e-shape

EuroGEOSS Showcases: Applications Powered by Europe

D5.2 First PERL definitions

e-shape

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ABSTRACT

The overall aim of WP5 is the long-term sustainability of e-shape Pilots, their penetration in the public and private markets and the support of their upscaling. In that context, a comprehensive effort to assess the maturity of R&D activities is proposed by e-shape. The methodology driving this effort is described in this report. The starting point is an analysis of the currently developed or used methodologies with focus on, i.e. technology or market. Focused on technology, the TRL approach, is well accepted and used but it doesn't take into account the market readiness of a given solution. On the other hand, CRI and MTRL methods integrate non-technical components, such as the user and the market, in defining the level of readiness, but are more complex to use.

Based on this rationale, the current document aims to propose a first definition and description of parameters to be included in a more inclusive approach which fits with the H2020 community: the Pilot Exploitation Readiness Level (PERL) indicator. Five parameters are identified:

- TRL
- Supply chain
- Users
- Regulatory environment
- Sustainability

Questions to be addressed for each of the five parameters were defined. Depending on the answers of these questions, the PERL level can be calculated. The parameters will be further assessed and prioritized, by setting weighting factors for some of them, in the course of the project.

The PERL definition will be further developed with the support of Pilots and finalized in the frame of WP5. The PERL approach will be reviewed and updated by M24 with interactions with the WP2.

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Abbreviations and acronyms

ARENA	*Australian Renewable Energy Agency*
CRI	*Commercial Readiness Index*
R&D	*Research & Development*
EO	*Earth Observation*
ECSS	*European Cooperation for Space Standardization*
ERATO	*European Association of Research & Technology Organisation*
e-shape	*EuroGEO Showcases: Applications Powered by Europe*
EU	*European Union*
ESA	*European Space Agency*
GEO	*Group on Earth Observations*
H2020	*HORIZON 2020*
HLG-KET	*High Level Expert Group on Key Enabling Technologies*
ITP	*Integrated Technology Plan*
KPI	*Key Performance Indicator*
MRL	*Market Readiness Level*
MTRL	*Market & Technology Readiness Level*
OECD	*The Organisation for Economic Co-operation and Development*
PERL	*Pilot Exploitation Readiness Level*
PV	*Photovoltaic*
SC	*Showcase*
SDG	*Sustainable Development Goal*
TRA	*Technology Readiness Assessment*
TRL	*Technology Readiness Level*

NASA	*National Aeronautics and Space Administration*
WP	*Work Package*

1 Introduction

The overall aim of WP5 is to enable the long-term sustainability of the e-shape Pilots, their penetration in public and private markets and to support their upscaling.

This deliverable is produced under Task 5.3 focussing on “Pilot upscaling and on-boarding”. In this context, the e-shape project brings forward the novel **Pilot Exploitation Readiness Level (PERL)** approach. The aim of this approach, as will be described in detail in this deliverable, is to establish a standardised methodology for the assessment of the maturity of R&D activities. In the particular context of e-shape, where this approach is first conceived, developed and tested, this applies to Pilots.

Therefore, Task 5.3 will work closely with WP2 co-design partners to codify the Pilot Exploitation Readiness Level (PERL), and use it to drive further Pilot development and support activities. As a 2nd step, this task will also support the introduction of new Pilots into the e-shape project and the EuroGEO landscape. This will be carried out within a dedicated “onboarding process”. This PERL approach will be reviewed and updated by M24 following the developments in WP2 and WP5. All along this process, close collaboration with the Showcase and the Pilot leaders will be ensured.

The overall structure of this report is formed of three chapters, including this introductory Chapter 1. The remainder of this work is organised in the following way:

- Chapter 2, “Assessing the maturity stemming from R&D activities” presents a review of currently used or developed methodologies, assessing the maturity of R&D activities focussing on a technology approach and, or, on the market approach.
- Chapter 3, “PERL definition” presents a first list of parameters to be included in the PERL indicator.

2 Assessing the maturity of solutions stemming from R&D activities

Measuring the maturity of a solution helps to define the necessary steps from idea level to operational implementation. Several pillars are needed to develop a solution: access to technology (e.g. data, processing methods, sensors, etc.), to market (e.g. identify new user/customers on the domestic market or international one), to knowledge (e.g. market trends, value chain components, market needs) and to capital (e.g. public or private funding). The extent to which these pillars are actually taken into account in the development of a solution defines its maturity and, eventually, its market readiness. In this regard, methodologies to assess the maturity of a solution were initially focussed on the technology and then integrated the market.

