# DEVELOPMENT AND APPLICATION OF AN EVALUATION FRAMEWORK FOR EU RTD INTERMODAL FREIGHT TRANSPORT PROJECTS

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## ABSTRACT

The EU's Seventh Framework Program (2007 to 2013) allocates a total budget of 4.1 billion € for research and technological development in transport. Therefore, it is of key importance to be able to assess these EU funded RTD (Research and Technological Development) projects from a demand (solutions needed) and offer (solutions provided through research) convergence point of view. Within the FP7 project AIMS, authors developed an innovative evaluation methodology in order to assess projects in intermodal freight transport.

In order to analyse the effectiveness of the European transport RTD in intermodal freight transport authors have investigated two areas: the demand side (solutions required by the transport sector) and the offer side (solutions provided through RTD projects) through a combination of a macro-approach (review of literature and identification of main trends) and a micro approach (interviews with selected demand and offer stakeholders). Results from the analysis of the offer and the demand have been confronted in order to highlight main gaps between market expectations and results provided. Finally, analysis led to an elaboration of an innovative evaluation framework for review of the European RTD in intermodal freight transport as well as the elaboration of key success indicators.

This paper presents a new evaluation framework for EU RTD projects in intermodal freight transport as well as a list of indicators for the assessment of the effectiveness of EU RTD programs in intermodal freight transport. On that basis, recommendations are provided regarding the next generation of EU RTD Framework Programs in intermodal freight transport.

The application of this new evaluation methodology guarantees that RTD projects provide actionable results and that they are in line with the other market developments (legislative, political, economic and social framework). This gives a strong contribution to raising the level of commercialization of research outputs paving the way forward to innovative and effective public and private intermodal freight transport research.

# INTRODUCTION

The evaluation of publicly funded research and technological development (RTD) has grown over the years, for reasons that include budget pressures and an increasing desire for accountability in the use of taxpayers' money (Arnold & Balázs, 1998).

The EU's first Framework Program (FP) for research and technological development started in 1984 with a budget around 1 billion € to come to funding of 4.1 billion € for research and technological development in transport for the Seventh Framework Program between 2007 and 2013 (European Comission, 2012).

The Commission has organised evaluations of specific research programmes, usually midway through, since the early 80s. (Luukkonen, 1998)

Originally, the EU framework programmes represented programmes that were supply, or technology-oriented: they had a mission to enhance the competitiveness of European industries by raising their technological level. Over time, there have been changes in the general objectives, the framework programme encompassing a wide range of targets from cohesion and job creation to the contribution of the programmes to the implementation of the various Community policies. In the programme documents, the technology or supply orientation has given way to a greater emphasis on diffusion and demand oriented research collaboration. (Luukkonen, 2002)

For the reasons mentioned above, it is of key importance to be able to assess the effectiveness of European RTD (Research and Technological Development) programs from a demand-offer point of view, i.e. to analyse how European RTD programs fulfil the market demand for RTD and to highlight levers for improving the quality and ensuring more actionable results of the RTD programs.

Following this rationale, authors conducted an assessment of EU RTD programs in intermodal freight transport from a demand (solutions needed) and offer (solutions provided through research) convergence point of view, within the FP7 project AIMS (Advanced Impacts evaluation Methodology for innovative freight transport Solutions). This assessment led to a development of an innovative evaluation framework for the assessment of the EU RTD programs.

In this paper, we confront the results from the demand and the offer analysis in the field of EU intermodal transport related RTD, leading us to highlight main gaps and main areas for improvement. Considering the results, we then present the evaluation framework for the assessment of EU RTD programs, and finally, we apply this evaluation framework to the EU's Seventh Framework Program leading to recommendations for future European RTD programs.

