their "distance to implementation" will be checked in patent DB or other documental sources potentially witnessing R&D activity in the related field.

Why?

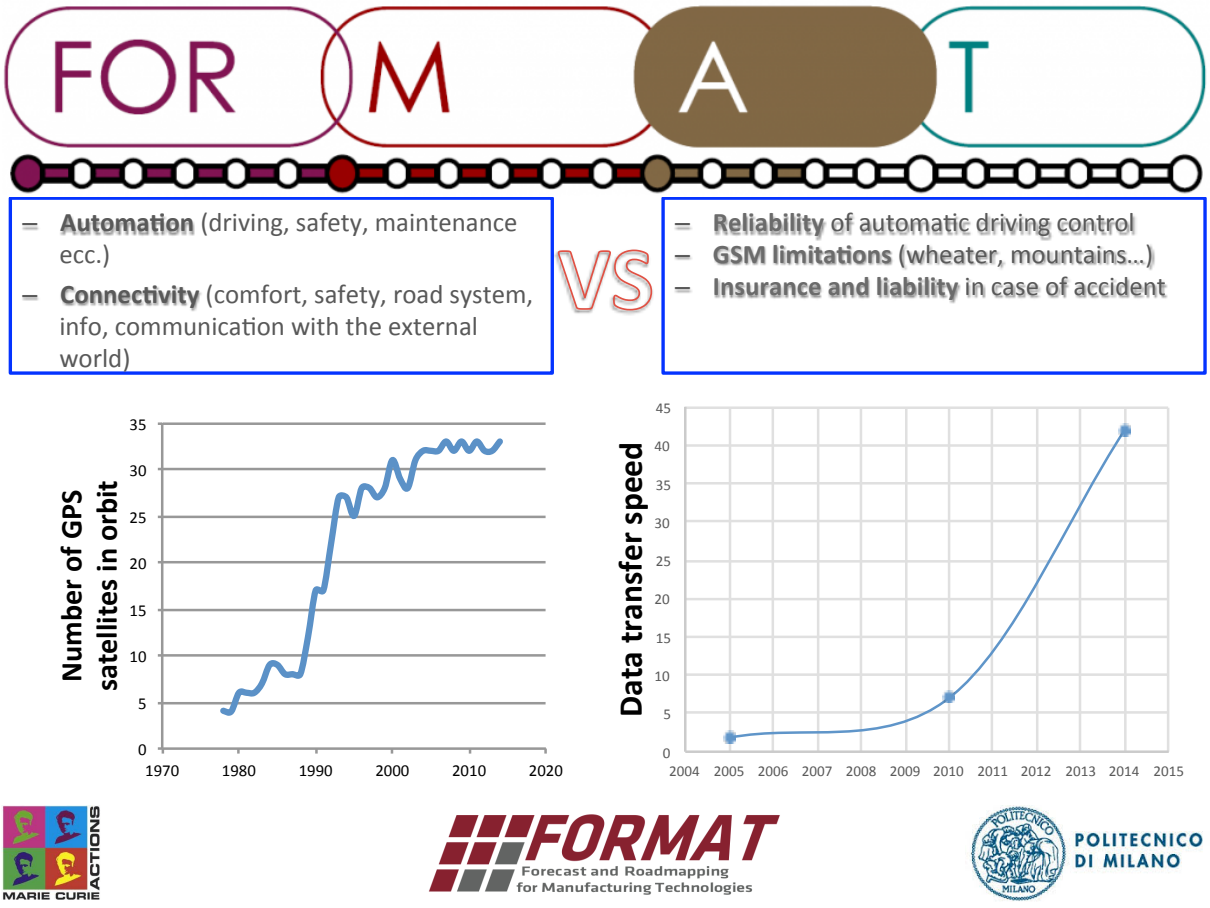
In order to establish distinctive features of future solutions and support the continuous monitoring of their appearance (or the appearance of enabling technologies) so as to catch emerging chances of development.