2.1 Method addressing the technology

2.1.1 Technology Readiness Level

Originally defined by NASA for the space technology in the 1970's and further developed in the 1990's, the Technology Readiness Level (TRL) scale is a well-known approach. TRL is a type of measurement system used to assess the maturity level of a particular technology. The TRL spans over nine levels from 1 to 9, 1 being the less mature one "Basic principles observed and reported", 9 being the most mature one "Actual system "flight proven" through successful mission operations (Figure 1).

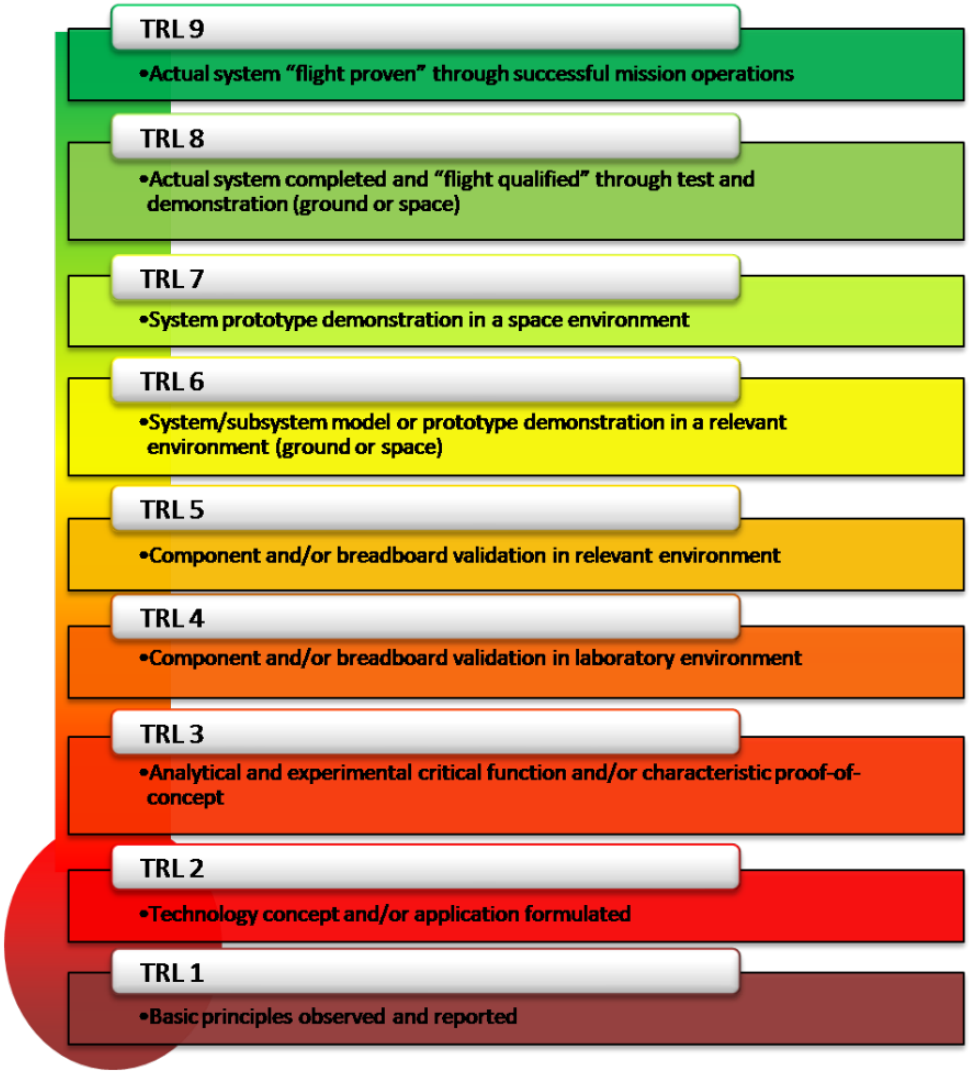

Figure 1: Technology Readiness Level (NASA), source: https://www.nasa.gov

A technology's TRL is determined during a Technology Readiness Assessment (TRA). TRA is applicable to many different sectors. It is used when developing a new technology, system or product, whereby the three main challenges applicable to any project are considered: performance, schedule and budget. TRA is a tool to inform on risk assessment and to support decisions making management. TRA allows to evaluate the products all along their life cycle, from the development phase, but also indicates the status of a given technology or product on a further development stage based on their components or subcomponents.

2.1.2 Adoption of the Technology Readiness Level

The TRL has been used by the U.S. Department of Defence for procurement purposes since the early 2000s. Moreover, it has been applied for the purposes of the U.S. Department of Energy and U.S. Department of Health and Human Services. Other actors such as the U.S. Air Force, the Oil and gas industry and the U.S. Federal Aviation Administration have also been making use of the TRL approach.

