European Coordinating Body for Maths, Science and Technology (ECB)

DELIVERABLE SUBMISSION SHEET

To: Noora Eronen *(Project Officer)*

EUROPEAN COMMISSION
Directorate-General for Research & Innovation
RTD/B/6
B-1049 Brussels Belgium

From:

Project acronym: ECB Project number: 266622

Project managers: Rinske van den Berg and Agueda Gras-Velázquez

Project coordinator Marc Durando

The following deliverable:

Deliverable title: Needs analysis

Deliverable number: 2.4

Deliverable date: 8 February 2013

Partners responsible: Universistat Autonoma de Barcelona

Status: ☑ Public ☐ Restricted ☐ Confidential

is now complete.
☑ It is available for your inspection.
☐ Relevant descriptive documents are attached.

The deliverable is:

☑ a document
☐ a Website (URL: .....)
☐ software (.....)
☐ an event
☐ other (.....)

Sent to Project Officer: Noora Eronen	Sent to functional mail box: noora.eronen@ec.europa.eu	On date: 08/02/2013

Published in February 2013. The views expressed in this publication are those of the authors and not necessarily those of EUN Partnership AISBL.

http://www.ingenious-science.eu

Coordinated by European Schoolnet

The work presented in this document is partially supported by the European Commission's FP7 programme – project ECB – European Coordination Body (Grant agreement № 266622). The content of this document is the sole responsibility of the consortium members and it does not represent the opinion of the European Commission and the Commission is not responsible for any use that might be made of information contained herein.

ECB - WP 2 D2.4 - Needs Analysis

CONTRACT NO	266622
DATE	08/02/2013
ABSTRACT	Deliverable2.4 summarises the strategy that has been defined for the performance of a Needs Analysis in order to identify problematic issues in current school-industry collaborations, both at national and at European level.
AUTHOR, COMPANY	Roser Pinto, Raquel Rios and Anna Artigas, Universistat Autonoma de Barcelona
REVIEWER, COMPANY	Derek Bell, Campanula Consulting Kim Lansford, European Roundtable of Industrialists Mikkel Bohm, Danish Science Communication
WORKPACKAGE	WP 2
CONFIDENTIALITY LEVEL[1]	PU
FILING CODE	ECB-D2_4_Needs Analysis_Final.Doc
RELATED ITEMS	

DOCUMENT HISTORY

Version	Date	Reason of change	Status	Distribution
V1	07/08/2012	1st draft	Draft	reviwers
V2	17/08/2012	Feedback from reviwers	Draft	authors
V3	30/08/2013	Revised version	Draft	reviewers
V4	29/01/2013	Final	Final	EC

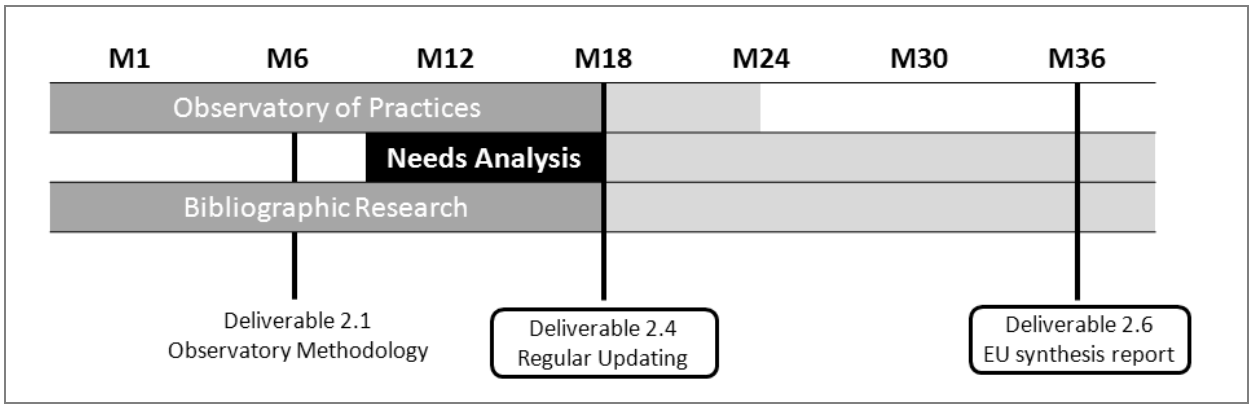
[1] 1 PU = Public
PP = Restricted to other programme participants (including the EC services);
RE = Restricted to a group specified by the Consortium (including the EC services);
CO = Confidential, only for members of the Consortium (including the EC services).
INN - Internal only, only the members of the consortium (excluding the EC services)

Executive summary

The ECB/inGenious project is a large-scale strategic response trying to strengthen links between education and STEM careers as a way of addressing several of the challenges related to science, technology, engineering and mathematics (STEM) in Europe. Since 2000, several strategies have been launched with the aim of transforming Europe into a competitive and dynamic knowledge-based economy. All of these strategies share the intention of increasing human resources employed in STEM as part of the initiatives to strengthen innovation, which is a motor for economic progress. In this context, closer cooperation between education and industry could undoubtedly help equipping people with the right skills for the jobs of today and tomorrow.

Within the ECB/inGenious project, which main aim is to contribute to making school-industry collaborations as effective as possible and to expanding them across Europe, the tasks performed in Work package 2 –WP2, entitled "Observatory of practice and needs analysis – Monitoring Research Developments"–, are addressed to explore both the current situation of and the main existing challenges in school-industry partnerships in Europe.

The present document is one of the six deliverables from WP2. According to the timeline of the project (see below), a Deliverable 2.1 was elaborated presenting the established methodology for the Observatory of Practices. That document, which included bibliographic information on factors influencing career choices, was mainly focused on the design of grids and questionnaires for collecting information about examples of school-industry collaboration. The present document – Deliverable2.4– summarises the strategy that has been defined for the performance of a Needs Analysis in order to identify problematic issues in current school-industry collaborations, both at national and at European level.



Timeline of the ECB/inGenious project, starting on February 2011 (M1) and ending on February 2014 (M36).

In general, the aim of a Needs Analysis is to identify needs or gaps between current conditions and desired conditions. However, in the frame of school-industry partnerships these desired conditions are understood in terms of the satisfaction of the involved stakeholders regarding the establishment, design, implementation and sustainability of these collaborations. In fact, despite the multiple benefits that can be obtained through school-industry partnerships, the parties involved in these activities might face shared difficulties, and a proper dialogue between the educational, industrial and political sector is required to discuss how these partnerships can be improved.

In this sense, the Needs Analysis is a crucial step to allow making effective decisions and recommendations addressed to enhance the effect of school-industry collaborations upon fostering young's interest on STEM careers and jobs in Europe. The final results of the Needs Analysis will be collected in a final EU synthesis report –Deliverable 2.6–, which will include the fundamental research results that constitute a knowledge baseline in the field, that is, the knowledge necessary for the design or adaptation of STEM education initiatives within a school-industry partnership that aim to increase students' interest and knowledge of STEM careers in Europe.

Our approach in designing the strategy for the Needs Analysis has been based on the rationale of Needs Assessment methodology, tailoring it to the ECB/inGenious. Thus, in order to collect appropriate information about the needs and gaps in school-industry collaborations, several steps have been and/or will be considered, including:

1- Identify the internal and external partners necessary for a correct/complete needs analysis.

2- Determine the kinds of data required to identify needs at different levels (strategic, tactical and operational), and the informants expected to provide it.

3- Determine potential sources of data to inform the needs assessment.

4- Make arrangements to collect information that is not already available.

5- Pilot test interviews protocols, questionnaires, and other information gathering tools.

6- A major step is to collect information that represents varying perspectives on the primary performance issues as it supposes to obtain it through all the stakeholders.

7- Define needs on the basis of performance gaps between current and desired conditions.

Along the process of Needs Analysis, representatives from the different sectors involved in STEM school-industry collaborations (political, educational and industrial) will be able to share views and

opinions in order to identify the main existing gaps between current and desired conditions. In this sense, the Needs Analysis represents a great opportunity for all the stakeholders to work on defining action plans and next steps addressed to improve the effectiveness of these partnerships as a way of fostering young people into STEM careers and jobs.

Apart from the outcomes from the discussions among stakeholders, the work performed in WP2 during the first phase of the project, which was focused on the establishment and implementation of the Observatory of Practices, has been very useful to set the basis for the Needs Analysis. In this sense, from the information collected so far it was possible to identify several “Difficulties to overcome” in current school-industry partnerships, which have been classified according to their typology under the following categories:

1- Difficulties related to the political context.

2- Difficulties related to the reasons for establishing school-industry collaborations.

3- Difficulties related to the procedures for the establishment of collaborations.

4- Difficulties related to the implementation of practices.

5- Difficulties related to financial barriers.

This preliminary information represents a starting point for the Needs Analysis and has been used to establish the subsequent steps, which mainly consist on the organization of a set of workshops that will take place among the different stakeholders (representatives from the educational, industrial and political sectors) both at national and at European level.

Through the whole process of Needs Analysis, it is also expected that success stories related to school-industry cooperation at different levels will be identified, and sharing them might represent a catalyst to improve the impact of these kinds of partnerships, especially in those countries in which there are less previous experiences in this field. In particular, several aims are expected to be reached:

- Getting to know the positive and negative outcomes of school-industry partnerships, both from the educational and from the industrial points of view.
- Identifying the main features which contribute to the success of school-industry collaborations.
- Getting suggestions or recommendations from national platforms and policy makers to companies and/or to schools.

Table of Contents

1 Introduction: About this deliverable

The present document –Deliverable 2.4– summarises the strategy that has been defined for the performance of a Needs Analysis process aimed to identify gaps and problematic issues in current school-industry partnerships at national and European level, both from an educational and industrial point of view.

According to the timeline[2] of the project, the Needs Analysis will be performed along 24 months, starting at the beginning of the second year –M12– and finishing at the end of the project –M36–. In this sense, the content of the Deliverable 2.4 is mainly focused on presenting the methodology that has been established to perform the Needs Analysis and some of the preliminary information collected so far (table 1). The final results of the whole Needs Analysis process will be presented at the end of the project in a European synthesis report –Deliverable 2.6–, which will include the necessary knowledge for the design or adaptation of STEM education initiatives within a school-industry partnership that aim to increase students' interest and knowledge of STEM careers in Europe.

Deliverable Number	Deliverable Title	Delivery date
D2.1	Observatory methodology	*M6 (Jul 2013) - Delivered*
D2.2	Report on the implementation of the observatory	M24 (Feb 2013)
D2.3	Observations summary report	M24 (Feb 2013)
D2.4	**Needs Analysis (regular updating of the document)**	**M18 (Jul 2012)**
D2.5	Country reports on research developments	M30 (Jul 2013)
D2.6	EU synthesis report	M36 (Feb 2014)

Table 1: List of deliverables for Work Package 2 and expected delivery dates.

[2] For clarity, the timeline of the project is expressed in months (M), starting at M1 (February 2011) and ending at M36 (January 2014).

2 A Problem to Face: The STEM Crisis in Europe

The Lisbon Especial European Council held in 2000 had the objective of strengthening employment, economic reform and social cohesion as part of a knowledge-based economy strategy. In 2005, after an evaluation process which helped to clarify its scope and aims, the Lisbon Strategy was re-launched with the initiative "Working together for growths and jobs", and several measures specifically targeted the younger generation(EC, 2010). The re-launched strategy aimed at **endowing this group with the human capital and the skills needed** in a dynamic knowledge-based economy. In fact, in 2004 the High Level Group (HLG) on Human Resources for Science and Technology[3] warned that new human resources for Science, Technology, Engineering and Mathematics (STEM) would not be attracted at the required level unless governments translated their political goals urgently into new research jobs and better career perspectives(Gago, 2004). In particular, the HLG pointed out that the Lisbon and Barcelona EU objectives of attaining 3% of GDP for R&D would roughly require a minimal level of eight researchers per thousand in the workforce (in 2001, the number of researchers per 1000 of the workforce, in full-time equivalent or FTE, was 5.7 for the EU-15). They argued, moreover, that reliance on importing suitable qualified workers from outside the EU is not sustainable in the long term, given the global nature of the market and the dynamics at play, and that EU ambitions will not be met on the present trajectory of increasing the numbers entering STEM career. In fact, according to updated data from Eurostat Education Statistics, the relative share of tertiary education graduates in STEM has been decreasing along the last decade (figure 1).