A_3: FIT TIME SERIES

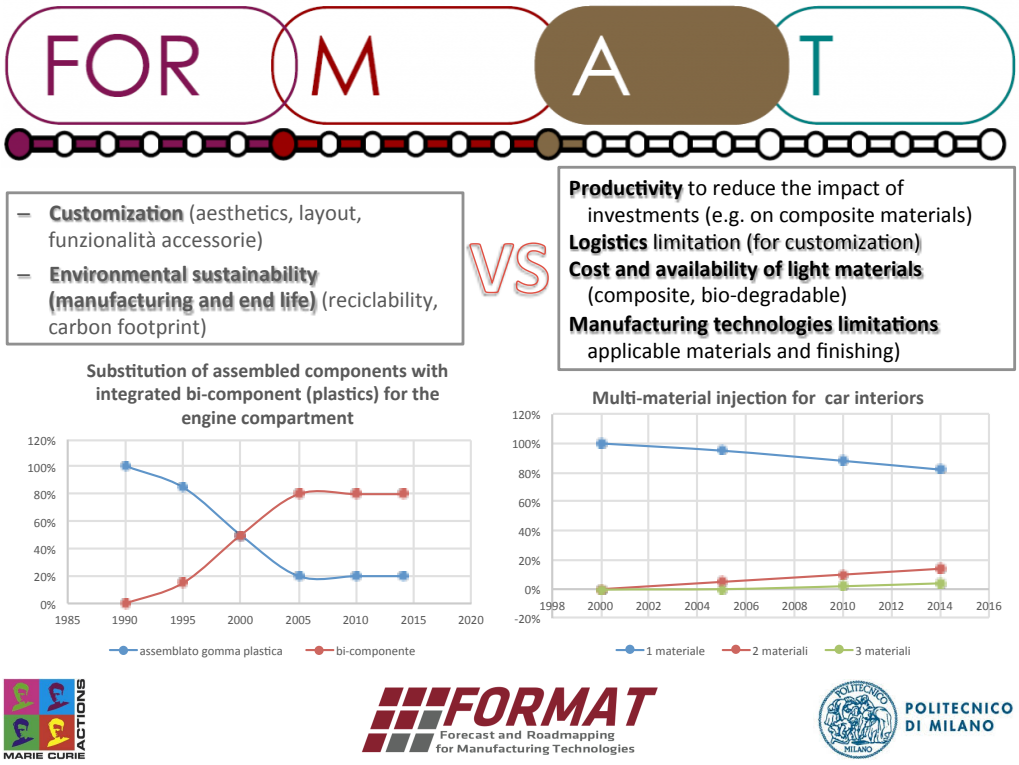
What was done?

Within this step, the team has focused on the retrieval of relevant data from the available sources as they were identified at the beginning of the study, during step FOR_5. Unfortunately, the data gathering was not always successful and time series were just sometimes available with good data quality and appropriate frequencies to run logistic regressions. In some cases the team exploited already in-house data and/or data sets with sporadic measurements in time. The latest had been used to fit curves as well and the team started considering the chance of using them to draw conclusions during the next step (A_4).

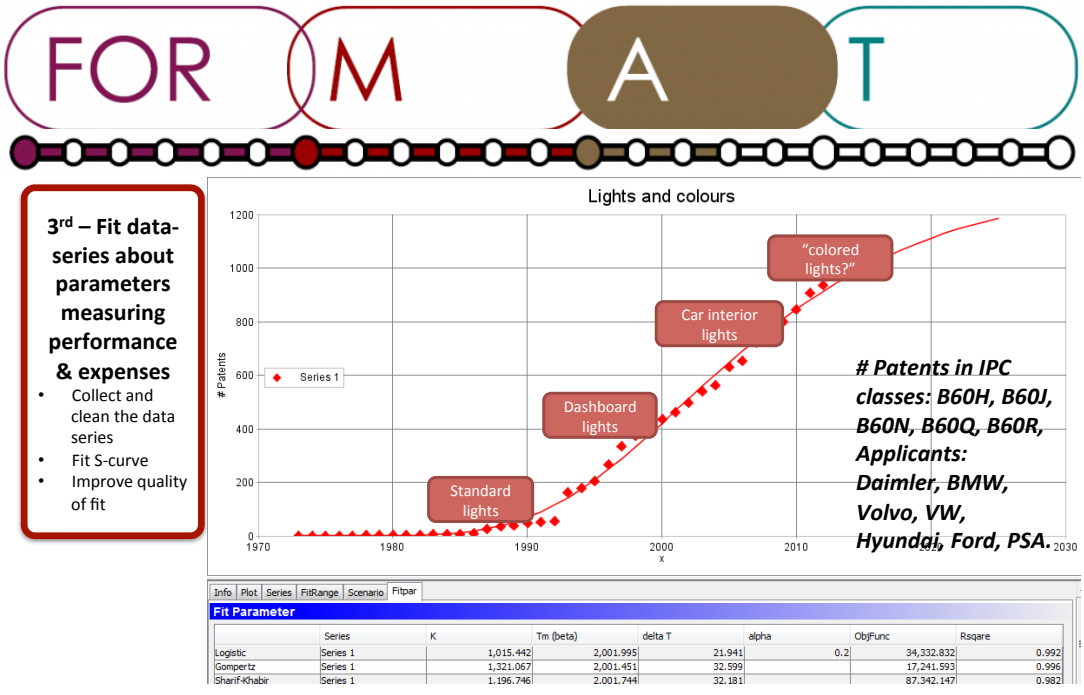
The next two slides present four data sets that refer to some exemplary characteristics that are useful to answer the questions to forecast defined in step FOR_4. In details, they more directly refer to what was defined along step A_1. For instance, the first slide shows two graphs about measurable quantities related to the drivers (left blue box) and barriers (right blue box). These measurable quantities do not exactly match with the measurable characteristics defined at the end of step A_1, but, considering the inherent difficulties to precisely retrieve what was supposed to be needed, the team considered them relevant as well.

