



**Adapting driver behaviour
for lower emissions**

MODALES D1.2: Innovation Management Plan

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Legal disclaimer

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List of abbreviations and acronyms

Abbreviation	Meaning
CEN	European Committee for Standardization
EC	European Commission
EFQM	European Foundation for Quality Management
EOBD	European On-Board Diagnostics
EU	European Union
HDV	Heavy Duty Vehicle
INEA	Innovation and Networks Executive Agency (agency of the European Commission)
IS	Innovation Solution
LDV	Light Duty Vehicle
NRMM	Non-Road Mobile Machinery
OECD	Organisation for Economic Cooperation and Development
SWOT	Strengths, Weaknesses, Opportunities and Threats
WP	Work Package

Executive Summary

The MODALES Project has a challenging objective to advance the fundamental understanding of the co-variability of user behaviour and vehicular emissions characterised by powertrain, brakes and tyres, and modify user behaviour via dedicated training including a driver assistance app and awareness campaigns in order to support effective air quality improvement plans and enforcement strategies to be developed by local and national authorities.

In order to achieve this objective altogether 13 Innovation Solutions (IS) are considered to be implemented during the project timeframe. It is therefore important to monitor during the Project cycle how all these 13 Innovation Solutions are developed and exploited to achieve the foreseen results in order to track the performance of the project results. In addition, during the development part of the project, MODALES partners will be also open to propose new Innovation Solutions and to update the state-of-the-art.

The implementation of the proposed Innovations involves risks and needs to be monitored carefully according to innovation system monitoring rules. There are no established standards related to innovation monitoring, but MODALES will use mainly the standard on innovation management [3] proposed by the European Committee of Standardization to monitor the achievement of its innovation objectives and beyond.

This deliverable, “Innovation Management Plan” provides a guideline for the project to:

- Keep regular monitoring of the state-of-the-art and of project innovation under development;
- Ensure favourable conditions for the 13 foreseen ISs in MODALES with an innovation process to monitor innovation within MODALES;
- Check and if needed take necessary actions to ensure that claimed innovations are being developed within MODALES;
- Identify and promote innovations arising during the course of the project work.

Innovation Management will be conducted through a formal innovation process, monitoring defined performance indicators. An Innovation Monitoring Team has been formed by MODALES WP leaders and the progress will be monitored on a monthly basis during the development phase of the project.

The Innovation Management Team will also manage the exploitation of the achievements developing a detailed technology roll-out plan with a deliverable at the end of Month 35 of the project (July 2022). This work will include:

- Characterisation of potential market for the developed innovations;
- Early identification and regular review of the exploitable results leading to potential marketable products;
- If relevant, preliminary evaluation of the market, SWOT analyses and preliminary exploitation strategy.

During the development of exploitation plans, the “Business Model Radar” methodology will be employed.

1 Introduction

1.1 Background

The OECD “Oslo Manual” [1] on the measurement of scientific and technological activities defines technological product and process innovation as follows:

“A technological product innovation is the implementation/commercialisation of a product with improved performance characteristics such as to deliver objectively new or improved services to the consumer. A technological process innovation is the implementation/adoption of new or significantly improved production or delivery methods. It may involve changes in equipment, human resources, working methods or a combination of these”

In the MODALES project the main innovations are carried out to improve air quality through effective management and assistance systems which will improve the behaviour of the drivers, encouraging low emission driving, improved maintenance habits and awareness on the impact of tampering. Therefore, the innovations will cover both areas of product and process innovations. Since awareness improvement is also very important, it would include also innovations in dissemination and marketing processes.

Innovation involves risks, so therefore needs to be monitored carefully according to innovation system monitoring rules. There are no established standards related to innovation monitoring, although EFQM has innovation system standards [2]. The European Committee of Standardization also has developed a draft standard on innovation management [3]. Therefore, in this project to achieve the objectives and to go beyond, these two guidelines will be used.

1.2 Purpose and scope

1.2.1 Objective

In the MODALES project, the main goal is expressed as “to advance the fundamental understanding of the co-variability of user behaviour and vehicular emissions characterised by powertrain, brakes and tyres, and modify user behaviour via dedicated training including a driver assistance app and awareness campaigns in order to support effective air quality improvement plans and enforcement strategies to be developed by local and national authorities”.