The EC HLG-KET (High-Level Expert Group on Key Enabling Technologies) addresses in their report (HLG-KET, 2011) that while Europe has strong results in fundamental research, or low TRL, only few research projects reach a high TRL.

Against this backdrop, the TRL was analysed, and numerous limitations were identified such as:

- TRL is often considered as not always indicative of the maturity of the solution but rather the risk involved in developing the product (Mankins, 2002);
- For complex systems, the assessment of technologies can be very complex (Michaud et al. 2008);
- Focuses on hardware (when originally developed), not software (Cornford and Sarsfield 2004; Smith 2004);
- Lacks definition of terminology as terms are open to interpretation (Cornford and Sarsfield 2004; Mining et al. 2003);
- The lack of assessment guidelines in defining the TRL scale in technology procurement, in areas other than space and weapons industry, as well as the software industry on some extent, is difficult. It requires a specific set of criteria to be met for each level to be objective (Heder, 2017).

2.1.3 Modification of the Technology Readiness Level

TRL is used by various organisations from governmental department to large companies. TRL scale were adapted to be used in a non-space domain and to complement the technical TRL approach.

Modification for production and organisational aspects

The European Association of Research & Technology Organisations (EARTO, 2014) developed their own reading of the TRLs scale to incorporate non-technological and organisational aspects of a production chain. The TRL scale is segmented along 6 steps from “Invention” from TRL 1 and 3 to Market expansion at TRL 9 (Figure 2).

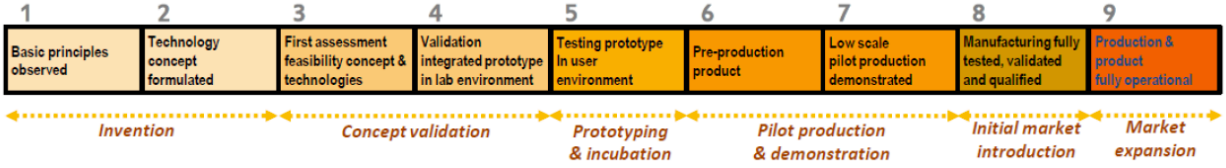

Figure 2: EARTO reading on the TRL scales incorporating manufacturability and including non-technical aspects in a multi-technology adaptation. Note that the word “Market” refers to the secured supply and production capabilities and not the identification of a potential user/customer.

Modification for software and hardware development

ESA (2008) has adopted the TRL and modified it to evaluate their hardware and software products or services. If the handbook does not contain a similarly sophisticated strategic planning framework to that in the NASA ITP document, it still features a detailed description of each level and also a workflow for technology readiness assessment. It provides additional information on how to use the TRL scale in software development (Table 1).

ESA as part of ECSS (European Cooperation for Space Standardization), proposed to ISO a global harmonization of the TRL definition in 2009 and in 2013 the ISO 16290 “Definition of Technology Readiness Levels (TRLs) and their criteria of assessment” was published and is since used by many Agencies and Industries around the world.

NASA basic TRLs Description	TRL	ESA Software TRLs Description
Actual system "flight proven" through successful mission operations	9	**Live product** (Has been applied in the execution of a real space mission)
Actual system completed and "flight qualified" through test and demonstration (ground or space)	8	**General product** (Ready to be applied in the execution of a real space mission)
System prototype demonstration in a space environment	7	**Early adopter version** (Building block and tailored generic software product: qualified for a particular purpose; Tool: ready for market deployment)
System/subsystem model or prototype demonstration in a relevant environment (ground or space)	6	**Product release** (Ready for use in an operational or production context, including user support)
Component and/or breadboard validation in relevant environment	5	**Beta version** (Implementation of the complete software functionality)
Component and/or breadboard validation in laboratory environment	4	**Alpha version** (Most functionality implemented)
Analytical and experimental critical function and/or characteristic proof-of-concept	3	**Prototype** (Prototype of the main functionalities of the integrated system)
Technology concept and/or application formulated	2	**Algorithm** (Individual algorithms or functions are prototyped)
Basic principles observed and reported	1	**Mathematical Formulation** (Scientific knowledge)

Table 1: ESA Basic TRLs and Software TRLs (ESA, 2008)

Modification for technology in Research

The use of the scale developed by ESA led to the first occurrence of TRL in a European Commission work program – in the "Space" section of the 2010 work program of the EU's Framework Program 7 (European Commission, 2009). Later, the TRL scale is used in the Horizon 2020 Work Programmes and calls for proposals (defined in Annex G of the Grant Agreement for H2020 projects) not only for "Space" but also for "Secure, clean and efficient energy" and the "Fast track to innovation". Some of the H2020 calls require the maturity level of the proposed technology or product for the project start and the expected level to be reached at the end of the project. No reference to space is made in the scale (Table 2).