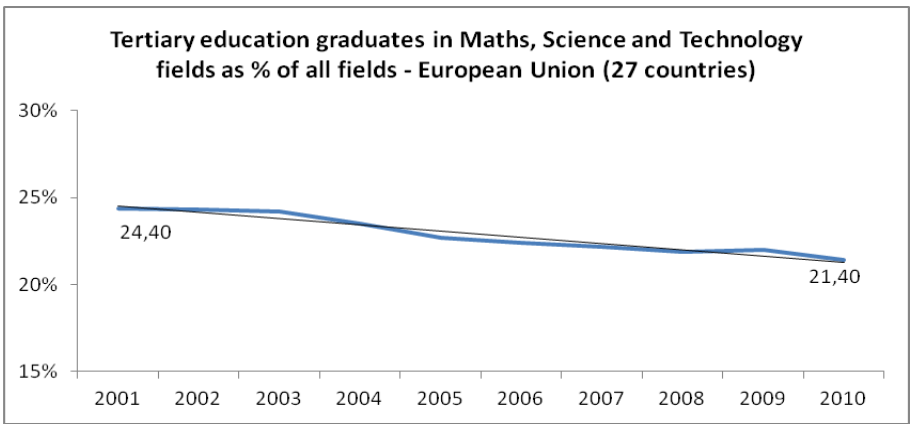


Figure 1: Relative share of tertiary education graduates in STEM (Data from Eurostat Education Statistics).

[3] The High Level Group (HLG) was part of the Commission's strategy to address the Lisbon EU Summit declaration of March 2000.

In this context, increasing the human resources employed in STEM is part of the initiatives to strengthen innovation, which is a motor for economic progress. Closer cooperation between education and industry could undoubtedly help raising awareness of STEM careers and equipping people with the right skills for the jobs of today and tomorrow. In fact, evidence exist suggesting that employer's involvement with education has positive impacts in terms of preparedness for work, developing job and work skills, improving work-based competencies, attitudes and behaviours, enhanced employability and higher initial wage rates (NCSR, 2008)

Even though European governments decided to achieve the Lisbon Objectives, there are a number of factors that seriously affect if they are able to reach the agreed targets. One of the main impediments for these objectives is the lack of understanding that might exist among the different stakeholders involved in STEM education and employment, this is, among educators, policy makers and industrial representatives. In this sense, the fundamental problem is how to align politics, education and STEM industry so that the current challenges that Europe is and will be facing (shortfall of STEM professionals foreseen for the future, energy and climate uncertainties, etc.) can be successfully overcome.

In this sense, the European Round Table of Industrialists (ERT) has been at the forefront of addressing the perceived challenges and prepared a report in order to assess how business role can help to address the roadblocks that threaten Europe's Future prosperity (ERT, 2009). With this report, the ERT together with European Schoolnet, established the basis for the creation of the European Coordinating Body, with the aim of fostering young people to STEM careers by reinforcing links between schools and industries through STEM education activities.

3 The ECB/inGenious Project: Addressing the STEM Crisis

The ECB/Ingenious project is a large-scale strategic response trying to reinforce links between science education and STEM careers in the private sector through reinforcing school-industry partnership[4]. In fact, although there is a great diversity of initiatives intended to promote the quality and innovation of STEM education at school –many of them promoted by universities, policy makers, informal learning environments, etc.–(Gerloff-Gasser, Jann, & Kyburz-Graber, 2007), those designed in collaboration with industries can be specially interesting for increasing young people's interest in STEM careers and jobs(Burge, Wilson, & Smith-crallan, 2012). In fact, as it was extensively explained in the Deliverable 2.1, the process of career decision making is influenced by several factors, many of which can be strongly emphasised through the collaboration between school and industry.

In this sense, the different work packages involved in the project (figure 2) are jointly addressed to contribute to making school-industry partnerships as effective as possible, and to expanding them across Europe. In particular, the Work package 2 (WP2) is mainly focused on exploring the current situation of and the main existing challenges in STEM school-industry partnerships in Europe, two questions which are being addressed through the establishment of an Observatory of Practices, the performance of a Needs Analysis, and a deep bibliographic research.

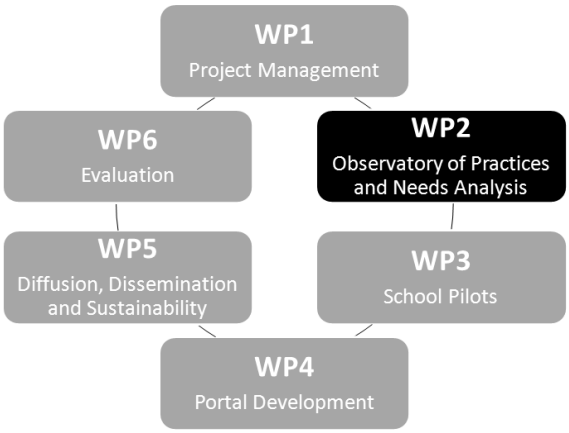


Figure 2: Workpackages in the project.

[4] Along the whole document, we will refer to school-industry partnerships or collaborations exclusively in the field of STEM.

3.1 WP2 in ECB/inGenious

As already mentioned, the work performed in WP2, entitled **"Observatory of Practices and needs analysis – Monitoring Research Developments"**, is mainly addressed to explore both the current situation in Europe regarding school-industry partnerships and the challenges that might exist in the field.

It is worth mentioning that the work developed within this WP2 is closely related to the other work packages, since some of the practices collected for the Observatory are being implemented in the School Pilots (WP3) and will subsequently evaluated by WP6, while the whole set of collected practices and policy actions will be gathered together in a data base available through the portal (WP4).

Concerning the Observatory of Practices, the methodology was established from two different perspectives, as explained in more detail in the Deliverable 2.1:

- On the one hand, to collect and analyse practices of school-industry collaboration in order to identify good practices following a set of criteria.
- On the other hand, to develop a permanent system for a repository containing a great number of initiatives carried out in Europe.

One of the main purposes of the Observatory is identifying good practices in order to disseminate them and stimulate new ones. During the first year and a half of the project, nearly 80 examples of actions were collected and analysed from several perspectives (regarding their aims, addressed target group, pedagogical approach used, use of evaluation methods, etc.) More examples are still being collected, and will allow to have a broad picture about the existing kinds of initiatives currently taking place in Europe in the field of school-industry collaborations related to STEM. In this sense, the results of applying the Observatory methodology will be presented in the Deliverable 2.2, while a catalogue of good practices and policy initiatives, including success stories to inspire teachers and policy makers and recommendations at both practical and policy-making level for enhancing the sharing of good practices, will be presented in the Deliverable 2.3.

The Needs Analysis, on the other hand, aims at identifying main obstacles in school-industry partnerships, and it will be a crucial step to allow making effective decisions and recommendations addressed to improve the effect of such collaborations upon fostering young's interest on STEM careers and jobs in Europe. The results of this Needs Analysis process, which will be focused on

needs both from an educational and an industrial points of view, will be collected in a final European synthesis report –Deliverable2.6–, according to the timeline of the project (figure 3).

It is important to highlight several added values that will outcome from this work, such as the fact that it will allow to identify key aspects that can help to design successful school-industry practices aimed to foster young students into STEM careers and jobs. Moreover, the possibility of generating clusters of stakeholders that can contribute to build fruitful school-industry relationships in Europe represents a valuable seed for the future development of STEM collaborations among the educational and industrial sectors in Europe.

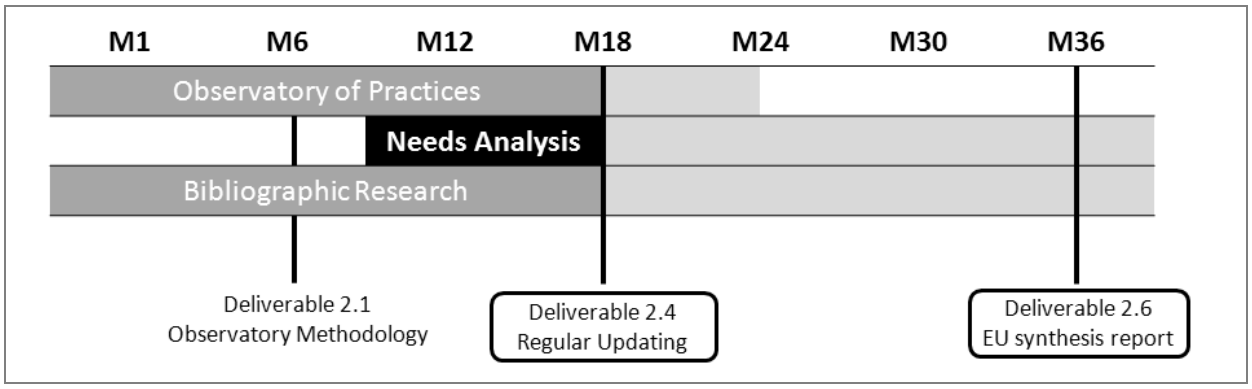


Figure 3: Timeline of the project.

4 Needs analysis: searching the path to overcome challenges

School partnerships between teachers and students, on the one hand, and STEM companies, on the other, can represent a positive way of awaking vocations for STEM careers and jobs. In fact, at first glance, there are various benefits a partnership can offer both to companies and schools. For instance, there is evidence to show that young people can get several benefits from employer engagement, such as obtaining information which can help them to decide on career paths. The involvement of employers with schools can also be beneficial for teachers, since they can widen their knowledge about the applicability of contents developed at school. On the other hand, some of the advantages that can be considered by employers for collaborating with schools are staff recruitment, staff motivation, staff development or building a strong corporate identity(Mann & Stanley, 2010).

Despite the multiple benefits that can arise from school-industry collaborations, the parties involved in these activities might face shared difficulties(Eurydice, 2011). In this sense, the identification of the main challenges that partners can encounter in their collaboration is a crucial step to be tackled in order to help bringing more partnerships to fruition. Obstacles might exist both for school teachers who try to establish collaboration with a company, as well as for industrialists who are keen to design school-business practices. Moreover, policy makers can also contribute to this kind of relationship, whether it is reinforcing or weakening them, depending on the policies that are promoted. In any case, one of the fundamental problems which hinders the proper development of school-industry collaborations has to do with the different interests and motivations of the involved stakeholders. For instance, the benefits of cooperating with industry might be quite obvious for a vocational teacher, whereas a STEM professional (and even a primary school teacher) might not see any advantage on this kind of collaborations. In this context, the establishment of a fruitful dialogue among the educational, industrial and political sectors to try to find a proper alignment of their positions would represent a driving force for promoting useful and efficient collaborations between school and industry as a way of increasing young people's interest on STEM careers and jobs.

With this in mind, and considering the international and multi stakeholder environment in which the ECB/inGenious project is being developed, a Needs Analysis will be performed to identify gaps and problematic issues in current school-industry partnerships both at National and at European levels, and from different perspectives (i.e., considering the educational, industrial and political

points of view). Moreover, it will be especially focused on identifying challenges regarding the establishment, design, implementation and sustainability of these collaborations.

4.1 Rationale - Needs analysis as an assessment tool

A needs analysis is an assessment tool to identify needs or gaps between current conditions and desired conditions. Although the expression “needs analysis” is occasionally used as a synonym for “needs assessment”, it is more accurate to define it as a needs assessment tool (Watkins, R., West Meiers, M. and Visser, Y., 2012).Both, however, have become concepts commonly used in the recent years throughout education, government, and the private sectors with regard to planning and improvement processes.