# ANALYSIS OF THE OFFER AND DEMAND FOR INTERMODAL TRANSPORT RELATED EUROPEAN RTD

## Methodology

The assessment of the European transport RTD was made through an investigation of two main areas. On one hand, we have analysed the demand for intermodal transport-related RTD by investigating the needs of market actors concerning the content of RTD projects (research areas and subjects) and the requirements of market actors regarding the practical implementation of the projects (project administration, accessibility of research results, etc.). On the other hand, we have investigated the offer in intermodal transport-related RTD through an analysis of past and current research programs and their characteristics both in terms of content and practical implementation. Finally, results from the analysis of the offer and the demand have been confronted in order to highlight main gaps between market expectations and results provided by the European RTD

Regarding the choice of evaluation methods for the analysis of the offer and the demand, (Arnold & Balázs, 1998) compares the different evaluation tools that can be used for the assessment of RTD programs and concludes that the following three tools are the most useful: (1) Case studies which consist in examining a limited number of specific cases or situations which the evaluator anticipates will be revealing in order to understand the dynamics within specific settings (2) Peer review based on scientists' perceptions of contributions by others (3) User surveys allowing hypothesis testing and detailed exploration of both process and impacts.

We have therefore conducted the analysis of the offer and the demand through a combination of tools providing a micro-vision (case studies and surveys) and tools providing a macro-vision (peer review).

For the analysis of the demand on a micro-level, interviews were conducted with demand stakeholders. Six relevant organizations in the sector (HESSE NOORD NATIE, KUEHNE & NAGEL, EUROPEAN INTERMODAL ASSOCIATION, UNION INTERNATIONALE DES SOCIETES DE TRANSPORT COMBINE RAIL-ROUTE, CEN - European Committee for Standardization, INTERMODAL CONCEPTS & MANAGEMENT) have been selected with the objective was to establish a panel of diversified audience in order to investigate the demand in the intermodal actors, including operators, professional associations and standardization committees. A questionnaire was created and interviews were held with representatives of these organizations. For the analysis of the demand on macro-level, we have reviewed literature authored by experts in the field and have reassembled qualitative opinions of demand stakeholders expressed during the interviews, in order to understand some macro-level patterns.

For the analysis of the offer, the macro analysis was conducted from the literature research and interviews with experts and has provided a macro-vision on the current offer in the intermodal transport research. The micro analysis of the offer was based on the case studies involving the investigation of five past (FP5 and FP6) EU projects (INHOTRA, TRIMOTRANS, INTERMODE-TRANS, EUTP II, GIFTS) and four on-going (FP7) EU projects (BE LOGIC, EIRAC II, SMART CM, INTEGRITY) and on interviews with offer stakeholders (project coordinators and participating organizations). The projects were selected based on the following criteria: (1) Integration of as much diversity as possible: small, medium and

large projects in terms of budget, partnerships and duration; (2) Coverage of all key aspects of intermodal transport (infrastructures, operations management, vehicles and loading units, harmonisation and standardisation issues); (3) Inclusion of SMEs; (4) Diversity of projects in according to types of objectives sought (tools, concept, prototypes, networking)…); (5) European Coverage of the final set.

Regarding the areas of investigation, we have used specific evaluation frameworks for the offer and the demand analysis.

For the analysis of demand, authors have adopted a three-level approach, as shown in the Table 1, in order derive specific project requirements based on information provided by market actors. This approach is based on an idea that specifications for the EU projects are a result of a sequence of needs on several levels. The first level concerns the needs of the intermodal transport sector, or, conversely, the obstacles discouraging its widespread development. These needs are not exclusively RTD related – they incorporate all measures that can be undertaken to encourage the modal shift and promote the intermodal transport. The second level concerns the needs for RTD in the intermodal transport sector – a need in the intermodal transport sector will lead to a certain number of needs in the RTD, like for example research domains or type of projects. The third level concerns the specifications of the EU projects – an identified needs in the RTD leads to a certain number of specifications for the EU projects, like for example the composition of the consortium or the project focus.