TRL Scale	Description
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)

Table 2: TRL scale used in H2020 Programme

2.2 Methods addressing the market

The Organisation for Economic Co-operation and Development (OECD) has described in several manuals (as the TEP Report, 1986, Paris, ERATO) the risk for setbacks in maturity as a crucial characteristic of Research, Development and Innovation processes. This was first integrated in 1986 through the Chain Linked Model. The Chain Linked model or Kline model of innovation was introduced by the mechanical engineer in Kline (1985), and further described by Kline & Rosenberg (1986). The chain-linked model is an attempt to describe complexities in the innovation process by including five major paths for innovation:

- Central chain of innovation;
- Feedback path;
- Chain-linked path;
- Radical innovation;
- Feedback from products of innovation to the science.

This approach develops the need to collect feedback from a potential user and not to focus only on technology. Similarly, both the HLG-KET, and the H2020 Work Programme interpret the path from TRL 1 to TRL 9 as the path from "idea to market", nevertheless the increasing technology readiness does not mean nearing a successful product (Heder, 2017).

2.2.1 Commercial Readiness Index

Created by the Australian Renewable Energy Agency (ARENA) the **Commercial Readiness Index (CRI)** (ARENA, 2014) was developed for the renewable energy market to avoid the risk to have a product which has reached TRL 9 without the enabling conditions for scale-up. CRI considers the Market as a factor to evaluate the non-technical parameters of a developed solution. It has proven to be useful in other markets (Medical, Policy). The 6 levels of CRI measure the maturity of a technology by the

financial arrangement of its deployment. The CRI (Figure 3) is composed of two components – the Status Summary and the Detailed Indicators (ARENA, 2014):

- The Status Summary has an overall rating numbered from 1 to 6 according to the status in the market.
- The Detailed Indicators reflect the commercialisation process of a renewable energy solution: regulatory environment, stakeholder acceptance, technical performance, financial proposition, Industry supply chain, skills, market opportunities, company maturity.