Allison Rossett (1987) defines needs assessments “the systematic study of a problem or innovation, incorporating data and opinions from varied sources, in order to make effective decisions or recommendations about what should happen next.” In a similar way, and according Bob Kizlik (2012), needs assessment is “a way of generating information that can be useful for solving some problem.”

Although some ambiguity might exist in the use of the expressions “needs assessment” and “needs analysis”, especially depending on the context in which they are found, it is important to make clear the difference between both concepts.

According to Watkins and Kaufman (1996), a needs assessment should be designed to identify and prioritize needs, while a needs analysis should break identified needs into its component parts and determine solution requirement. In this sense, needs analysis can be considered as a tool to be used in the performance of a needs assessment that will define gaps in results and highlight opportunities to improve performance (Watkins, R.et al, 2012), but rigorously speaking, it is not the process of needs assessment itself. The relationship between needs analysis and needs assessment can be shown as it is illustrated in figure 4.

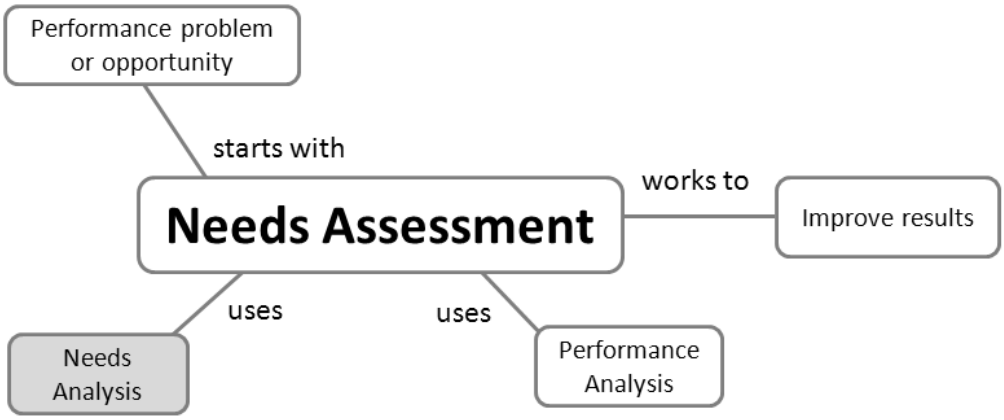


Figure 4: Illustration of relationships between concepts (adapted from Watkins *et al,* 2012).

Depending on the size and scope of the needs assessment, a useful plan can be created for identifying needs, analysing them, and deciding what to do next (or at least making recommendations). In any case, the process should start by **identifying needs** (that is, gaps between desired and current results), and in order to do this, it is important to follow the next steps (Watkins *et al* 2012):

1. Identify the internal and external partners for the needs assessment.
2. Determine what data are required to identify needs (that is, gaps) at the strategic, tactical, and operational levels.
3. Determine potential sources of data (community members, documents, and so on) to inform the needs assessment.
4. Make arrangements to collect information that is not already available (schedule interviews, create surveys, arrange focus groups, collect documents to be reviewed, and so forth).
5. Pilot test interview protocols, questionnaires, and other information gathering tools.
6. Collect information using a variety of tools and techniques, and include sources that represent varying perspectives on the primary performance issues.
7. Define needs on the basis of performance gaps between current and desired results.

The ultimate aim of the needs analysis is to establish: 1) what needs actually exist; 2) whether they are important; 3) how the needs become apparent; 4) how they were defined; 5) how they may best be addressed and 6) what the priorities are (Erasmus, B., Schenk, H., Swanepoel, B., Van Dyk, W., 2000).

Focused on improving performance, the following basic step in a needs assessment consists on **analysing needs** and **potential solutions**. Such a process, which links needs with the information required to make decisions about what actions should be taken, involves the following steps (Watkins et al 2012):

1. Establish an initial prioritization of needs on the basis of size, scope, distinguishing characteristics, and relative importance.
2. Conduct a needs analysis – for the highest-priority needs – to better understand what is working, what is not working, and what the systemic relationships are among needs.
3. Collect information (a) regarding the causal factors (or root causes) associated with what is not working and (b) leading to priority needs.
4. Analyse and synthesize the useful information that has been collected about the needs.

This last process, however, is out of the scope of the work right now, and thus it is not considered at this moment.

5 The strategy to perform needs analysis in Ecb/inGenious

The consortium of ECB/Ingenious project is composed by partners from 15 European countries, each of them with its particular idiosyncrasy regarding the situation of school-industry partnerships. Having in mind that the educational, political and industrial contexts across the involved countries might be very different from each other, and at the same time considering the European frame of the project, the needs or problematic issues in school-industry partnerships must be tackled from two perspectives. For this reason, the needs analysis will be performed both at national level (i.e., in the different countries involved in the project) as well as at European level. This is to say, for each country participating in the project, a needs analysis will be carried out, and the outcomes will be subsequently shared to identify common strategic areas of needs across Europe and target groups.

5.1 Defining the steps to follow

In the frame of the ECB/inGenious project, the steps mentioned in section4.1.as being involved in the identification of needs have been considered in order to perform a needs analysis addressed to the particular situation of school-industry partnership. The details for the procedure to be followed, which will be developed until the end of the project, are presented through the following sections.

1. Identify the internal and external partners for the needs assessment

Since we will focus on needs both from educational and industrial points of view, we need to gather the different opinions of the involved stakeholders (school teachers and industrialists) and also of other agents from institutions relevant for school-industry partnerships (policy makers, national platforms and science education experts).

Apart from the internal partners, which are those directly involved in ECB/inGenious, the participation of members external to the project will also be considered for the Needs Analysis. In fact, one of the first steps of this process has been trying to identify representatives from institutions or organisations that would be relevant, such as Universities, Trade Organisations, etc. For each of the 15 countries involved in the project, internal partners have been requested to

propose external experts, which will be nominated along the process of organisation of the National Workshops (see below).

2. Determine the data required to identify needs (that is, gaps) at the strategies, tactical and operational levels

1- *Strategic level*: typically involves goals, objectives, and strategic policies defining the relationship between organizations and the society they serve (Watkins et al 2012).In the case of ECB/inGenious project, we expect to get information from policymakers and national Platforms about goals, objectives, and strategic policies to promote school-industry partnerships.

2- *Tactical level*: includes the policies and procedures put in place to both support strategic decisions and guide operational decisions, thereby defining the goals and objectives of an organization or institution. The policies and procedures in the frame of ECB/inGenious are usually designed by National Platforms and, up to a point, by companies. Thus, from these stakeholders we will obtain tactical information regarding ways to address difficulties in the collaborations between school and industry.

3- *Operational level*: includes all sort of short- and long- term decisions that typically involve implementing projects or programs and carrying out tasks to produce results. The data at operational level in the frame of ECB/inGenious will come from the agents involved in the implementation of school-industry practices. This is to say, schools and companies will be the main source of information at this level.

All these different kinds of data required to identify needs at different level together with the informants expected to provide it are summarised in table 2.

Level	Data required to identify needs	Informants
Strategic	About goals, objectives, and strategic policies to promote school-industry partnerships	Policymakers and national Platforms
Tactical	About policies and procedures put in place to both support strategic decisions and guide operational decisions	Stakeholders: National Platforms and, up to a point, companies
Operational	About difficulties that arise during the	Teaching staff, STEM professionals and other agents directly involved in

	implementation of the practice	the implementation of school-industry practices.

Table 2: Kinds of data required to identify needs at different levels, and informants expected to provide it.

This information is better illustrated in figure 5:

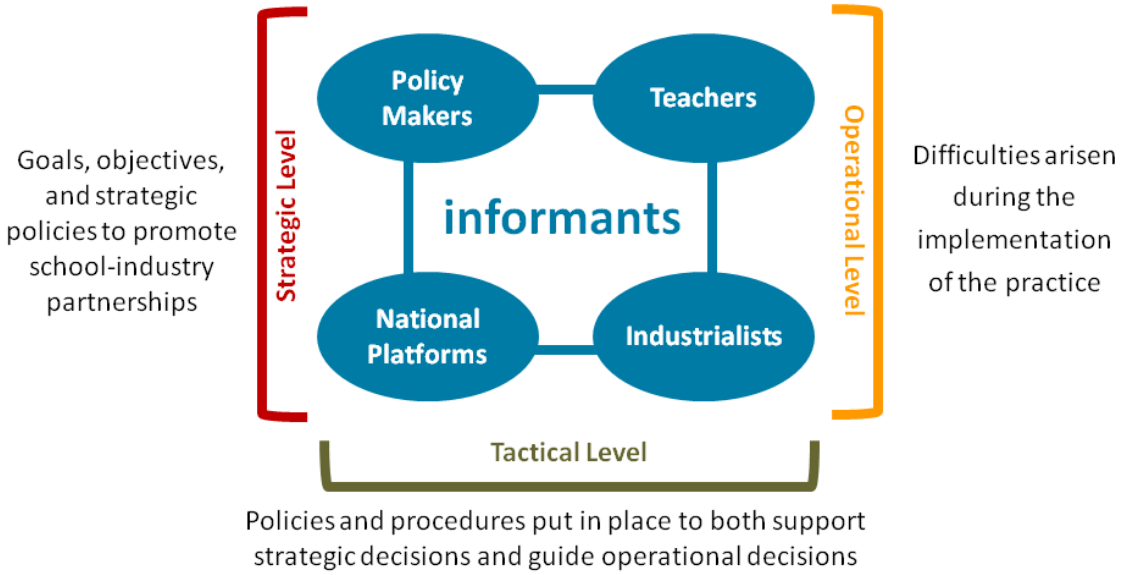


Figure 5: Data required to identify needs at different levels, and informants expected to provide it.

3. Determine potential sources of data (community members, documents, and so on) to inform the needs assessment

In order to get information from the previously mentioned internal and external partners, several documents have been collected and analysed up to now, and some others will be collected subsequently.

i. On the one hand, in the first phase of the project **two surveys were addressed to policy makers and industrial partners of ECB/inGenious** to collect data for the Observatory of Practices. These questionnaires were designed to collect information about practices and policy actions currently taking place in Europe, in particular regarding the aims of the collaborations and the way they are designed to address these aims. Having in mind the Needs Analysis that should be performed during the project, through the mentioned questionnaires the respondents were also asked to describe the difficulties that must be

overcome, according their views, to successfully establish/design/implement a school-industry practice.

ii. On the other hand, **several reports have been written by representatives from National Platforms and companies** involved in ECB/inGenious. Considering the large experience of the partners of the project in promoting and participating in school-industry collaborations, they are able to provide a more general perspective about the current situation of these partnerships in their respective countries.

iii. Moreover, and as it will be explained later, **different workshops** will be organised among partners and external experts in school-industry partnerships related to STEM, in consonance with what was proposed in the planning phase of the project. This approach has been adopted considering that surveys and reports, although very valuable resources, might be insufficient to deeply explore the existing challenges and gaps. In fact, from our experience it has been highlighted the difficulty in obtaining standardised feedback to the questionnaires designed. Moreover, questionnaires are sometimes rejected by their potential responders if they require too much time to be answered. Having this in mind, and in order to adjust the needs analysis methodology according the possibilities of the agents involved, it has been proposed that the information would be mainly gathered via a set of national workshops. These workshops will represent a meeting point for the different stakeholders to discuss about current challenges in school-industry partnership, representing the main source of information for the Needs Analysis. Furthermore, they will also allow establishing a dialogue among representatives from the educational, industrial and political sectors to propose possible ways to improve these collaborations. Another potential benefit of these workshops is their contribution to stimulate the formation of country clusters of stakeholders who can then cooperate on a number of specific activities to achieve economies of scale. However, it must be pointed out that the outcomes of these workshops will highly depend on the particular attendees, whose experience in school-industry collaboration will highly determine the quality of both the discussion and the proposed recommendations. In this sense, one of the main weaknesses of this approach will consist on finding the right people who can better contribute. Moreover, the results of each workshop will be gathered in a report, being all the reports the source of information for the Needs Analysis at national level. Thus, the quality of the report in terms of both covering the key points to identify challenges and proposing recommendations to overcome them will be also determinant.