To achieve this goal, MODALES will research, develop and test at least 13 innovation solutions (IS) in 4 key areas (namely, Driver, Retrofits, EOBD and Inspection), in order to substantially reduce vehicle emissions from 3 main sources (i.e. powertrain, brake wear and tyre wear) for LDVs and HDVs as well as NRMM. New innovative solutions being developed in other initiatives (e.g. the Horizon Prize on Engine Retrofit for Clean Air) are to be also reviewed and (wherever appropriate) evaluated in this project. In Figure 1, the main innovation areas have been depicted.

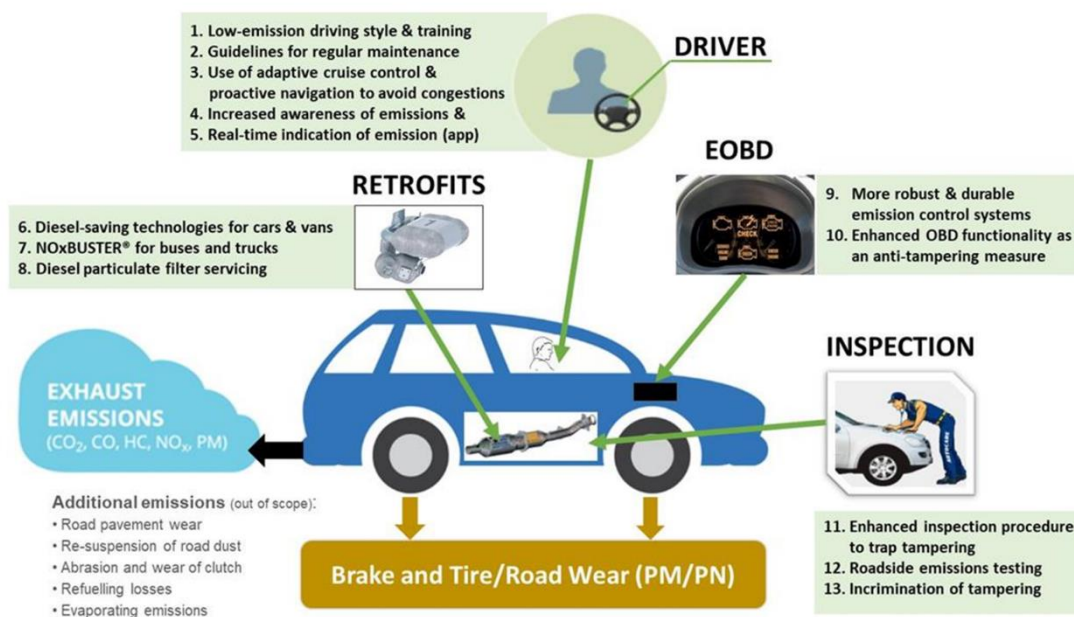


Figure 1: Overview of the MODALES' innovation areas and candidate solutions

It is therefore important to monitor during the Project cycle how all these 13 ISs are developed and exploited to achieve the foreseen results in order to track the performance of these ISs. In addition, during the development part of the project, the MODALES partners will also be open to propose new innovation Solutions as long as the budget of the project is not exceeded.

This document will be the guide to follow the realization of all 13 Innovation Solutions and some new ones if there happen to be any.

To develop the foreseen ISs and to come up with new ones a seamless integration and innovative environment also in virtual sense is necessary. Therefore the objective of this "Innovation Management Plan" deliverable can be described as a guideline to achieve the following objectives:

- Keep regular monitoring of state-of-the-art and of project innovation under development;
- Ensure favourable conditions for the 13 foreseen ISs in MODALES and develop an innovation process to monitor innovation within MODALES;
- Check and if needed take necessary actions to ensure that claimed innovations are being developed within MODALES;
- Identify and promote innovations arising during the course of the project work;
- Develop an exploitation plan;
- Consolidate the rules for joint undertaking for innovation outcomes leading to joint exploitation.

1.2.2 Innovation Monitoring Team (IMT)

The team is composed by the leader of each work package and is coordinated by Prof. Dr Orhan Alankus from Istanbul Okan University (OKAN).