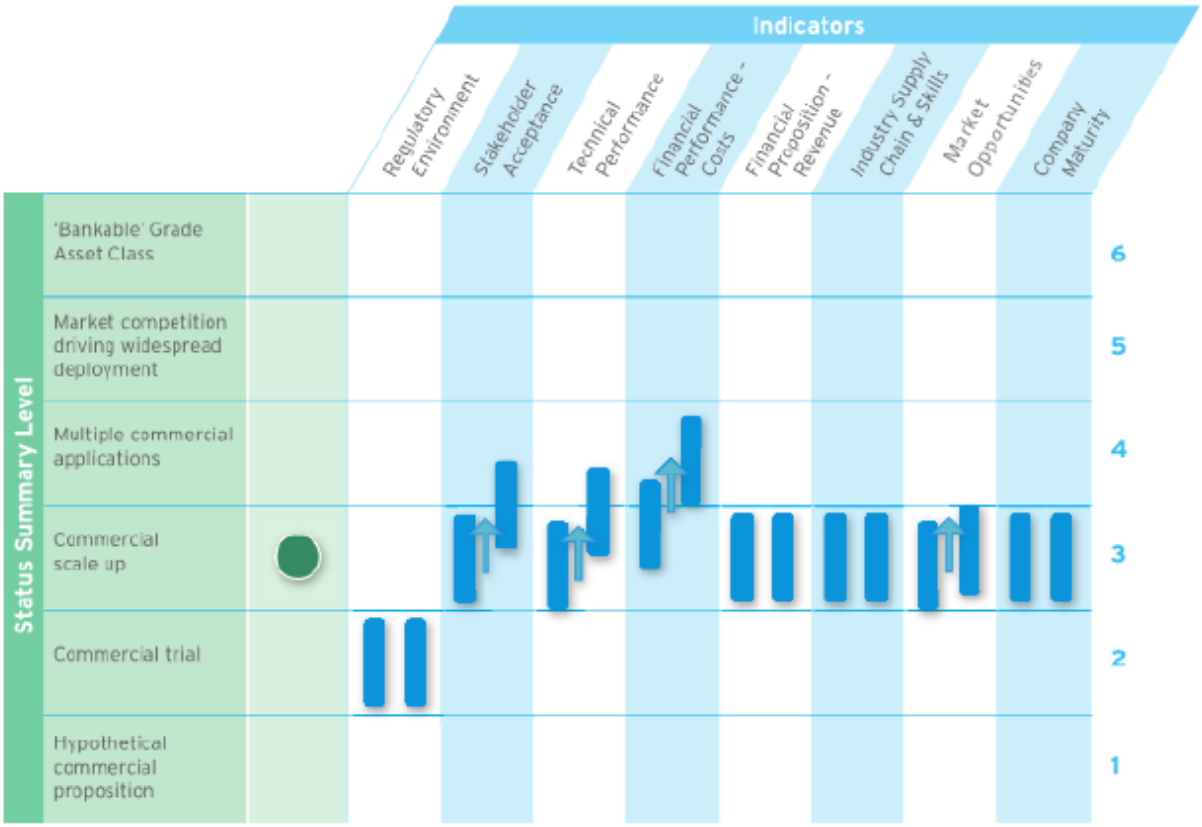

Figure 3: Example of CRI Project Evaluation for a Utility Scale Solar PV Project (ARENA, 2014)

2.2.2 Market and Technology Readiness

The Market & Technology Readiness Level (MTRL) framework (2016, Frank Bennett), aims to provide decision makers with a holistic view of a project's maturity in a simple way - with a single score. It offers decision makers a faster way to assess, measure and support technology projects. The basis of the assessment relies on 3 components, the Business Model Canvas, the Four fits and a modified TRL scale, as presented by CloudWatchHub (2016):

1. **Business Model Canvas** (Figure 4) is evaluating nine important building blocks: Customer Segments, Value Propositions, Channels, Customer Relationships, Key Resources, Revenue Streams, Key activities, Key Partnership, Cost Structure;

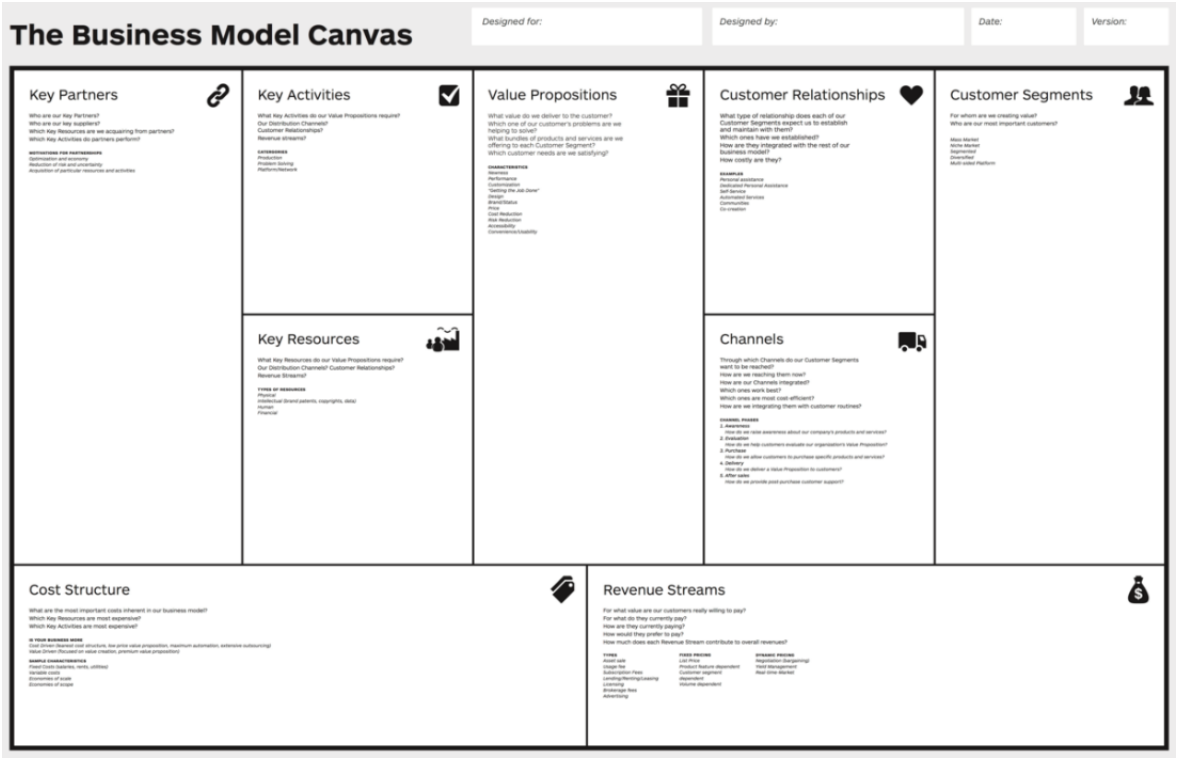

Figure 4: Business Model Canvas (source: www.strategyzer.com)

2. **The model of "Four Fits"** (Table 3) aims to develop a go-to-market strategy. The engagement phases to be defined with the customer or user interaction are evaluated using the models of "Four Fits".