From all these sources (which are summarised in table 3), as well as from the deep bibliographic research performed along all the project, we will be able to gather information about the gaps and benefits of school-industry cooperation in the different countries involved in the project (see figure 6).

Sources of data	**Surveys addressed to policy makers** about policy actions to put in place school-industry collaborations[5]
	Surveys addressed to industrial partners of ECB/inGenious about practices implemented by companies[6]
	Reports from National Platforms and companies involved in ECB/inGenious
	Reports from the National teachers' coordinators through national workshops with school teachers involved in the pilot schools
	Workshops at National level (in each of the participant countries)
	Workshops at European level
	Bibliographic Research

Table 3: Sources of data from which information will be collected to perform the Needs Analysis.

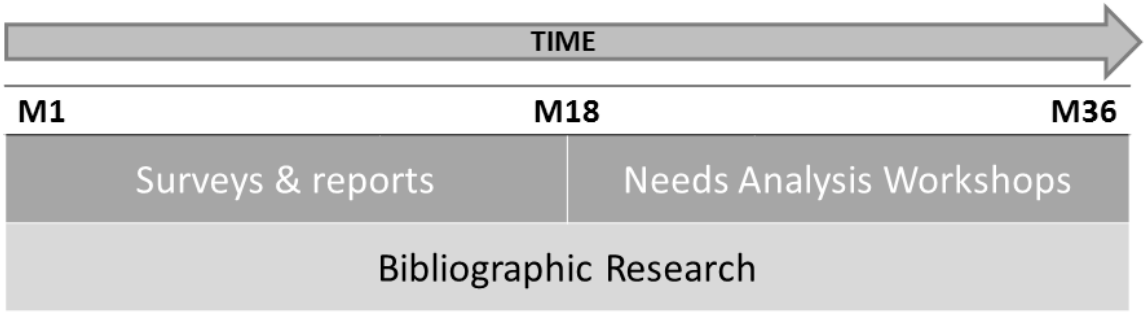


Figure 6: Timeline illustrating the collection of data from the different sources along the project.

4. Make arrangements to collect information that is not already available (schedule interviews, create surveys, arrange focus groups, collect documents to be reviewed, and so forth)

[5]These surveys were elaborated as a tool to collect information for the Observatory of Practices (Deliverable 2.1) before the start of the Needs Analysis. However, they included an open question requesting the partners to highlight the "difficulties to overcome" in school-industry collaborations.

[6]Idem.

The different stages that are being followed to collect information for the Needs Analysis are schematically represented in figure 7, in which the first two steps were performed during the first year and a half of the project as part of the Observatory of Practices (Deliverable 2.1).

In the first place, and as it was explained in Deliverable 2.1, two questionnaires were elaborated and distributed to industrial partners, national platforms and policy makers (figure 7, step 1). The elaboration of these questionnaires, which aimed at collect information about practices and policy actions of school-industry collaboration, was preceded by a previous bibliographic search about the factors influencing young people when making career choice. From this theoretical background, a set of variables was selected in order to design two grids for collecting information about practices and policy actions. Subsequently, the two questionnaires were designed to obtain, from the involved agents, the necessary information to fill the grids. The questionnaires, which were made available through the ECB/inGenious platform, included closed questions with pre-coded answers with a direct fit into the grids, as well as open questions to allow the respondents describing with ease and fluency all the relevant information to communicate about the matter in question. As it has been already mentioned, these questionnaires were originally designed to collect information for the Observatory of Practices. Furthermore, having in mind the Needs Analysis process that would be performed afterwards, we included an open question in which the respondents were required to explain the main difficulties that need to be overcome to design/implement an action and to help promote and extend it.

On the other hand, during a General Assembly held at the end of 2011, it was highlighted that National Platforms and partner companies represent a valuable source of information about current school-industry partnerships in Europe, due to their extended experience in the field. Thus, in order to make the most of this potential, representatives of National Platforms and companies involved in ECB/inGenious were required to write a brief report giving their opinion and experience about the current situation of STEM education in the frame of school-industry collaboration (figure 7, step 2).

Therefore, from the information collected through the previously mentioned steps during the first year and a half of the project, several difficulties were detected. This information, jointly with findings from the bibliographic research, was used to establish an outline of issues to be subsequently explored in more detail during the Needs Analysis process (figure 7, step 3). It is important to highlight that this preliminary information is essential as a starting point to guide the whole process, although the results and conclusions of the Needs Analysis will be mainly based on the outcomes of the next steps.

The following step to gather relevant data for the Needs Analysis will consist on the organisation of a set of workshops at national level. The ones that will take place first will be attended by teachers involved in pilot schools and their national teachers' coordinator (figure 7, step 4).

Subsequently, a second group of workshops will be organised in each country, so that a scientific committee of national educational and scientific STEM experts will be brought together to discuss needs at national level and to make recommendations on that basis (figure 7, step 5). Through these workshops, and as it will be later explained, we will collect information from different sources: teachers from pilot schools, national teachers' coordinators, National Platforms, Ministries of Education or other political institutions, STEM industries, and experts on school-industry partnership.

Finally, a set of workshops will be organised at European level among representatives from the different sectors involved in this kind of collaborations. In this sense, a scientific committee of educational and scientific experts at European level will joint together to discuss the outcomes of the previous National Workshops in order to identify common strategic areas of needs across countries and target groups and give recommendations to improve the efficiency of school-industry partnerships (figure 7, step 6).

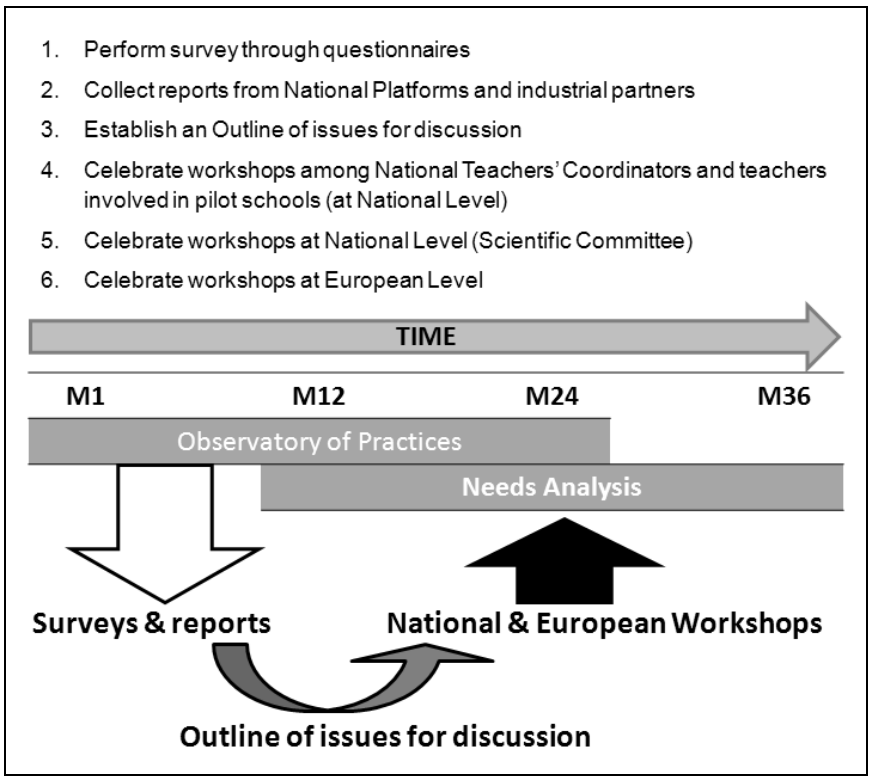


Figure 7: Schematic representation of the steps followed to collect information (above) and timeline showing them along the project (below).

5. Pilot test interview protocols, questionnaires, and other information gathering tools.

During the establishment of the Observatory methodology, the questionnaires mentioned in the previous section were piloted by making them available to the partners of the project in order to get their feedback. Considering the received inputs, the questionnaires were later refined trying to make them easy to fill in and not too long, so that a maximum of responses could be achieved. After this piloting and refinement process, the final versions of the questionnaires were made available on line.

6. Collect information using a variety of tools and techniques, and include sources that represent varying perspectives on the primary performance issues

From the first phase of the project that has been carried out up to now, it has been possible to collect some useful information which represents a starting point to explore the main gaps found in school-industry partnerships.

The data obtained from this first stage, which is presented in section 5.2, give us an idea of the main existing barriers in the establishment, design, implementation and maintenance of school-industry collaborations. According to this information, an “Outline of issues for discussion”, which is presented at the end of the document (Annex A1), was elaborated in order to guide the subsequent steps for the Needs Analysis.

Having in mind the European dimension of the project, as well as its multi stakeholder nature, in order to establish a feasible mechanism to collect the needed information from all the relevant agents in these workshops a three-stage approach is proposed:

6.1 Collecting information at National level

In a first stage, and in order to gather the educational point of view at national level, all the teachers from pilot schools will meet together with their National Teachers’ Coordinator to discuss a set of issues related to school-industry collaborations. In these meetings, which are planned to be held during the 2012 Summer School that will be held in Istanbul from 24th to 26th August, each National Teachers’ Coordinator will gather the point of view of the different teachers in order to come out with a summary of the educational view representing each country. The outcomes of these meetings will be shared at national level with the rest of the scientific committee of experts in order to find common strategies to improve school-industry partnerships.

In a second stage, a scientific committee of industrial representatives, national educational and scientific STEM experts will be brought together in a set of workshops to discuss needs at national level. In particular, these workshops are aimed towards a number of goals, such as:

- Identifying strengths and challenges of the current school-industry collaboration.
- Identifying the main factors which contribute to the success of school-industry collaboration.
- Putting forward recommendations from the participants.

An important effort must be made so as to assure that the scientific committee is properly balanced, including representatives from all the different (educational, industrial and political) sectors involved in school-industry partnerships. Assuring such a balance will allow to obtain a good description of the situation in the different countries which represents the diversity of views from the different stakeholders.

The discussion should address several issues related to the contribution to school-industry partnerships from the political context, the reasons and procedures for establishing school-industry collaborations, the gaps and successes along the design and implementation of practices, and the financial barriers. However, and having in mind that each of these national workshops will be celebrated along one day, clear guidelines for the discussion must be defined in order to optimize resources and be as efficient as possible. In this sense, a draft agenda was proposed and distributed among the organisers of the National Workshops as a guide. According to this proposal, and even thought the agenda will be properly adapted to each particular context, the overall structure of the workshop will consist of two main parts (table 4). On the one hand, a set of presentations will allow the different sectors (political, industrial and educational) to express their views regarding school-industry collaborations in their country. Once the different perspectives have been shared, group discussions will be established so as to tackle several items regarding the design, implementation and assessment of school-industry practices It is important to assure a good balance of representatives from all the different sectors in these group discussions in order to be able to identify gaps at all levels (strategic, tactical and operational level)

PRESENTATIONS
School-industry links – National Policies Brief overview of the contribution from policy makers to increasing STEM school-industry collaborations.
School-industry links – The Industry Perspective Brief overview of the Industry's involvement in collaborations with education at national level. Motivating factors and expected benefits for the industry, key challenges in initiating / maintaining school-industry collaborations…
School-industry links – The School Perspective Brief overview of the schools' involvement in collaborations with industry at national level. Motivating factors and expected benefits for schools, key challenges in initiating / maintaining school-industry collaborations…
GROUP DISCUSSIONS
School-industry links – The Design, Implementation and Assessment of school-industry practices related to STEM disciplines • Degree of collaboration between teachers and STEM professionals • Fitting the school-industry practices within the school curriculum • Characteristics which make practices successful / challenging to design / implement • School-industry collaborations that would be positive from the educational point of view but are not feasible to carry out • Funding for implementing school-industry practices • Definition of clear objectives in school-industry collaboration • Use of evaluation methods to assess the outcomes of collaborations

Table 4: General structure of the National Needs Analysis Workshops agenda.