| **Area of analysis** | **Key issues** |
|---|---|
| European RTD programs | • Are the R&D related to the intermodal freight transport suitable enough to cover/answer the needs in the sector?<br>• Is the EU research accessible to all parties?<br>• Is the EU research attractive enough to ensure the participation of all relevant actors?<br>• Is the EU research strategy clearly formulated and communicated and how is it derived into specific projects? |
| R&D needs in the intermodal transport | • Which are the R&D needs from the side of the market in the intermodal freight transport? |
| Needs in intermodal transport market | • Which obstacles discourage the widespread development of the intermodal transport within Europe (operational, technical, financial, infrastructure-related, logistical)<br>• Does the EU policy and initiatives encourage sufficiently the development and the public awareness of the intermodal freight transport? |

Table 1: Three-level approach for investigating the demand for RTD in Intermodal transport market

For the analysis of the offer in the European projects, we have used an assessment framework composed out of several elements, as shown in the Table 2. The first element are project origins, i.e. what has been the idea at the origin of the project (a perceived market-need or something else) and who were the actors involved in the genesis of the idea. The second element concerns the project focus, for example if the focus is on developing new technologies or using the existing ones, on theoretical research or on demonstrations. The third element is linked to the project implementation - what are the significant elements concerning the way that the project was managed (number of partners, duration of the project, etc.). Finally, the last element of investigation is the project follow-up, i.e. how are the results of the project planned to be used after the project ends.

| Area of analysis | Key issues |
|---|---|
| Project origins | • Does the project correspond to an actual market demand?<br>• What is the composition of the consortium, Were the market representatives involved in the genesis of the project? |
| Project focus | • What is the type of innovation/technology that is foreseen with this project?<br>• What is the type of expected results? |
| Project administration | • What is the size of the consortium?<br>• How was the negotiation? How long?<br>• The duration of the project – project flexibility |
| Project follow-up | • Are the results of the research applicable after the project?<br>• Was the realization (implementation of the project) planned? + Transition period for implementation of technology, Trade unions/employees, impact on jobs, trainings, etc.<br>• The communication/dissemination/marketing actions |

Table 2: Approach for investigation the offer in RTD in the intermodal transport market

## Main results from the confrontation of the offer and demand analysis

The confrontation of the results from the offer and the demand has provided several insights.

The demand and the offer stakeholders agree that projects must originate from an existing market demand and acknowledge that efforts have been made in this direction - indeed, all analysed projects have demonstrated their market-driven focus. Demand stakeholders have all the same pointed out that some market needs are never translated into projects because they do not match current calls.

Concerning the industrial participation, it is highlighted as crucial by both demand and offer stakeholders. All analysed projects include relevant market actors, but our analysis suggests that end-users should be included earlier in the process in order to ensure that the technology developed fits with the field needs and that projects can pass the commercialization threshold - currently, the process of the preparation of the proposal is often left to research centres and consulting companies since it is too time-consuming for market actors and since the uncertainty regarding its outcome is too high for commercial organizations. Later in the process, end users should be present at the advisory board or accompanying board of the projects and be involved in the preparation and realization of any pilot demonstration foreseen.

The project focus on the other hand, must be on demonstration, on tangible products, on commercialization and implementation of technologies developed rather than on new theoretical researches. Stakeholders find that the existing technologies are sufficient for the current demand in the intermodal transport. The focus should not be on the development of the new technologies and on "hi-tech" projects, but on the application of the existing technologies in a certain context and on the standardized use of the existing technologies. This need is well addressed by the analysed projects that are focusing mainly on the existing technologies that are being pushed beyond their limits and applied in a certain context.

Regarding the practical implementation of the project, and more particularly the consortium size, both the offer and demand agree that the consortium size should be limited in order to avoid overhead work and costs. Indeed the inflation of the consortium sizes increases the unnecessary coordination workload and administrative costs, which obviously reduces the quality of the outputs. A number of 10-15 stakeholders, such as observed in analysed projects, is judged as adequate. If a greater number of actors should be necessary for the realization of the project, these actors can be included in the project Advisory Board.