Step 1	**Problem/Solution Fit**	"Does the problem exist? Can we solve it? Are we 'improving' or 'creating new'?"
Step 2	**Vision/Founder Fit**	"Do we have the right team to solve the problem? Do we have support?"
Step 3	**Product/Market Fit**	"Is my product desirable? Is it the *right* target market for my product/service?"
Step 4	**Market/Business Model Fit**	"Do we understand the model for exploitation and sustainability?

Table 3: "Four fits" model

3. **Modified TRL** puts up a slightly higher barrier on technology maturity, emphasizing technology validation closer to the market on TRLs 6 and 7. This puts more emphasis on and differentiation between Research (TRL 0 – 3) and Innovation (TRL 4 – 5), and gives credit to industry's need for more mature technology available to develop for market entry (as that would lower the cost of implementing a go-to-market strategy).

Source: CloudWatchHub (2016).

Based on the three components, the Market Readiness Levels defines 10 level (0 to 9) scale (Table 4). This scale was used in H2020 projects CloudWatch2 (2016) and Cyberwatching.eu (2018, D2.3 Methodology for Classification and Market Readiness)[1]:

MRL	**Description**	**Phase**
0	**Hunch** You perceive a need within a market and something ignites.	Ideation
1	**Basic research** You can now describe the need(s) but have no evidence.	
2	**Needs formulation** You articulate the need(s) using a customer/user story.	
3	**Needs validation** You have an initial 'offering'; stakeholders like your slideware.	
4	**Small scale campaign**	Testing

[1] https://www.cyberwatching.eu/d23-methodology-classification-projectsservices-and-market-readiness

	Run a campaign with stakeholders ("closed" beta - 5 - 10 friendly stakeholders)	
5	**Large scale campaign** Run a campaign with early adopters ("open" beta - 10 - 20 pipeline customers)	
6	**Proof of traction** Problem/Solution Fit Sales match 100 paying customers.	Traction
7	**Proof of satisfaction** Vision/Founder Fit A happy team and happy customers give evidence to progress.	
8	**Proof of scalability** Product/Market Fit A stable sales pipeline and strong understanding of the market allow revenue projections.	Scaling
9	**Proof of stability** Business Model/Market Fit KPIs surpassed and predictable growth.	

Table 4: Market Readiness Levels, (2016, Frank Bennett)

2.3 Limitations

The TRL scale developed by NASA contributes to the evaluation of the readiness of technologies or products and has been used intensively. It has limitations when applied out of the aero-space industry. To tackle these limitations and improve the TRL, different indicators and assessments has been developed as the CRI and MTRL. We evaluated the pros and cons of the TRL, CRI and MTRL (Table 5).

Indicators	Pros	Cons
TRL	• Successfully applied in the aerospace and defence sectors; • TRL is identified as a part of ISO Certification; • Assess the components and subcomponents; • Applied as a tool for risk assessment and management; • Applied for decision making with respect to technology funding and technology transfer.	• Engineering and technology focused; • Difficult to evaluate the whole product; • Higher TRL doesn't mean the product will be used or purchased by any user/customer; • The use of TRL doesn't enable to move from fundamental (low TRL) to applied research (High TRL); • Lack of assessment guidelines for non-aerospace, weapons and software industries.
CRI	• Identify the potential use or purchase of the product;	• Focus on commercialization and may not be suitable for research;

	• Includes two-component assessment: the status in the market and the commercialisation process of a renewable energy solution; • Developed to be used by other sectors.	• Criteria assessment is complex and could be considered as subjective.
MTRL	• Emphasizing technology validation closer to the market; • Includes an evaluation of the user engagement and business and marketing features also.	• MTRL evaluates solutions on their technological maturities and their proximity to the market. Less mature ones, not yet tested in real environment, are disadvantages. • The first interaction with potential customers is identified late in the process at Level 5.

Table 5: Pros and cons of TRL, CRI and MRL indicators

Based on the analysis of the three indicators in the table above, the following can be summarised:

- Along the history of methods to assess "readiness", the paradigm shifted from technology readiness to go-to-market readiness, and methodologies increasingly consider both technology, market and commercialisation approaches;
- TRL is a well-accepted method which has been customized to fit specific needs;
- MRL includes the user in the process;
- Business model components, regulatory environment, stakeholder acceptance, the supply chain is taken in account to evaluate the maturity of the solution;
- However, the market-oriented perspective could generate a difficulty for a non-commercial user such as a researcher involved in H2020 projects. Use and re-use of EO layers in the context of research should be taken in consideration;
- Guidelines with clear definition of criteria for a dedicated solution are needed to ensure coherent assessments.