The team is therefore formed by the following partners: ERTICO, LEEDS, VTT, CERTH, LIST and ACASA. The representatives of each partner for the "Innovation Team" are as follows:

Table 1: MODALES Innovation Monitoring Team

No	Partner	Representative
1	OKAN (Istanbul Okan University)	Orhan Alankus
2	ERTICO (ERTICO – ITS Europe)	Jean-Charles Pandazis
3	LEEDS (University of Leeds)	Haibo Chen
4	VTT (Technical Research Centre of Finland)	Juhani Laurikko
5	CERTH (Centre for Research and Technology Hellas)	Dimitris Margaritis
6	LIST (Luxembourg Institute of Science and Technology)	Sebastian Faye
7	ACASA (Automòbil Club Assistència)	Joan Domingo

The Innovation Team is responsible for the MODALES innovation process, in particular to:

- Organise the Innovation Management process within MODALES;
- Make and update regularly an audit of (external) state-of-the-art & of (internal) project work
- Check if conditions are favourable for innovation;
- Identify any other MODALES innovation arising during the course of the work;
- Report the MODALES Innovation by answering to the EC Innovation Questionnaire related to MODALES.

The Innovation Manager together with the team will also:

- Be in charge of the production and signing of an agreement amongst partners in the consortium on the allocation and the terms of exercising the ownership of the proposed results and outcomes leading to joint exploitation after the end of the project;
- Be responsible for managing the knowledge produced during the project lifecycle with the goal of successfully implementing innovative ideas;
- Coordinate and supervise the preparation of the Exploitation Report, including detailed Business Plans;
- Make recommendations to the MODALES Steering Committee on issues of exploitation, including warnings in case of inconsistencies with the market goals;
- Assure the successful implementation of innovative ideas.

1.2.3 Innovation Solutions and Related Technology Levels

The following Innovation Solutions (IS) of MODALES were identified and detailed during the preparation of the Project. This list of ISs and foreseen achievements are given in Table 2.

Table 2: List of Technology/Innovation Solutions in MODALES Project

Solution Area	Number	Technology/Innovation	TRL Now	TRL After MODALES
Driver	1	Personal driving assistant implementing real-time recommendations to reduce emission levels (smartphone app)	4-5	7
	2	Material to understand, become aware of and learn low-emission driving (i.e. guidelines, training courses)	3	6
	3	Data correlation module to study the relationship between driving variability and exhaust emissions	3	5
	4	Data correlation module to study the relationship in real life conditions between driving variability and tyre emissions.	4	6
	5	Driver profiling methods, considering data flows collected from his/her personal equipment (i.e. phone, OBD dongle)	5	7
Retrofits	6	Retrofitted emissions control systems for (diesel) passenger cars	4-5	7
	7	Retrofitted emissions control systems for heavy (urban) vehicles (NOxBUSTER© upgrading)	6	8
	8	(Diesel) particulate filter servicing	5	7
Inspection	9	Equipment for (remotely) identifying a vehicle's emission rate	2	4
EOBD	10	Data collection module to detect powertrain parameters and provide real-time estimate of emissions (exhaust, brakes, tyres) via an EOBD interface	2 (brakes) -4	6
	11	Capability of EOBD to detect elevated emissions due to poor maintenance and/or deliberate tampering	3-4	5-6
	12-13	Roadside Emission Testing and Incrimination and Tampering	n.a.	n.a.

Technology Readiness Levels will be evaluated as regards to the official definition, as follows:

TRL 1 – Basic principles observed

TRL 2 – Technology concept formulated

TRL 3 – Experimental proof of concept

TRL 4 – Technology validated in lab

TRL 5 – Technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)

TRL 6 – Technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)

TRL 7 – System prototype demonstration in operational environment

TRL 8 – System complete and qualified

TRL 9 – Actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)

The innovation team will keep track of the exploitation of the innovation solutions and check that the related TRL's as indicated on the table will be achieved. In case there happens to be some new innovation solutions they will also be added to the table and followed up.

Innovation Solutions 12 and 13 do not involve development of new technologies so there is no TRL level attached for IS 12 and IS 13.

1.2.4 Innovation Management Process

The Innovation Management Process as defined by the CEN standard 16555 [3] is shown in Figure 2 and is adapted to MODALES work-packages.