The adequate duration of the project is a trade-off between the necessity to respond to market needs quickly and the time needed to implement results properly. The typical project duration of 3-4 years, such as observed in analysed projects, is considered as adequate. However, the time between the project genesis and the project approval is too long (in some case from 1 to 2 years), and is a result of a long negotiation phase (although improvements have been noticed in the last calls) and long delays necessary for the establishing and signature of the contract. Technologies changing and ageing fast and intermodal transport being a sensitive and competitive issue, this time period needs to be reduced to the strict minimum: otherwise, there is a threat that parallel projects will appear in order to keep up with the moving market and that the publically-funded R&D will become obsolete.

The post-project activities are considered as crucial for the proper dissemination of results, but not always carefully planned in the analysed projects. In fact, the official project end should not correspond with the project end for the coordinator and/or key partners that must ensure follow-up and dissemination activities. The examined projects include communication and marketing activities, however, in many cases, it is not clear how the project results will be exploited after the project end. There should be a time period of 3 to 5 years after the project end where the coordinator and/or partners should be available upon request from the Commission for the provision of data or results to following projects. Indeed the difficulty in getting information from projects that ended recently is unacceptable.

# EVALUATION FRAMEWORK FOR ASSESSMENT OF RTD PROGRAMS

The carried-out analysis has led to highlighting gaps between the offer and the demand regarding the EU projects in intermodal transportation. Based on these, we have elaborated a general evaluation framework for RTD programs which adopts a process-view while assessing the quality of RTD programs. In fact, our analysis shows that there are three generic processes linked to the implementation of RTD programs in intermodal transportation sector which can be translated into three different of maturity levels.

The first level (Figure 1) corresponds to a traditional approach to the RTD projects where a project is considered successful if there is a match between its specifications (contained in a formal contract) and its output (the deliverables produced during the project). There is however no guarantee that project specifications match an actual market need (the approach is therefore a “push” rather than “pull”. Moreover, there is no assurance about the usefulness of the project output and opportunities for their market implementation, since the project outputs can be purely theoretical.


Figure 1: Research process, 1st level of maturity

The second level of maturity (Figure 2) corresponds to a more integrated approach: RTD needs are identified (preferably coming from the market) and project outputs consist of tangible results, such as demonstrations, products, and prototypes. There is, however, no guarantee that the identified RTD need is in line with other market developments (such as legislative, political, economic or social). Moreover, there are little indications as to the usage of results after the project end, and consequently, there is a remaining uncertainty as to the achievement of the leveraging effect that is sought by publically financed RTD.

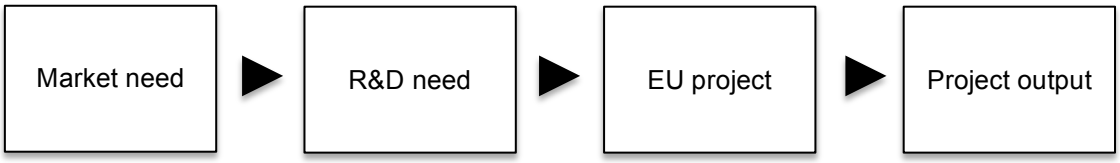


Figure 2: Research process, 2nd level of maturity

The third level of maturity (Figure 3) is the final stage of integration of the offer and the demand and consists out of a cyclic research process. The origin of the research is a specific market need, which is then derived into several strategic lines of actions, such as new legislations, political or social frameworks and RTD requirements, all of which attempt to address the market need - consequently, RTD is taking part in a global strategy and is inline with other market developments. The RTD requirements that have been identified are then derived into a series of specific projects, which are again inline with a global RTD strategy. Translating RTD needs into valid projects requires the participation of key organizations such as market actors or professional organizations from the very genesis of the project - in order to ensure this participation, projects must be attractive and accessible to all relevant parties.

Projects are then carried out and they produce tangible results that are implemented in the market - this is only possible if the implementation and commercialization strategy have been carefully considered from the very beginning of the project. Finally, for project results to meet the original market need, they must be applicable to the existing market conditions on one hand, and must be accompanied by communication and marketing actions on the other hand (during the project and after the project end - the latter is absolutely crucial in order to ensure a leveraging effect of the RTD results).