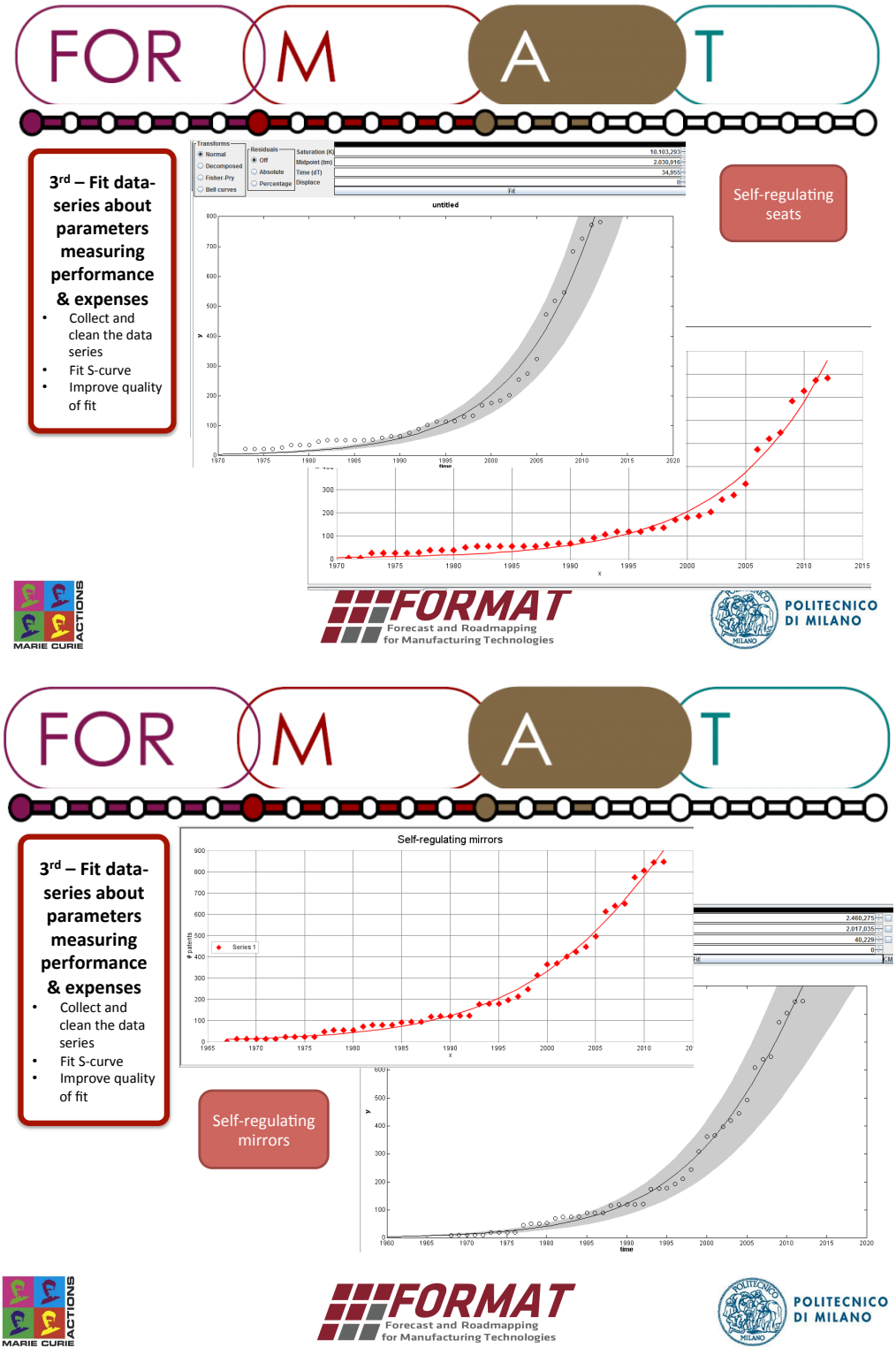


The following slide, in turn, presents two graphs about mixed drivers and barriers. The team, indeed, considered the following data sets relevant to provide new knowledge elements for both drivers and their related barriers. The data sets where determined according to the shared and harmonized experiences of the participants.