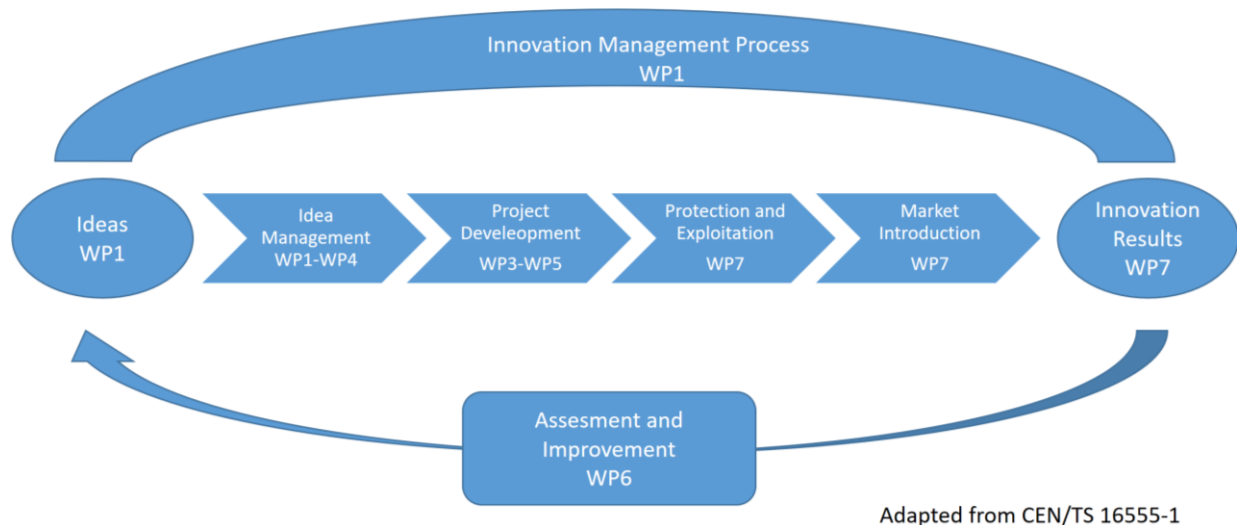


Figure 2: Innovation Management Process to be used in MODALES

The work-packages with relevant tasks will be followed up closely to monitor the achievement of the innovation solutions.

2 Key Performance Indicators and Monitoring System

For an effective monitoring action, firstly key performance indicators are to be determined and monitoring system in parallel with the innovation system depicted in Figure 1 is to be established.

2.1 Key Performance Indicators

Key performance indicators for Innovation Solutions are determined as follows:

- Timing
- TRL level
- Discrepancy from objective
- Possible IPR
- Number of new ideas.

2.2 Monitoring System

Key performance indicators are to be followed up closely in relation to the work plan and related tasks.

Leadership for monitoring will be facilitated through the “Innovation Monitoring Team”. This team together with partners form the innovation culture and facilitate innovation enabling factors to develop the Innovation Solutions determined successfully and also to come up with new ideas and Innovation Solutions.

Then monitoring the innovation results a system is to be formed and used rigorously. The following system will be the main process for monitoring the key performance indicators:

1. Keep regular **audit** of (external) state-of-the-art & of (internal) project work
 - 1.1 Form **teams** from experts to scrutinize the state of the art develop suggestions and feedback to working groups
 - 1.2 Make sure there is one responsible partner/person for each innovation solution.
2. Ensure favourable conditions for the 13 foreseen innovations in MODALES and develop an innovation process to monitor the innovation within MODALES
 - 2.1 Follow up “Consortium Agreement” for industrial rights sharing protocol, so that a favourable and transparent working environment is formed
 - 2.2 Form a system to resolve and eliminate any possible conflicts rapidly
 - 2.3 Form a virtual system for brainstorming and exchange ideas (using for example the project’s internal SharePoint online working space)
 - 2.4 Reserve a certain time during each consortium face-to-face meeting for monitoring innovation solutions and brainstorm on possible new innovation solutions.
3. Check and if needed take necessary actions to ensure that claimed innovations are being developed within MODALES
 - 3.1 Get feedback from Innovation Solutions responsible partners with adequate periods and follow up the development
4. Identify and promote innovations arising during the course of the project work.
 - 4.1 Create an online portal for new ideas: a directory in the MODALES internal SharePoint portal has been created to collect new innovation ideas.
 - 4.2 Innovation Management Team to evaluate the possible applications of the new ideas.

The first step is to clarify the responsibility of Innovation Solutions and related tasks. Table 3 below shows the responsibility and related tasks.