As already mentioned, the outcomes from these workshops will represent one of the main sources of information for the Needs Analysis, and so it is important to assure that the achieved conclusions and the different arisen opinions from each national workshop are properly collected. With this purpose, a document template has been elaborated from the "Outline of issues for the

discussion" so as to facilitate the task of reporting the main outcomes. The structure and expected contents of this report are planned in the following chapters:

- Chapter 1 will summarise the contribution from the national political context to school-industry collaborations, explaining the existence of political strategies addressed to reinforce the kind of partnerships that might exist. It will be also interesting to know if there are particular institutions in charge of fostering these collaborations in the country at national, regional and/or local level, the way they are coordinated, etc.
- Chapters 2 and 3 will collect, respectively, the Industry and the School perspectives regarding the involvement of companies and educational institutions at national level, and the main reasons and challenges that teachers and employers/employees find to collaborate.
- Chapter 4 is addressed to include the outcomes of the group discussions, that is, to present the educational and industrial perspectives regarding the design, implementation and assessment of STEM practices.
- Chapter 5 will collect the recommendations and short-term objectives arisen from the dialogue among the different stakeholders at national level.

The organisation of these meetings, which are expected to take place during September and November of 2012, is being coordinated by UAB and EUN teams. The main partners of each country involved in ECB/inGenious, which will be in charge of organising the national workshops, have been contacted so as to inform them about the aims of such an event, to provide them the draft agenda and to request them to propose and nominate external participants. Several steps are being followed together with the organiser partners in order to plan such workshops. In particular, we dealt with:

- The feasibility of hosting the needs analysis workshop in their country between September and October 2012.
- The proposed structure for the workshop (draft agenda)
- The list of invited participants for the workshop.
- The identification of a Moderator to chair the workshop and of a Rapporteur to draw up the national needs analysis report.

- The identification of areas where EUN, as project coordinators, can support and assist in the organisation of the national needs analysis workshops.

6.2 Collecting information at European level

Once the Needs Analysis has been performed in all the different countries involved in ECB/Ingenious project, a meeting at European level will be organised in order to share the different outcomes arising at national level. The expected participants will represent the educational, industrial and political sectors having participated already in the Needs Analysis at national level.

7. Define needs on the basis of performance gaps between current and desired results

As already mentioned, the desired conditions in the frame of school-industry partnerships are understood in terms of the satisfaction of the involved stakeholders regarding the establishment, design, implementation and sustainability of these collaborations. Bringing together representatives from the different sectors involved in STEM school-industry collaborations through the previously mentioned steps will allow to identify the main existing gaps between current and desired conditions. Moreover, these transversal workshops will represent a good opportunity for all the stakeholders to work on defining action plans and next steps addressed to improve the effectiveness of these partnerships as a way of fostering young people into STEM careers and jobs.

Through the process of Needs Analysis, it is also expected that success stories related to school-industry cooperation at different levels will be identified, and sharing them might represent a catalyst to improve the impact of these kinds of partnerships, especially in those countries in which there are less previous experiences in this field. In particular, several aims are expected to be reached:

To know the positive and negative outcomes of school-industry partnerships, both from the educational and from the industrial points of view.

To identify the main features which contribute to the success of school-industry collaboration.

To get suggestions or recommendations from national platforms and policy makers to companies and/or to schools.

To achieve these goals and complete the Needs Analysis, we already count on the information previously obtained from the indicated stakeholders, which is presented in the following section.

In this sense, the qualitative results of the surveys and the reports from National Platforms and industrial partners represent a first approach to the main gaps in school-industry partnerships, which will be completed throughout the whole process along the following months.

Figure 8 shows a schematic representation of all this process that will lead to a final Guideline containing common strategies to face gaps and problems in school-industry partnerships.

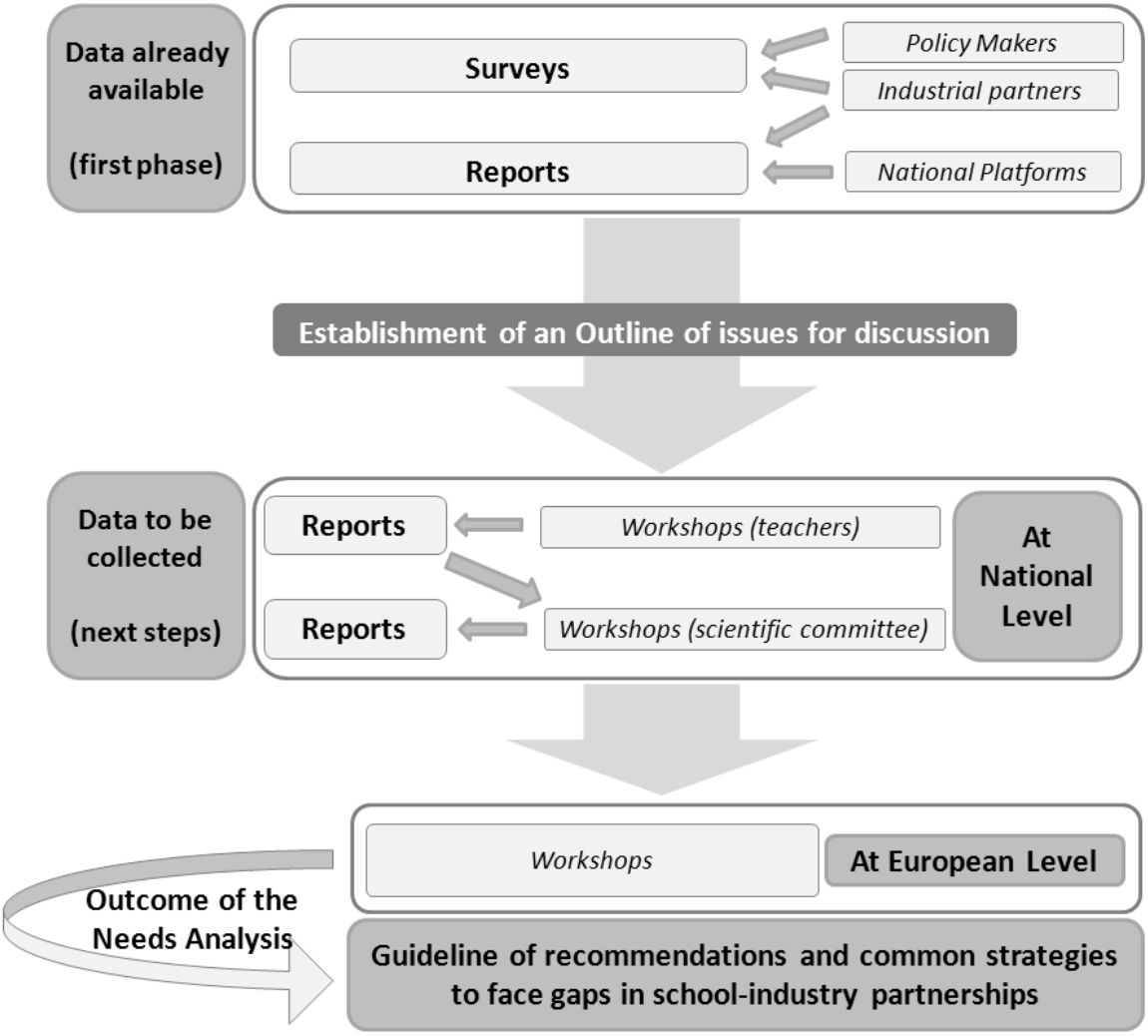


Figure 8: Schematic representation of the general process for the performance of the Needs Analysis in the frame of the ECB/Ingenious project.

5.2 Preliminary information

5.2.1. Information obtained from partners

As it has been already mentioned, during the first phase of the project, and in order to collect data for the Observatory of Practices, two surveys were addressed to policy makers and industrial partners of ECB/inGenious, and several reports were provided by representatives from National Platforms and companies. From all this information, it was possible to identify several “Difficulties to overcome” in current school-industry partnerships, which represent the starting point for the subsequent performance of the Needs Analysis process.

In particular, 66 specific difficulties (detailed in Annex A4) were referred through the questionnaires. It must be noticed that some of the questionnaires analysed up to now referred several difficulties, while some others did not refer any. In this sense, the answer to “difficulties to overcome” was “None / No difficulties foreseen” in some cases, and no answer at all was given in others. In one particular case, the respondent considers not having to overcome any difficulty under certain condition: “None as long as conditions of use in schools are respected”.

On the other hand, the reports provided by national platforms and some industrial partners represent another valuable source of information for the Needs Analysis due to their large experience in promoting and participating in school-industry collaborations, and in fact they mention some of the main problems existing in this kind of partnerships. In particular, we gathered very interesting remarks from our German, English and Swedish partners, who highlighted several barriers (detailed in Annex A5).

All this information has been analysed, and the different existing difficulties have been coded and classified according to their typology and to the different perspectives through which we have established the outline of issues for discussion for the foreseen Workshops.

5.2.2. Questionnaires

The statements referred by the partners through the questionnaires have been labelled considering the obstacles that they represent, and this has led to identify several kinds of barriers (for each of them, some quotations are given as an example):

- **Lack of coordination within political agents**

"Lack of coordination between municipal, regional and national actions targeted the development of Industry-School relationship."

- **Lack of teachers willing to participate**

  "Some countries are faced with a lack of young teachers (more inclined to participate) because of bad social situation and massive amount of work (teaching + administration + reforms implementation + youth care, etc.)"

- **Time expenditure for teachers / involving extra work**

  "Teaching involving contact with industries takes teachers' time."

- **Teachers not familiar with science and technology issues**

  "Sometimes it is not easy to convince the teachers for the project because they fear the theme/issue."

- **School schedule / Overlapping with school calendar**

  "The time schedules in schools can be an obstruction to work for longer periods of time."

- **Inertias from the educational sector**

  "Lack of flexibility and willingness to change in educational institutions, including taking part in a multi-disciplinary teams with colleagues."

- **Lack of companies willing to collaborate with educational institutions / schools**

  "Involvement of employers in curriculum design and implementation."

- **Time expenditure for professionals**

  "A reliable estimate of time expenditure of the company, which must be well defined and limited."

- **Excessive offer (high competition for companies)**

  "The schools are crowded with extra-curriculum tasks. The competition is immense."

- **Establish new collaborations (with companies and with schools)**

  "Establishment of contact persons in participating companies."

- **Maintain collaborations with companies despite changing of contact persons**

"Maintenance of contact persons in participating companies in spite of change of persons (which happens often)."

- **Requirement of long-term commitment**

  "Long-term commitment might be hard to get from companies and in some respects also from educational institutions, and for practices involving a deep collaboration (e.g. internships in a company) both school and company need to commit the activity for a relatively long period of time."

- **Finding an interesting project both for school and for companies**

  "Find an enterprise that will participate in the initiative by formulating an assignment for the students."

- **Connection between content of the practice and school curriculum**

  "Assure a clear connection between teaching goals and distribution of roles for pupils both in preparation of and completion of the event."

- **Idiomatic barriers**

  "When workshops were conducted in different countries, the language (English) was a barrier in some of them."

- **Logistical and organisational obstacles**

  "Great work of logistics, so that chaos and "empty time slots" for the pupils are avoided."

- **Technological barriers**

  "Ability to download high amounts of data through internet."

- **Geographical distance**

  "Transport is often a problem when teaching/learning takes place outside the school."

- **Difficulties related to Financial barriers**

  "Business involvement in times of crisis is generally low."

All these previous kinds of barriers have been qualitatively classified, considering their common features, under five main categories:

1. **Difficulties related to the political context**
   Those based on the lack of support from the political institutions to the parties involved in school-industry relationships.
2. **Difficulties related to the reasons for establishing school-industry collaborations**
   Those mainly due to a lack of willingness of the potential stakeholders to get involved in these partnerships (benefits not clear enough, too many inconvenients for collaborating).
3. **Difficulties related to the procedures for the establishment of collaborations**
   Those related to the ways or paths that make possible to initiate a school-industry partnership.
4. **Difficulties related to the implementation of practices**
   Those related to the practical issues faced during the performance of activities, being them connected to the guiding person, to the audience, to the content of a particular practice or to the physical space where it is developed.
5. **Difficulties related to financial barriers**
   Those due to economic limitations.