The next three slides, differently from above, presents three examples of statistical regressions carried out on data sets retrieved by patent searches. The team searched for relevant patents in the different fields interested by the solution envisioned along step A_2. The appropriate frequency of data points in the sets allowed the team to carry out meaningful statistical regression. Patents have been processed as time-based data sets after a skimming process to remove irrelevant patents and improve precision. Please note that the last two regressions diverge and an estimation about the limit of growth can significantly differ from the real future conditions.





Why?

In order to build conclusions on fact-based evidences and their related interpretations. In other words, this step and the activities it requires to carry out, focus on providing factual evidences about what was identified as a relevant trend to be monitored along steps A_1 (for what concerns the consumptions and/or the availability of limiting resources) and A_2 (for what concerns the emergence of envisioned solutions). What appears as a non-explored patenting direction might represent an opportunity for developing promising solutions yet to be engineered.

A_4: DEFINE FUTURE TRAITS

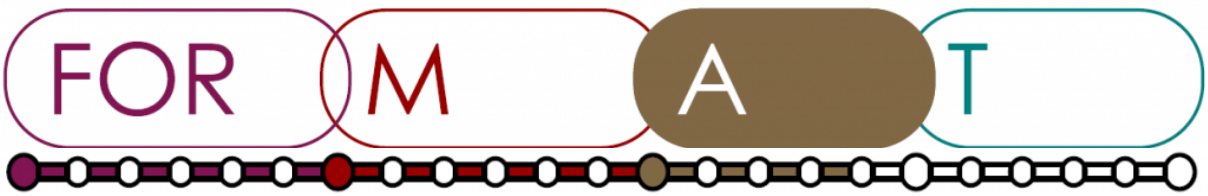
What was done?

The team completely rescanned the whole process leading them to this step, so as to focus once again on the question to forecast (Stage FOR); the existing STF, its development in time and its competitors (Stage M); the problems preventing its evolution, a meaningful set of envisioned solution as well as numerical evidences (Stage A) of what was just intuitively recorded in previous steps. This worked as a process of knowledge re-alignment among the team participants, before building the conclusions.

In details the outcomes of the previous steps (A_1, A_2 and A_3) have been considered as a knowledge set to be considered as a whole, so as to start depicting future characteristics (or simply their updated values) for the STF, consistently with the purpose defined by the question to forecast.

As introduced in the previous step (A_3), the numerical analysis is, in some cases, based on a limited amount of data points that make the inference of limits of growth non statistically significant. However, when the team unanimously recognized a marked tendency, their interpretation has been used as well to formulate (more qualitative) conclusions.

The next three slides provide examples on the conclusion the team formulated. Please note that the following conclusion takes into account both elements referring to numerical analysis about envisioned solutions (LED lights) and problem-related characteristics (as the injection of multiple materials or plastic+inserts).



4th - Build conclusions about future traits for STF
- To asses features of STF
- To group (chunk) features into main traits

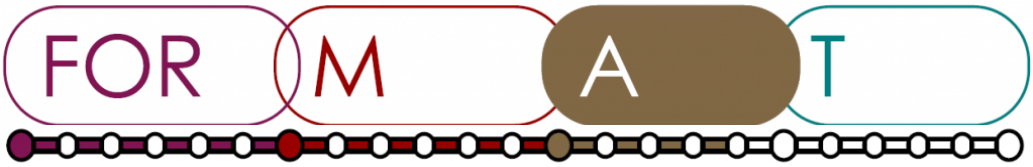
Aggregated conclusions on the evolution of technologies and materials for car interiors (1/11)

- In order to integrate a higher number of light sources inside the car (or a single source distributed by optical fiber), there is no need to change plastic materials. Nevertheless, the manufacturing technologies for plastic parts need to be properly updated so that it is possible to directly embed other parts in the plastic structure.