Table 3: Innovation Solutions and task / partner responsibility in MODALES

Solution Area	Number	Technology/Innovation	Related Task	Responsible
DRIVER	1	Personal driving assistant implementing real-time recommendations to reduce emission levels (smartphone app)	T5.3	LIST
	2	Material to understand, become aware of and learn low-emission driving (i.e. guidelines, training courses)	T5.5	IRU
	3	Data correlation module to study the relationship between driving variability and exhaust emissions	T3.1, T3.5	LEEDS/VTT
	4	Data correlation module to study the relationship in real life conditions between driving variability and a) brake and b) tyre emissions.	T3.2, T3.3, T3.5	LEEDS/BREMBO/BRIDG
	5	Driver profiling methods, considering data flows collected from his/her personal equipment (i.e. phone, OBD dongle)	T5.3	LIST
RETROFITS	6	Retrofitted emissions control systems for (diesel) passenger cars	T4.3	PROV
	7	Retrofitted emissions control systems for heavy (urban) vehicles (NOxBUSTER® upgrading)	T4.3	PROV
	8	(Diesel) particulate filter servicing	T4.3	PROV
INSPECTION	9	Procedure for (remotely) identifying a vehicle's emission rate / Roadside emission testing	WP3, WP4	VTT/LEEDS
EOBD	10	Data collection module to detect powertrain parameters and provide real-time estimate of emissions (exhaust, brakes, tyres) via an EOBD interface	T4.1	LIST/CERTH
	11	Capability of EOBD to detect elevated emissions due to poor maintenance and/or deliberate tampering	T4.2	CERTH

2.3 IPR Management

In the consortium agreement IPR issues are handled and therefore related points are clarified. Related possible patent applications will be reviewed by the Innovation Management Team and the rights distribution will be organised in line with the Consortium Agreement.

2.4 Preparation of Exploitation Report

The Innovation Management Team will also be responsible for preparing the exploitation report. The studies will commence at the end of the first year of the project and the Business Model Radar shown in Figure 3 will be used as to clarify the value creation model and the actors. The objective is to develop a business plan with a technology roll-out strategy to maximise the exploitation of project results and expand the use of the MODALES solution. All the Innovation Solutions will be evaluated so as to develop the relevant technology roll-out strategy in line with the Business Model Radar. The results will be presented in Deliverable D1.5 in Month 35.