The number of the different kinds of barriers mentioned by the partners, according the first detailed classification, is shown in figure 9:

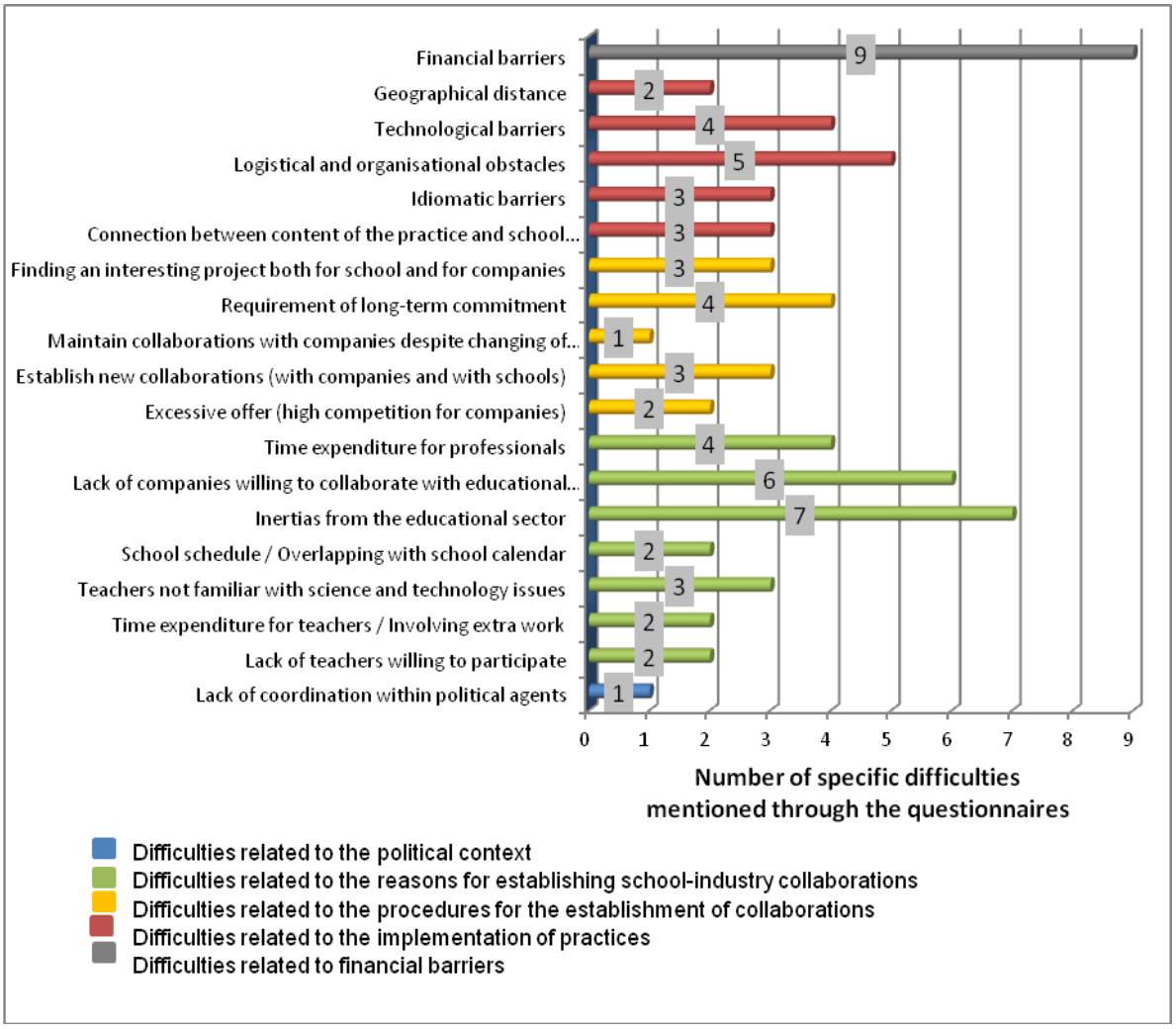


Figure 9: Number of difficulties raised by the partners through the questionnaires.

Grouping together these particular barriers according to their common features, it can be observed (also in figure 10) that the main challenges referred from partners through questionnaires are related to the reasons for establishing school-industry collaborations. In this category, the most highlighted barriers are the "inertias from the educational sector" and the "lack of companies willing to collaborate". The second most stated barriers are those related to the implementation of practices, in particular those due to "logistical and organisational obstacles".

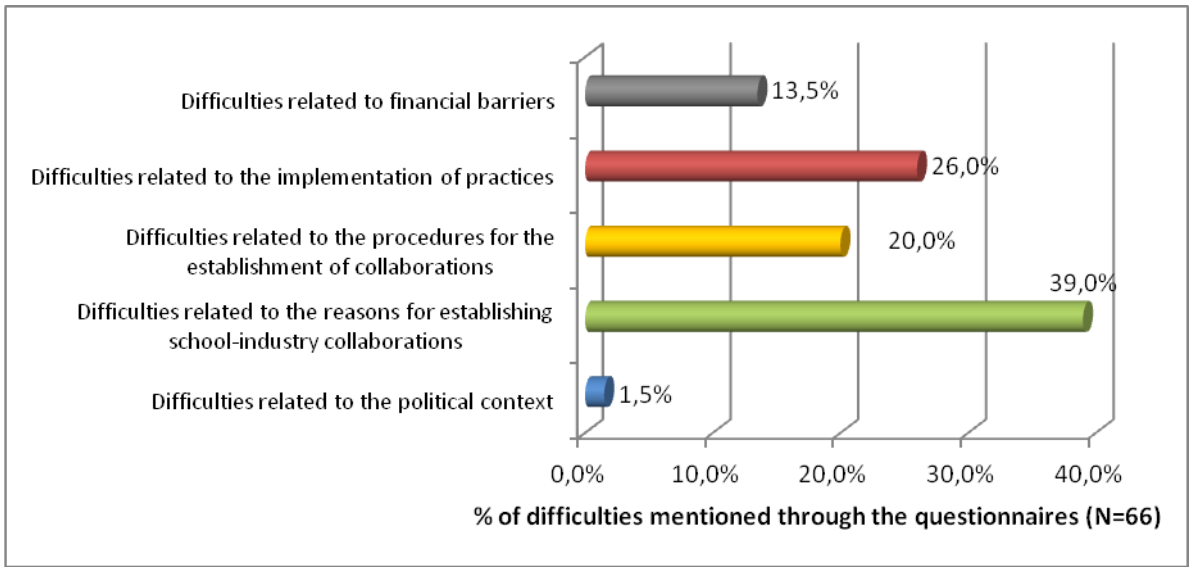


Figure 10: Frequencies of categories of difficulties raised by the partners through questionnaires.

5.2.3. Reports

The analysis of the difficulties stated in the collected reports, which represents a much smaller sample (n=14), lead to a very similar classification than the one performed from questionnaires:

- **Excessive pressure for introducing innovations from educational authorities**

  "Teachers have to deal with on-going structural changes that are initiated by politicians. Often a new initiative starts before it had been possible to generate a valid long-term assessment of the last one. This frustrates teachers and headmasters and makes them less open to further new projects that might come from industry."

- **Time expenditure for teachers / involving extra work**

  "The programs that are most agreed to and appreciated are those which are ready-to use and do not need any or little effort for the teachers."

- **Teachers not familiar with science and technology issues**

  "Many teachers still feel unconfident to teach technology and science."

- **School schedule / Overlapping with school calendar**

  "In the case of teacher training, it is crucial to choose the right timing. The programs should not be offered at times of big exams, during weekends or school vacations. Nevertheless,

some trials showed that the motivated teachers would 'sacrifice' the weekend or free days to participate. In return, they expect a program with a lot of up-to-date information, challenging discussion and exchange of experience."

- **Inertias from the educational sector**

  "There are strong traditions when it comes to teaching that the teachers have to go against after training."

- **Lack of assessment about the quality of practices**

  "It is a challenge for the teacher to assess the quality of the program and its benefit for the lessons. Quite often they do not have the time (or are willing to invest it) for their own assessment so they rely on the reputation of the provider, experiences of their colleagues or official certificates."

- **Time expenditure for professionals**

  "The activity should not be too time-consuming for they [companies] all do these activities as CSR (Corporate Social Responsibility) on a voluntarily basis. So the activities should include to some extent the cooperation with companies, but when it is becoming too much, this might be a factor for failing."

- **Excessive offer (high competition for companies)**

  "Difficulties may occur when teachers are not allowed to spend a whole school day away from their school too often. Usually classes have a certain contingent of time that they can spend outside school. So our offers compete with visits of theatres, movies, circuses, museums, hiking tours etc."

- **Connection between content of the practice and school curriculum**

  "The main difficulty is to find the right anchor for the planned activities, that is, to find the subject(s) in which the theme is taught and to convince the teachers that there is no on-top work connected with this."

- **Lack of guides or instructions for teachers to use materials**

"A success factor when supporting sciences and techniques on a practical level is the importance of providing the schools with material and information for the teachers. This is also supported by trainings, so that the teachers are not afraid to use the material."

- **Lack of intermediary agencies between schools and industries**

"English schools have become heavily engaged in generic employer engagement where it has been low cost and easy to engage in (where organised by an intermediary). With real costs rising and in the absence of easily accessible data on impacts on pupil attainment, new risks emerge to schools choosing to engage."

- **Difficulties related to Financial barriers**

"Political-driven changes to education policy may prove to present risks to continuing progress being made. In addition to changing the funding of local employer engagement facilitation, the government has signalled that dedicated funding for careers services delivered through local authorities will end, with the duty of care for providing careers support moving directly to schools from 2012. The change has raised concern across the STEM community that it will become more difficult to deliver a national, strategic approach to STEM careers advice."

As it is shown in figure 11, the most highlighted barriers, according to industrial partners and national platforms, are, as in the previous section, also related to the reasons for establishing school-industry collaborations and to the implementation of practices.

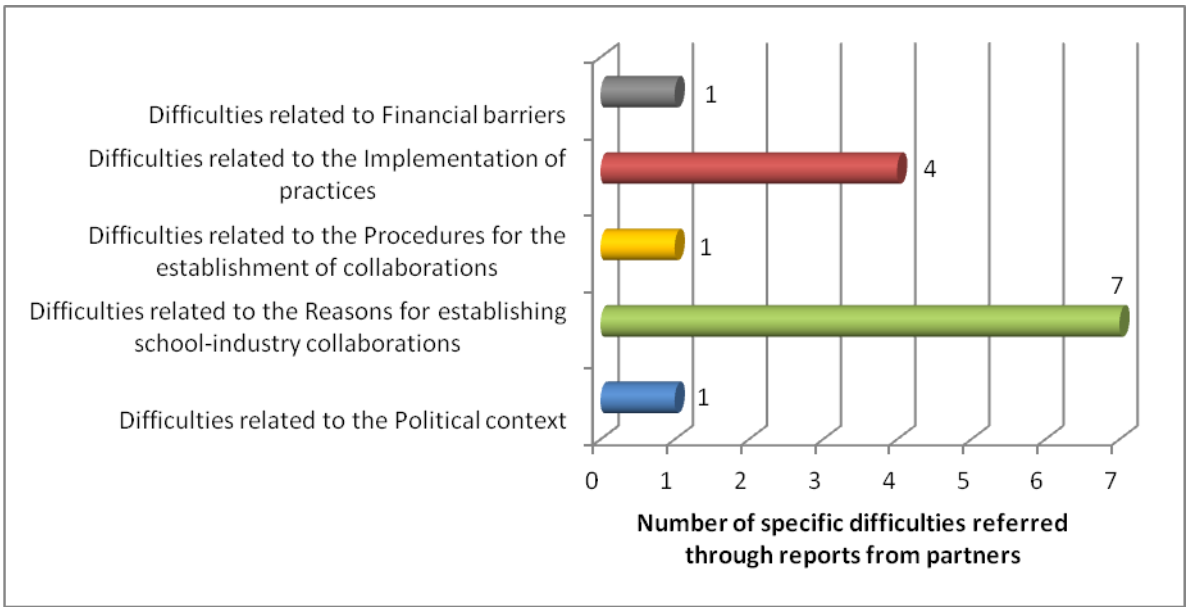


Figure 11: Number of difficulties raised by the partners through reports.