Effective RTD programs require therefore a logical succession of steps all throughout the cycle. It is not sufficient to have all the steps in the cycle done effectively (for example, project corresponding to specifications or project results successfully produced), it is also necessary to reduce gaps between the different steps in order to have effective RTD programs.

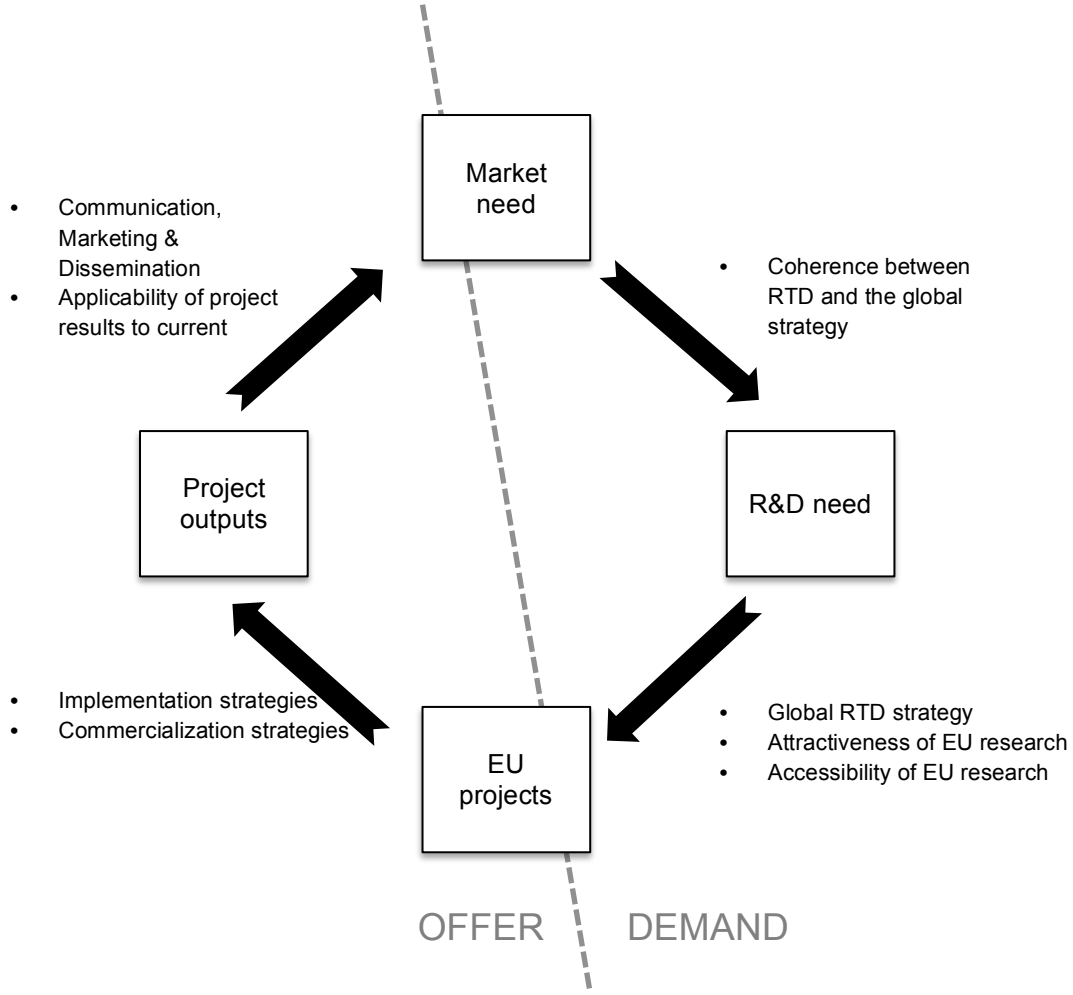


Figure 3: Research process, 3rd level of maturity

# APPLICATION TO EU'S SEVENTH FRAMEWORK PROGRAM (INTERMODAL TRANSPORT SECTOR) AND RECOMMENDATIONS FOR FUTURE RTD PROGRAMS