No solution fully matches the need of e-shape to assess the diversity of the Pilots. A new scale can be proposed to take into account the specificity of the project, to measure the maturity of solutions and, subsequently to globally address the evaluation of exploitation readiness for R&D activities, which is denominated as the Pilot Exploitation Readiness Levels (PERL).

3 PERL definition

The Pilot Exploitation Readiness Levels (PERL) aims to support the development of R&D activities and in particular to support the identification of milestones to be reached for a solution to become sustainable and, or to reach the market. PERL would be used as a metric to:

1) Assess the current status of e-shape Pilots;
2) Assess potential new Pilots to be on-boarded;
3) Identify technology or business components to be developed or improved;
4) Apply to other R&D projects to ensure the re-use or the access to market.

3.1 PERL parameters

The review presented in Chapter 2 highlights that the Pilot Exploitation Readiness should be based on:

- A composite approach evaluating the technology, the supply chain, the user engagement, the regulatory environment and the sustainability;
- Quantitative parameters;
- A detailed description of criteria or the involvement of a third-party to perform the assessment;
- Flexible parameters to be used in diverse thematic or market;
- Flexible to fit Research and Commercial needs.

Addressing e-shape Pilots needs and designing PERL applicable specifically for e-shape Pilots but also for others R&D activities, five main parameters should be considered as criteria to be included in the PERL:

- **TRL** – The technological maturity of a given pilot to measure the technological development to be done. Each pilot started with a specific technology maturity based on previous development and is aiming to reach a higher maturity at the end of the project (Annex 1).
- **Supply chain** – The supply chain represents the steps it takes to get the product or service from its original state to the user and customer. The existence of a complete supply chain is essential for a pilot to become truly operational. The assesmsent of the supply chain maturity is made under the co-design initial assessment process, based on the data-information-usage framework.
- **Users** – The technological maturity of a given pilot does not pre-empt the existence of actual users who have or are willing to utilise the solution. Therefore, engaged users or co-designers assessing the fitness for purpose of the developed solution.
- **Regulatory environment -** Earth observations, geospatial information and big data support the implementation of the SDGs at national, regional and local levels, and the monitoring and reporting against the global indicator framework. This parameter will provide a view on the involvement of the pilot in the implementation of SDG´s.
- **Sustainability** – Multifactorial parameter developed to pursue the exploitation of the pilot. It includes potential application, scenarios for its long-term uptake, use and re-use, commercialisation perspectives, business plan. The e-shape project will provide Pilots with tools and services that will allow them to strengthen and implement business models or sustainability strategies, bringing concrete value to users and customers across several sectors.

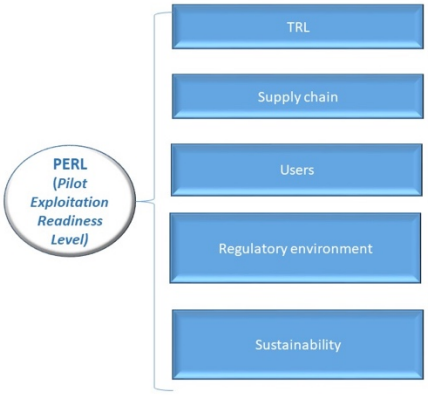

Figure 5: PERL parameters

No.	Parameters and descriptions	Response Options	Coefficient
1	**TRL** divided into 4 categories:		
	TRL 1-3 TRL 4-5 TRL 6-7 TRL 8-9	0 1 2 3	**TBD**
2	**Supply chain** Understanding of the existence or not of a well-established supply chain.		
	Is the supply chain well defined? 1. Ability of the pilot to provide a first prototype of the service: a. Is the access to required data already guaranteed? b. Are the models transforming data into information already robust? c. Is information understandable by targeted users? 2. Ability of the pilot to turn this prototype into a fully operational service: a. Is the access to required data guaranteed over time? b. Are the infrastructures already adapted to provide the service with the required availability (processing capacities, secondary chain in case of failure for 24/24 7/7 availability, maintenance, customer support etc)? Distance between current state and operationality: if additional means (equipment/actors) are needed to guarantee operationality, can they be easily obtained by the pilot? If other actors need to be involved, does the pilot already have interactions with them?	YES/NO	**TBD**
3	**Users** Assessing existence of engaged users or co-designers and their competencies:		
	Variety of users: • How many users are targeted by the pilot?	YES/NO YES/NO YES/NO	***TBD***