As a summary, table 5 shows the general classification of barriers that have been identified through questionnaires and reports.

1. Difficulties related to political context

1a. Lack of coordination within political agents

1b. Excessive pressure for introducing frequent structural changes by educational authorities

2. Difficulties related to the reasons for establishing school-industry collaboration

2a. Lack of teachers willing to participate

- 2a.1 Time expenditure for teachers / Involving extra work
- 2a.2 Teachers not familiar with science and technology issues
- 2a.3 School schedule / Overlapping with school calendar
- 2a.4 Inertias from the educational sector
- 2a.5 Lack of assessment about the quality of practices

2b. Lack of companies willing to collaborate with educational institutions / schools

- 2b.1 Time expenditure for professionals

3 Difficulties related to the procedures for the establishment of collaborations
3a. Excessive offer (high competition for companies)
3b. Establish new collaborations (with companies and with schools)
3c. Maintain collaborations with companies despite changing of contact persons
3d. Requirement of long-term commitment
3e. Finding an interesting project both for school and for companies
4. Difficulties related to the implementation of practices
4a. Connection between content of the practice and school curriculum
4b. Idiomatic barriers
4c. Logistical and organisational obstacles
4d. Technological barriers
4e. Geographical distance
4f. Lack of guides or instructions for teachers to use materials
4g. Lack of intermediary agencies between schools and industries
5. Difficulties related to Financial barriers

Table 5: Classification of difficulties referred through questionnaires and reports.

5.2.4. Information obtained from the literature

Apart from the results obtained during the first part of the project, several other barriers have been found from the literature on the field. In particular, and according to a survey of 400 English school leaders carried out through one of the better studies of school attitudes towards employer engagement (Edcoms, 2007), the biggest barriers to working with business are the ones shown in figure 12.

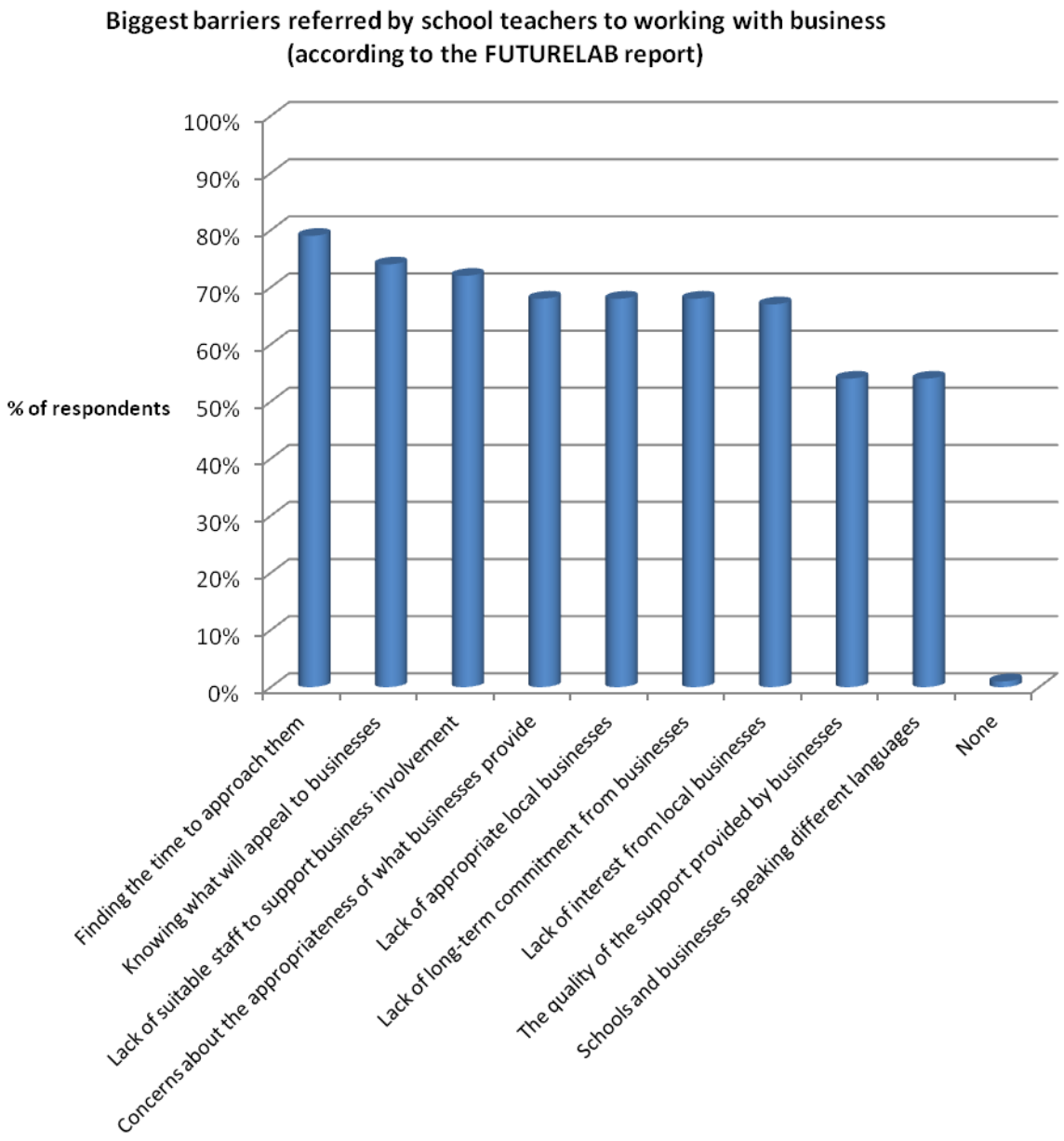


Figure 12: Results of a survey of 400 English school leaders showing the biggest barriers to working with business (adapted from Mann, A. and Oldknow, A., 2012).

These barriers can be also classified according to the five main categories that were established from the analysis of the data collected through questionnaires and reports. In this sense, none of them is related to the political context or to financial, but they mostly correspond to difficulties due to the reasons for establishing school-industry collaborations, as it is shown below:

Difficulties related to the reasons for establishing school-industry collaborations

- Finding the time to approach them [business]
- Knowing what will appeal to business
- Concerns about the appropriateness of what business provide
- Lack of long-term commitment from business
- Lack of interest from local business
- The quality of the support provided by business
- Schools and business speaking different languages

Difficulties related to the procedures for the establishment of collaborations

- Lack of suitable staff to support business involvement

Difficulties related to the implementation of practices

- Lack of appropriate local business

5.2.5. Conclusions from the preliminary information

It is worth mentioning that, comparing the results obtained from the analysis of information collected via questionnaires and reports (sections 5.2.1.1. and 5.2.1.2.) with those found in the literature (section 5.2.2.), the reasons for establishing school-industry collaborations seem to represent the biggest obstacle according to the perspectives of both the industrial and the educational points of view. Thus, even though the stakeholders involved in these partnerships might have to face many other barriers at operational level, especially when designing and / or implementing practices, it is crucial that strategic and tactical decisions are made so that the benefits and expected outcomes, as well as the degree of commitment, are clearly aligned for all sides.

From these results, and taking into consideration the kinds of challenges that have been identified so far, it looks obvious that all the stakeholders involved in school-industry partnerships (industrialists, teachers and policy makers) have a decisive role in offering solutions to overcome such barriers. In order to improve school-industry partnerships, a dialogue between the educational and the industrial sector is essential to align position, and if the benefits and expected outcomes

for both parties are clear and aligned, they will be more willing to collaborate. Moreover, highlighting the needs (at strategic and tactical level) from school and industry is crucial to guide political decisions that can give support to the establishment and sustainability of collaborations between education and industry.

6 Conclusions

The present document summarises the strategy that has been defined for the performance of a Needs Analysis in the frame of the ECB/inGenious project has been presented, which main aim is to contribute to making school-industry collaborations as effective as possible as a way of fostering young people's interest in STEM careers. Within this project, the work performed in Work package 2 –WP2, entitled **"Observatory of practice and needs analysis – Monitoring Research Developments"**–, is mainly focused on exploring both the current situation of and the main existing challenges in STEM school-industry partnerships in Europe.

In particular, the content of this document is related to the exploration of existing challenges in school-industry collaborations. In fact, despite the multiple benefits (for both students and teachers, as well as for industrialists) that can arise from the cooperation between education and industry, the parties involved in these activities might face shared difficulties. In this sense, the identification of the main obstacles that partners can encounter in their collaborations is a crucial step to allow making effective decisions and recommendations addressed to enhance the effect of school-industry partnerships on young students' career choice. In particular, one of the fundamental problems for the proper development of these collaborations has to do with the different interests and motivations of the involved stakeholders. Thus, it is essential that a fruitful dialogue is established among the educational, industrial and political sectors to try to find a proper alignment of their positions which allows the promotion of useful and efficient collaborations between education and industry. This is, in fact, one of the main aims pursued by the Needs Analysis, a process that will last until the end of the project, and which results will be presented in a final EU synthesis report –Deliverable 2.6–.

Taking into account the international and multi stakeholder environment in which ECB/inGenious is being developed, the Needs Analysis will be performed both at National and at European levels, and from different perspectives (i.e., considering the educational, industrial and political points of view). Moreover, it will be especially focused on identifying challenges regarding the establishment, design, implementation and sustainability of STEM-related school-industry collaborations.

This document explains the methodology that has been established to collect the information for the Needs Analysis, showing the approach that has been based on the rationale of Needs Assessment methodology and adapted to ECB/inGenious.

It is worth mentioning that the work performed in WP2 during the first part of the project, which was focused on the establishment and implementation of Practices, has been very useful to set the basis for the Needs Analysis. In this sense, from the information collected so far, it has been already possible to identify several “Difficulties to overcome” in current school-industry partnerships, which have been classified according to their typology under the following categories:

1. Difficulties related to the political context.
2. Difficulties related to the reasons for establishing school-industry collaborations.
3. Difficulties related to the procedures for the establishment of collaborations.
4. Difficulties related to the implementation of practices.
5. Difficulties related to financial barriers.

This preliminary information represents a starting point for the Needs Analysis and has been used to establish the subsequent steps, which mainly consist on the organization of a set of workshops that will take place among the different stakeholders (representatives from the educational, industrial and political sectors) both at national and at European level.

Through the whole process of Needs Analysis, it is also expected that success stories related to school-industry cooperation at different levels will be identified, and sharing them might represent a catalyst to improve the impact of these kinds of partnerships, especially in those countries in which there are less previous experiences in this field. In particular, several aims are expected to be reached:

- Getting to know the positive and negative outcomes of school-industry partnerships, both from the educational and from the industrial points of view.
- Identifying the main features which contribute to the success of school-industry collaborations.
- Getting suggestions or recommendations from national platforms and policy makers to companies and/or to schools.

7 References

Burge, B., Wilson, R., & Smith-Crallan, K. (2012). *Employer involvement in schools: a rapid review of UK and international evidence*.

Watkins, R., West Meiers, M., Visser, Y. (2012). A Guide to Assessing Needs: Tools for collecting information, making decisions, and achieving development results. Washington, DC: World Bank.

Mann, A., Oldknow, A. (2012). *School-industry STEM links in the UK: A report commisioned by Futurelab.* Futurelab. http://www.futurelab.org.uk/resources/school-industry-stem-links-uk Accessed 1st March 2012

Kizlik, B. (2012). *Needs Assessment Information (Wants determine Needs)* http://www.adprima.com/needs.htm Accessed 20th March 2012.

Eurydice (2011). *Science Education in Europe: National Policies, Practices and Research.* Brussels: European Commission.