MARIE CURIE ACTIONS

FORMAT Forecast and Roadmapping for Manufacturing Technologies

POLITECNICO DI MILANO



4th - Build conclusions about future traits for STF
- To asses features of STF
- To group (chunk) features into main traits

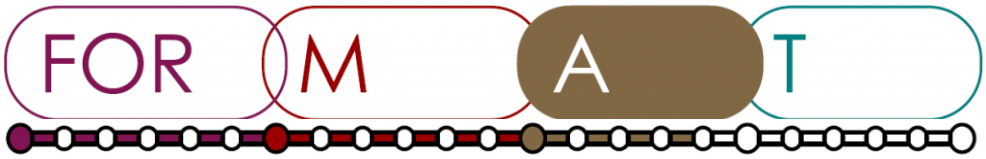
Aggregated conclusions on the evolution of technologies and materials for car interiors (2/11)

- If rear mirrors won't be replaced by other systems delivering the same function, materials and manufacturing technologies won't be affected by the emerging trend concerning their self-regulation.
- On the contrary, if alternative systems for rear viewing (e.g. LCD screen) will substitute current mirrors, it might be necessary to integrate printed circuits in plastic parts for car interiors. To this purpose, plastic materials having lower melting points (lower temperature) will be needed.

MARIE CURIE ACTIONS

FORMAT Forecast and Roadmapping for Manufacturing Technologies

POLITECNICO DI MILANO



4th - Build conclusions about future traits for STF

- To asses features of STF
- To group (chunk) features into main traits

Aggregated conclusions on the evolution of technologies and materials for car interiors (6/11)

- The emergence of new plastic materials providing a “soft-touch” sensation might be able of changing the current amount of manufacturing treatments (e.g.: reupholstery, subsequent injections) to produce dashboard and other parts.

Why?

In order to define the more relevant future characteristics the STF should have in order to continue existing, considering the resources it can rely on and the performances it has to provide to keep being meaningful in its market.

GATE A

What was done?

In order to complete the Stage A and move to the next stage, the team checked the following items were fully satisfied:

- *List of limiting resources preventing the solutions to problems that drives evolution of STF* - done in step A_1
- *Directions of development of new solutions for STF (evolutionary trends)* - done in step A_2
- *Dynamics of parameter(s) measuring Performance & Expenses for STF (data series and graphs)* - done in step A_3
- *Aggregated conclusions about future traits for STF* - done in step A_4

Why?

As for the previous Gate, the M Gate allows the team to double check the correctness and the completeness of the outputs produced along the related Stage. For the effectiveness of the methodology, the gate conditions have to be fully satisfied before moving to the next Stage.

4. TRANSFER STAGE

This Stage aims at transferring the results obtained at the end of the previous stages to the ones who will use them in order to make strategic decisions about research and development operations, so as to answer the question to forecast defined in the Stage FOR.

T_1: ANSWER QUESTIONS

Considering the specific composition of the team, where the participants also have the role of decision makers in their companies, this step has been skipped. Each of the participants, with the gained knowledge, can formulate its own answers according to the specificity of its company and its stakes.

T_2: REPORT RESULTS

As well, this step was not performed, because the team members were provided with updated slides containing the contents explored along the case study after each of the meeting sessions. Data, information and knowledge that is relevant to the purposes of the project are already collected in the full set of slides, making the final report of small interest for the company

T_3: DEVELOP REPORTS

The conclusions drawn during the step A_4 were already shaped in a quick and usable way according to the perspectives of the diverse team participants.

T_4: DELIVER PRESENTATION

This step was not explicitly performed, even if the activities of Step A_4 (rescanning the outcomes of the different stages and building conclusions on the basis of the information and knowledge elaborated during the whole Stage A) carried out together with decision makers, can be considered as a substation of this step.

GATE T

The Stage T have not practically begun at all because the team members had the role of decision makers in their own companies and the results after Stage A were already expressed in an understandable and reusable way.

CONCLUDING REMARKS

At the end of the forecasting project the team members carried out an internal assessment of the overall activity carried out with the support of the FORMAT methodology. The results of such an assessment, together with the results of the forecasting project on car interiors, have been presented at a public event in Treviso, Italy: "12° Giornata dell'economia - Il forecasting tecnologico per le reti di PMI" (English title: "12th day of economics - Technology forecasting for SMEs networks").

The following bullet list summarized the reflections raised by the team members after the conclusion of the project:

- Skepticism at the beginning of the process
- The methodology supports intuitions by numbers and facts
- The methodology filters the viewpoint of opinion leaders and allows reducing/preventing analysis (and decisions) done by sentiment or emotionally.
- With a very limited amount of resources and external consultancy (paid external experts) the forecast started being confirmed by prototypes in fairs and conventions.
- The method is useful to practically and concretely identify the objectives the network of companies participating the study will focus on in the next future.
- The project gets higher benefits when it is driven by a more expert member that verify the correct application of tools and stimulate the analysis.