No.	Parameters and descriptions	Response Options	Coefficient
	For each user, robustness of the pilot-user relationship : • Is there a signed letter of support? • Has the list of requirements of the service already been discussed between the pilot and the user? • Has a first prototype already been tested by the user? • Does the pilot already have a long-term relationship with this user? • Is the user willing to be involved in the design of the solution? • Is the user interacting with other data providers that might compete with the pilot? For each user, competencies of the user: • Does the user already use/develop products with non EO data that would be complementary/competing with EO data? • Is the user able to integrate EO data in its daily operations? • Is the user able to develop its own service mobilizing EO data? For each user, current match between what is provided by the pilot and user's needs: • If existing discussion about the list of requirements or test of the service: interest of the user to use the service/product? Willingness of the users to pay for the service/product or to re-use it?	YES/NO	
4	**Regulatory environment** Alignment with SDGs, Paris agreement, Sendai framework, EU Directives		
	At least one connection	YES/NO	***TBD***
5	**Sustainability** /Provide a brief justification (3-4 bullets) for the sustainability potential of the application and the scenarios for its long-term uptake. For example, you could refer to commercialisation perspectives. If there is a business plan, or not, if they have how complete it is – costs, revenue, projection for future, etc./		
	Business model is defined IP management is defined Compliance to the GEOSS Data Management Principles ? Compliance to the FAIR Data Management Principles ?	YES/NO	***TBD***

No.	Parameters and descriptions	Response Options	Coefficient
	Long-term strategy for exploration of future services?		

Table 6: Descriptions of PERL parameters

3.2 Calculation of PERL

The calculation of the PERL will include weighting factors to be defined in the course of the project. Weighting factors may be different if the development of the pilot is focused on research or commercialization.

The PERL will be tested first with the Pilots interested to tackle the sustainability challenges. The weights will be developed after the sustainability sheets are processed (task 5.1) and are in a position to assess – qualitatively at first – the maturity of the sample of pilots.

4 Way forward

In the frame of WP5 the PERL will be tested for evaluation of representative Pilots and compared to the standard TRL approaches. To validate the methodology, the PERL should be efficient to assess the Exploitation Readiness Level of Pilots involved in different markets having research or business aims. Weighting factors and criteria will be detailed to be re-used. The assessment will be performed by WP5 and the related pilot leaders with the support of WP2 and WP3 to ensure a shared understanding of the criteria and to codify the process.

The PERL will be used to drive further Pilot development and support activities. PERL will also support the on-boarding of new Pilots into the e-shape project and the EuroGEO landscape.

This PERL approach will be reviewed and updated by M24 following the developments in WP2 and 5. All along this process, close collaboration with the Showcase and the Pilot leaders will be ensured.

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The TRL Scale as a Research & Innovation Policy Tool, EARTO Recommendations, 2014

Annex 1

e-shape Pilots TRL

Pilot	Current TRL	Expected TRL
S1-P1-GEOGLAM	4-5	7
S1-P2-EU-CAP Support	5	7
S1-P3-EU-Vegetation-Index Crop-Insurance in Ethiopia	7	9
S1-P4-EU-AGRO Industry	4-5	7
S2-P1-EO-based surveillance of Mercury pollution	5-6	7-8
S2-P2-EO-based surveillance of POPs pollution	8-9	9
S2-P3-EO-based pollution-health risks profiling in the urban environment	8	9
S3-P1-nextSENSE	4,7	8
S3-P2-High photovoltaic penetration at urban scale	4-5; 7-8	7-8; 5-6
S3-P3-Merging offshore wind products	3-4	6-7
S4-P1-mySPACE	7-8	8-9
S4-P2-mySITE	8	9
S4-P3-myVARIABLE		
S5-P1-Improved historical water availability & quality information service	7-8	8-9
S5-P2-Satellite Earth Observation-derived water bodies & floodwater record over Europe	7-8	8-9
S5-P3-Dive - Diver Information on Visibility in Europe	4	6-8
S5-P4-Sargassum detection for seasonal planning		
S5-P5-Monitoring fishing activity	5	7
S6-P1-EO4D_ASH - EO Data for Detection, Discrimination & Distribution (4D) of Volcanic ash	5	7
S6-P2-GEOSS for Disasters in Urban Environment	5-9	7
S6-P3-Assessing Geo-hazard vulnerability of Cities & Critical Infrastructures	7-9	7-9
S6-P4-ReSAgri - Resilient & Sustainable ecosystems including Agriculture & food	5-6	7-8

S7-P1-Global Carbon and Greenhouse Gas Emissions	1-3	4-6
S7-P2-Urban resilience to extreme weather - climate service	1-2	6-7
S7-P3-Forestry conditions - climate service	7	9
S7-P4-Hydropower in snow reservoir – climate service	1-3	9
S7-P5-Seasonal preparedness	3	7