EC (2010). *Lisbon Strategy evaluation document*. Brussels: European Commission.

ERT (2009). *Mathematics, Science & Technology Education Report. The Case for a European Coordinating Body. Report of the ERT Societal Changes Working Group.*

Edcoms (2007), *Business in Schools Research Findings*. London: BiTC. http://www.educationandemployers.org/media/8463/business%20in%20schools%20research%20findings%20-%20edcoms.pdf Accessed 16th January 2012.

Gerloff-Gasser, C., Jann, P., & Kyburz-Graber, R. (2007). *D3.1 Report on Research and Education Cooperations in Europe*.

NCSR. (2008). *The Involvement of Business in Education : A Rapid Evidence Assessment of the Measurable Impacts*.

Gago, J. M. (2004). *Increasing human resources for science and technology in Europe*.

Erasmus, B., Schenk, H., Swanepoel, B., Van Dyk, W. (2000). *South African Human Resource Management Theory and Practice* (2nd ed.), Cape Town: Juta

Watkins, R. and Kaufman, R. (1996). An Update on Relating Needs Assessment and Need Analysis. *Performance Improvement*, *35* (10), 10-13.

Rossett, A. (1987). *Training Needs Assessment*. Englewood Cliffs, NJ: Educational Technology Publishing Co.

8 Annexes

A.1 Outline of issues for discussion

The following list is a set of issues to be discussed in the meeting among the members of the scientific committee of national educational and scientific STEM experts in order to gather information about the gaps and the problematic aspects concerning school-industry partnerships. Information about different aspects that could favour and/or hinder the establishment of school-industry collaboration is required.

We encourage dealing broadly with each of the different listed issues, collecting the different points of view and the related topics that might arise during the discussion.

What is your opinion and / or experience regarding different aspects that could favour and/or hinder the establishment of school-industry collaboration?

Contribution from the political context	- Support/barriers from the educational authorities to increase the interest of students in STEM careers through school-industry partnerships. • Existence/absence of political strategies. • National/regional/local organisations coordinating these collaborations. • Others. - Main difficulties found in designing and implementing these policy actions.
Reasons for establishing school-industry collaborations	- Main motivations and expected benefits for companies (staff recruitment, staff development, staff engagement, corporate reputation, ...) - Main motivations and expected benefits for schools (career information, students engagement in STEM disciplines, ...) - Possible prejudices before starting a partnership.
Procedures for the establishment of collaborations	- Main difficulties and/or optimal ways to initiate partnerships (procedures in order to initiate the collaboration, institution promoting the first contact between the stakeholders, …) - Preferences to establish a collaboration: • Industry profile preferred by schools (local business, multinational, environmental impact, ...) • School profile preferred by industries (located near the industry,

	private, public ...). • Preferences of industries about the students' level and its reasons. - Difficulties to maintain collaborations along the time (lack of time, economic reasons, lack of interest from local business/schools…) and to organise one-off events. - Necessity or not for clear definition of objectives in the school-industry collaborations.
Kinds of collaborations established	- Benefits and difficulties, both for companies and for schools, related to the different kinds of collaboration (regarding its organisational issues and its educational outcomes): • Teachers use educational material designed by a company • Activities performed inside school involving STEM professionals • Activities performed outside school involving STEM professionals • Activities involving parents/family • ... - Unfeasibility of certain kinds of school-industry collaborations that would be positive from the educational point of view.
Gaps and successes along the design and implementation of practices	- Degree of coordination between teachers and STEM professionals to design/prepare/perform/... the practices. - Fitting between the practices and the curriculum (practice designed according to or independently of the curriculum). • Extra work needed or not by the teacher to fit the practices with the curriculum. - Characteristics which tend to make practices successful. - Characteristics which tend to make practices unsuccessful. - Personal obstacles due to the interface created by the contact of the industrial and educational sectors (feeling uncomfortable with the public, lack of security with the content ...). - Teachers' difficulties, if any, to put into practice what has been observed/learned through practices carried out by STEM industries (lack of support from colleagues, logistical problems…)
Financial barriers	- Funding of the practices and of the educational materials (in case there is available data about the overall cost of these kinds of collaborations and the different institutions paying for them, please provide it).

Conclusions and recommendations	- Positive or negative outcomes of school-industry partnership and suggestions from schools' point of view. - Positive or negative outcomes of school-industry partnership and suggestions from industry point of view. - Suggestions or recommendations, if any, from National Platforms and policy makers to companies and/or to schools. - Necessity or not for measuring the impact in education of the involvement of business, and difficulties that it entails. - Controversial issues of the previous points considering the different points of view.

A.2 Difficulties to overcome obtained from the questionnaires

Answers to the Questionnaire referring the "Difficulties to overcome" in order to implement practices of school-industry collaboration:

"Existence of many different debating contests to compete with."

"Weaknesses of the project – subject restricted to petrochemistry vs. chemistry as a whole."

"Weaknesses of the project – competitions should be planned and communicated earlier so that teachers can include them into their programme."

"Weaknesses of the project – language barrier."

"Both students and teachers need to be motivated with more and attractive prizes."

"Some countries are faced with a lack of young teachers (more inclined to participate) because of bad social situation and massive amount of work (teaching + administration + reforms implementation + youth care, etc.)"

"The complexity of the submission tool."

"When workshops were conducted in different countries, the language (English) was a barrier in some of them."

"Language barriers are always a problem in some cases."

"Establishment of contact persons in participating companies."

"Maintenance of contact persons in participating companies in spite of change of persons (which happens often)."

"Assure a clear connection between teaching goals and distribution of roles for pupils both in preparation of and completion of the event."

"Develop a concept which assures that the element of teaching becomes serious for the 2nd grade high schools students (Knowing the theme of the day far in advance is important for preparation of their communication as part of their teaching)."

"Great work of logistics, so that chaos and "empty time slots" for the pupils are avoided."

"Find an enterprise that will participate in the initiative by formulating an assignment for the students."

"Long-term commitment might be hard to get from companies and in some respects also from educational institutions, and for practices involving a deep collaboration (e.g. internships in a company) both school and company need to commit the activity for a relatively long period of time. "

"To convince the companies of their important role"

"To make the companies receive young pupils."

"Financial means for operation of study programmes, including salary to teachers involved in development and test of programmes."

"Financial means for operation of study programmes, including transportation to working place of development team."

"Financial means for operation of study programmes, including investment in basic kits and apparatus at school."

"Lack of flexibility and willingness to change in educational institutions, including changing to a different and more demanding way of teaching."

"Lack of flexibility and willingness to change in educational institutions, including taking part in a multi-disciplinary teams with colleagues."

"Lack of flexibility and willingness to change in educational institutions, including organize lessons and subjects in a coherent way."

"Lack of flexibility and willingness to change in educational institutions, including perceive subjects in a new way and teach them differently, so they awaken the interest of the pupils."

"A reliable estimate of time expenditure of the company, which must be well defined and limited."

"Distribution of DVDs."

"Ability to download high amounts of data through internet."

"Distribution of electronic components to schools."

"A Non-Disclosure Agreement might be required from the schools and/or the students depending of the industry."

"Teacher's facilitation style required is closer to "coaching" than "teaching". Especially, the interventions are done in "yes and…" mode vs. "no but…" which requires a change of posture from the teacher."

"Web site update or creation."

"Need geographical proximity between the school and the industry locations, or special trip."

"A lot of efforts from industrial professionals are required."

"Internet connectivity in some countries."

"Sometimes it is not easy to convince the teachers for the project because they fear the theme/issue."

"Project for high schools interested."

"Developing relationships with schools."

"Securing financing."

"Tailored offers between demand and availability at the school site on the corporate side."

"The schools are crowded with extra-curriculum tasks. The competition is immense."

"Long term commitment from municipalities and school principals."

"The educational materials must be purchased."

"Buy in and engagement from the entities within the [company name]."

"To make the industry able to cooperate broadly with educational institutions/schools."

"The time schedules in schools can be an obstruction to work for longer periods of time."

"Buy in from partners."

"Employer engagement."

"Changing landscape for information and advice and future delivery of this within schools."

"Financial sustainability."

"It requires perseverance and "coherence thinking" as well as a strategy to be pursued over several years are required. Collaboration also requires great attention to exploit and create

opportunities for application-oriented science education in both management and teachers in those subjects.

"Teaching involving contact with industries takes teachers' time."

"Teaching involving contact with industries is difficult to organize. It needs certain teacher qualification."

"Transport is often a problem when teaching/learning takes place outside the school."

"To get new industries involved."

"Finances from the municipality and companies who have the financial and mental surplus to get involved."

"Business involvement in times of crisis is generally low."

"Different cultures in Industry and School demand long term relationships."

"Hard for Industry to communicate to the pupils at the right level. The teachers must understand their role as a pedagogical "interface."

"Teachers in primary school lack skills to understand and explain complex industrial matters."

"Lack of coordination between municipal, regional and national actions targeted the development of Industry-School relationship."

"Ensuring engagement of schools is time consuming to achieve."

"Establishing the Academy."

"Securing sponsor."

"Building the employer base for engagement."

"Involvement of employers in curriculum design and implementation."

A.3 Main problematic issues in school-industry collaborations stated by National Platforms and industrial partners

From the reports provided by National Platform and industrial partners, a series of problematic issues have been detected. In most cases, the highlighted or stated difficulties have to do with teachers' issues, although this does not mean that these are the only ones.

"Difficulties may occur when teachers are not allowed to spend a whole school day away from their school too often. Usually classes have a certain contingent of time that they can spend outside school. So our offers compete with visits of theatres, movies, circuses, museums, hiking tours etc."

"The programs that are most agreed to and appreciated are those which are ready-to use and do not need any or little effort for the teachers."

"In the case of teacher training, it is crucial to choose the right timing. The programs should not be offered at times of big exams, during weekends or school vacations. Nevertheless, some trials showed that the motivated teachers would 'sacrifice' the weekend or free days to participate. In return, they expect a program with a lot of up-to-date information, challenging discussion and exchange of experience."

"For schools (in Germany) it is always negative if they [teachers] have to use extra time for projects especially when they are taking place in the afternoon, which is usually the free-time of the teachers when they prepare for the next schoolday."

"The activity should not be too time-consuming for they [companies] all do these activities as CSR (Corporate Social Responsibility) on a voluntarily basis. So the activities should include to some extent the cooperation with companies, but when it is becoming too much, this might be a factor for failing."

"The content of the programs needs to be in alignment with the curriculum so the teachers get an advantage out of it and can justify to participate."

"It is a challenge for the teacher to assess the quality of the program and its benefit for the lessons. Quite often they do not have the time (or are willing to invest it) for their own assessment so they rely on the reputation of the provider, experiences of their colleagues or official certificates."

"A success factor when supporting sciences and techniques on a practical level is the importance of providing the schools with material and information for the teachers. This is also supported by trainings, so that the teachers are not afraid to use the material."

"The main difficulty is to find the right anchor for the planned activities, that is, to find the subject(s) in which the theme is taught and to convince the teachers that there is no on-top work connected with this."

"There are strong traditions when it comes to teaching that the teachers have to go against after training."

"Many teachers still feel unconfident to teach technology and science."

"Teachers have to deal with on-going structural changes that are initiated by politicians. Often a new initiative starts before it had been possible to generate a valid long-term assessment of the last one. This frustrates teachers and headmasters and makes them less open to further new projects that might come from industry."

"English schools have become heavily engaged in generic employer engagement where it has been low cost and easy to engage in (where organised by an intermediary). With real costs rising and in the absence of easily accessible data on impacts on pupil attainment, new risks emerge to schools choosing to engage."

"Political-driven changes to education policy may prove to present risks to continuing progress being made. In addition to changing the funding of local employer engagement facilitation, the government has signalled that dedicated funding for careers services delivered through local authorities will end, with the duty of care for providing careers support moving directly to schools from 2012. The change has raised concern across the STEM community that it will become more difficult to deliver a national, strategic approach to STEM careers advice."