In order to evaluate a level of maturity of a specific RTD program, we have elaborated a list of requirements that characterize each level of maturity (Table 3). The first level of maturity fulfils only one of the requirements whereas the third level of maturity fulfils all of them. We have assessed the EU's Seventh Framework Program according to this interpretation grid and concluded that this RTD program is between the second and the third maturity level.

| Requirement | 1st level of maturity | 2nd level of maturity | 3rd level of maturity | EU research |
|---|---|---|---|---|
| RTD is a part of a global strategy that is clearly formulated and communicated | | | √ | |
| RTD strategy is clearly formulated and communicated: there is coherence and a clear pipeline of projects | | | √ | |
| EU research is attractive to all relevant parties | | | √ | |
| EU research is accessible to all relevant parties | | | √ | |
| Project start from a specific need that is perceived in the intermodal freight market | | √ | √ | √ |
| Project output corresponds to project specifications | √ | √ | √ | √ |
| Project produces tangible results | | √ | √ | √ |
| Project focus is on demonstration, commercialization and implementation strategy | | √ | √ | √ |
| Project results are applicable to the current background (market conditions) | | | √ | √ |
| A marketing and communication strategy is planned in order to disseminate project results (during the project) | | | √ | √ |
| A marketing and communication strategy is planned in order to disseminate project results (after the project) | | | √ | |

Table 3: Different levels of integration of the demand and offer in the RTD programs

Several recommendations can be formulated in order to reach the third level of maturity.

The first recommendation is that the management of the RTD programs should be a part of a global integrated strategy for intermodal freight transport that must be clearly formulated and communicated, thus enabling more strategic science and technology policies to be developed, and an allocation of public RTD funds that more closely reflects economic and social priorities (Arnold & Balázs, 1998) (AIMS project, 2010). In fact, RTD is just one of the tools for achieving these economic or social objectives, and must be supported by other

measures, such as illustrated on the Figure 4). These measures include standards that should support RTD results and serve to leverage them, legislation that should create the right framework conditions in which RTD results may be used or complementary measures, such as trainings or raising of public awareness about intermodal transport. Considering that most of the measures taking part in this global strategy share the characteristics of being quite long to put in place, the global strategy, in order to be effective, must be formulated on long-term be anticipative.

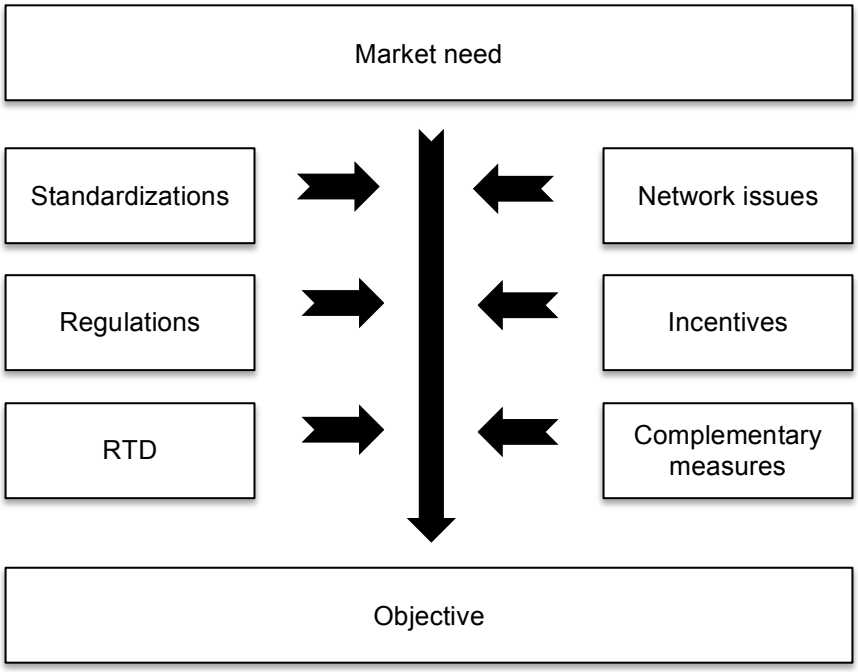


Figure 4: Integrated approach to the RTD; Source: own elaborations from CEN documentation;