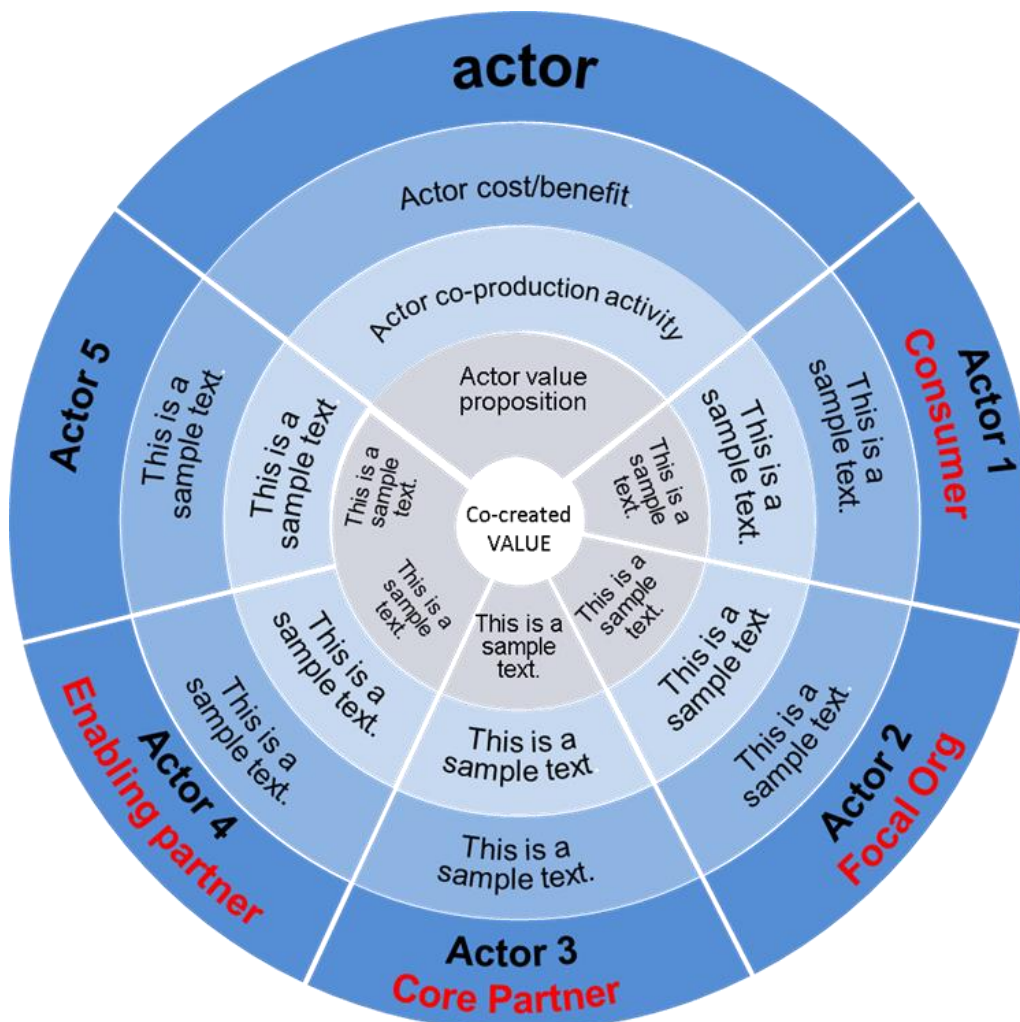


Figure 3: Lüftenegger's Business Model Radar

The exploitation plans of the partner groups are presented in Table 3 below, these plans and individual plans of the partners will be monitored by the Innovation Management Team in parallel with the innovation monitoring activities.

Table 4: Partner Group Exploitation Plan

Partner group	MODALES partners	Exploitation plan
ITS association	ERTICO	Increased knowledge of the effects of different vehicle components and driving behaviour on emissions will help tailor Intelligent Transport Systems and ICT applications to specific situations or users to maximise benefits. ERTICO and national ITS associations can help ensure the dissemination and use of project results across a range of different sectors (manufacturers, operators, public authorities, services providers, researchers and user groups) and increased awareness and use of the MODALES outcomes will provide business opportunities and challenges to all of these groups. ERTICO is thus very well placed to facilitate the development of goals and strategies which are supported by all stakeholder groups rather than just in the interest of one sector.
User associations	ACASA, FIA, IRU	Dissemination to their members (associations, companies and individuals) of MODALES results and best practice; building on results to provide training and education to promote greener driving. These bodies are particularly valuable in terms of reaching final users and propagating awareness campaigns.
Universities	LEEDS, OKAN, SICH (China), SEU (China)	Generate new public funded or bilateral research projects that reduce the emissions from the powertrain, brakes and/or tyres of vehicles; provide opportunities for teaching modules and PhD projects.
Research institutes	CEREM, CERTH, LIST, CHENG (China), VTT	Allows research institutes to provide their research results to other users by further developing and implementing applications and increasing their capacity to act as independent assessors for different vehicle systems. In particular, results from the methodology developed in MODALES for assessing driver's driving behaviour with PEMS will be used to advance knowledge and experience of powertrain emissions in real-world driving situations. The PEMS-methodology developed in MODALES will open new possibilities for VTT to offer such measurements in their contracts in the future.
Industry	BREMB, BRIDG, MICH, PROV	Enables them to test and improve their products and gain a competitive advantage.
Legal	SPARK	Increased knowledge of legal situation on this topic in different EU Member States will improve their capacity.

3 Conclusion

As emphasized above, innovation management has many aspects and it is not enough just to monitor performance indicators.

In the MODALES project different aspects will be taken into account, and leadership, innovation enablers and innovation culture will also be flourished and monitored carefully. Having the environment set for innovation, there will be the possibility of new innovations coming up and also an effective team work to achieve the established innovation solutions.

There will be also be close monitoring of progress of each innovation solution in line with the related tasks to make sure that the project objectives are achieved and even exceeded in a timely manner.

4 References

- [1] OECD, "the measurement of scientific and technological activities, OSLO MANUAL",
<https://www.oecd.org/sti/inno/2367580.pdf>
- [2] EFQM (2012). An Overview of EFQM Excellence Model Title. etc.
- [3] CEN/TS 16555 1-7 (2015) Innovation System



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