Once the global strategy has been clearly formulated, emphasis should be put on the definition and the communication of a long-term strategy specific to European RTD. This includes the creation of a clear pipeline of the projects that is ensuring their coherence on one hand, and assuring a better communication of this global strategy to all relevant stakeholders on the other hand. In fact, most of the interviewed stakeholders affirmed lacking a global vision of the European RTD strategy - however, this “helicopter vision” is necessary if one wants to turn perceived RTD needs into European projects and assure consistency in the on-going research.

In order to turn existing RTD needs in the successful projects, it is necessary to ensure the participation of certain market actors. The European research must therefore be both attractive and accessible to these actors. The attractiveness of the research can be measures by comparing the invested time and effort with the usable results of the research. The accessibility of the research reflects how easily market actors (and especially new entrants) can take part in European research. Despite the noticeable efforts to make the EU research more attractive and more accessible to all relevant parties, several observations have been made. Concerning the participation of market actors, industry and end users are mostly active once the project has been approved since the time and effort needed to prepare the proposal and run the negotiation process is too big for these actors. More generally, EU projects are still assimilated with a great administrative burden. It is therefore quite difficult for the “new” companies to enter a project because of the lack of “know-how” in European research procedures. Finally, the information about the ongoing research/calls is often difficult to follow because it is too time-consuming.

Therefore, actions are necessary in order to include more actors in the EU research and assure the participation of all actors from the genesis of the project. Some possible lines of actions include reducing the administrative burden linked to the projects, reduce the time/effort needed for writing the proposal or reducing the risk of that time/effort not leading to project acceptance (a "two-step" process for the proposal submission is an option) and working more on providing better communication to all actors about the ongoing research/calls.

Another major recommendation concerns post-project activities for intermodal freight transport RTD. Until now, a lot of emphasis has been put on producing project results that are usable and tangible, which is an important point for the success of the research. However, another important issue should not be neglected: EU projects are expected to have a leveraging effect, meaning results that can be used by the in a big number of different cases throughout the whole industry and not just on a specific case of the project. In order to ensure this leveraging effect, it is absolutely crucial to ensure both the applicability and the accessibility of project results.

The applicability of the project results concerns the interoperability between the innovation to come and the current situation, meaning the possibility of using the project results in the real market. In order to guarantee it, it is necessary to guarantee the feasibility of the proposed solutions, the economic rationale behind suggested solutions, the use of existing standards, etc.

The accessibility of the project results can be improved by defining a post-project activity plan that should indicate clear roles and responsibilities regarding the dissemination, communication and marketing actions after the project end. This post-project activity plan should also establish the ownership of the results and the plan on how to use them after the project end, including a clear definition of how the project results should be used (publically distributed or propriety of a private actor) - without this, there is a danger of not coming to a compromise in the public-private dilemma and of not making any use of the results at all.

A final recommendation relates to the flexibility of the intermodal freight transport RTD projects. In fact, the cyclic approach to research indicates that there is a certain time gap between the moment where a market demand has been defined and the moment when the project results are supposed to fill in this need. Because of the market and technological advancements during the projects, it is possible that this need will change over time – therefore it is necessary to ensure that the projects have the necessary flexibility to update and if necessary redirect the research during the project course in order to match the best the evolving demand. Another danger with long delays (writing the proposal, negotiation, start) are that actors within or without the consortium may start to develop parallel projects or that the project results become obsolete by the end of the project. It is therefore recommended to include flexibility clauses from the beginning in order to facilitate any necessary changes further on. In fact, there should be no hesitation if ever a current project needs to be reoriented in order to better fit the expectation of the end users.

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