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Market and Technology Readiness Level (MTRL) methodology and assessments V1

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Abstract:	The two reports will focus on the progress in the MTRL methodology as well as project self-assessments and progress through the stages of market and technology readiness. The first iteration of this deliverable will also include pointers to the MTRL webinars (planned in M4, M7, M10 and M13). These webinars are intended to be mandatory educational material for projects in the SWForum.eu project radar, and who wish to embark in regular MTRL self-assessment activities. The webinars are designed not to be repetitive, but to build onto each other, with the first providing an introduction and first walk-through, and subsequent webinars diving deeper into the matter, highlighting issues such as IPR, licensing, contracting, partnering and other business processes necessary to increase the market readiness of the innovated product. The second report will contain not only the update of the methodology (when relevant) but also results of the self-assessments.
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Terms and abbreviations

CRL	Commercialisation Readiness Level
CSA	Coordination and Support Action
DoA	Description of Action
EC	European Commission
GA	Grant Agreement to the project
KPI	Key Performance Indicator
MTRL	Marketing and Technology Readiness Level
SW	Software
SWForum.eu	European forum of the software research community

Executive Summary

Within this deliverable of the SWForum.eu project we discuss the Marketing and Technology Readiness Level (MTRL) approach to product assessment and its application within the SWForum.eu set of supported projects to understand how we may improve their competitiveness as described in one of our key project objectives:

Provide guidance for increasing the competitiveness of European initiatives through the definition of a methodological approach to the improvement of their MTRL, Mentoring, Technology Transfer & Best Practices guiding towards Policy Innovation.

We describe in some detail the MTRL methodology including the utilisation of the Market Readiness Level (MRL) and Technology Readiness Level (TRL) and how, using automated assessment techniques, we are able to quickly and easily (depending on the engagement of the projects to be assessed themselves) get MTRL assessments completed for projects. This has been assisted through the production of two webinars, one on the overall MTRL assessment framework and one on how to complete the assessment mechanism.

Following this we show the outputs of assessments completed to date and then conclude. Within this conclusion we further discuss how we are going to be able to engage more projects from within the supported calls, how we can again utilise further webinars, to showcase how a project in the past has found the methodology useful and therefore boost, beyond the low numbers of assessments completed so far, the number of responses to allow us to help and support as many of the relevant projects as possible.

Future work will be to develop through assessment of projects supported through this project and the use of the MTRL methodology in prior activities to generate a validation paper that showcases the usefulness and correctness of the methodology and the feedback to the projects that it facilitates.

The next version of this deliverable will include MTRL assessments from as many of the supported projects as we are able to engage as well as further analysis of how different sectors of the software space are advancing in the readiness of their outputs for market launch.

1 Introduction

Within the SWForum.eu project one of the key objectives of the project is:

Provide guidance for increasing the competitiveness of European initiatives through the definition of a methodological approach to the improvement of their MTRL, Mentoring, Technology Transfer & Best Practices guiding towards Policy Innovation.

This objective aims at defining a methodology to provide guidance to projects to the assessment of their Marketing and Technology Readiness Level (MTRL) and to its consequent improvement, consequently improving the ability of project outputs to be launched to market as successfully as possible. Building on the MTRL methodology designed in the CloudWATCH.eu [1]project, originally designed to be domain agnostic, we have customized it for the complex problem domain of software engineering, digital infrastructures and cybersecurity. Through the self-assessment tool developed, projects themselves are able to perform the assessment and receive initial guidance on possible improvements required. Alongside the development of the tool we have also held two webinars, one introducing at a high level the MTRL methodology and the next assessment methodology. The aim of these webinars is to guide software engineering projects through their MTRL self-assessment journey and provide another tool with which projects can achieve self-improvement.

This document describes the underlying methodology used, the assessment tool and the feedback it provides. Finally, it summarises assessments that we have so far obtained from supported projects.

1.1 Document structure

Section 2 describes the underlying methodology that makes up the MTRL.

Section 3 describes how assessment input data is collected and analysed to create the result and first levels of guidance for the project/product being assessed.

Section 4 describes the results of assessments completed so far.

Section 5 concludes the deliverable including descriptions of what the next version will include.

2 Methodology

2.1 Measuring the readiness of a product for market launch

One of the most widely used methods to measure the technological maturity of a product or service is the Technology Readiness Level (TRL). Implemented by NASA [2] during the 1980s, this was later formally defined and expanded for use in other industries. At its core, TRL aims to objectively assess the maturity of a technology and classify it against a range of possible points in an idealised product lifecycle, starting with fundamental research and ending with an actual system proven in operational environment. It is now extremely widely used, including by the European Commission Horizon 2020 (H2020) programme.

There are however issues if, you were to use the TRL classification alone, and most particularly for software products as supported by SWForum.eu. We would be unable to confirm the readiness level of a product and/or service to a suitable standard using this one measure in a way that would be useful to the project themselves, since there are further non-technical items that must be considered alongside the technical. Just as technology must be prepared for entry into the market, relevant non-technical factors must be also at a similar level of preparedness. These include support systems and processes, which are increasingly digital, must be available and ready before a product can be sold or a successful service be offered. Moreover, customers must be ready, or enabled to be ready, to acquire and use technology. The gap between pure technology and its preparation for the market must be saved with a better approach.

In the CloudWATCH2 project, this new approach was proposed [3] through the inclusion of an assessment for the Market Readiness Level (MRL) of the outcomes of the cloud-based projects developed under the EU H2020 research program, alongside the Technical Readiness Levels.

This approach aims to give a complete vision of a project both from technical and non-technical points of view. The score obtained by a project according to this methodology is called the **MTRL Score** and it is a combination of the pair of separate inputs TRL & MRL that can be graphically presented to display the status of the project. This representation can be used both to assess the current situation of a project and to design a plan for the future of the project, that is, where we are and where we want to go. Although this approach was thought for the Cloud services domain, it has also been applied to the Cybersecurity and Privacy domain, and we now aim to apply this to the software domains as software has been the key component of those areas where MTRL has been previously applied.

The following sections briefly describe the concepts of TRL and MRL, as they have been used in the scope of this MTRL methodology. This will be the basic methodology that will be used for the assessment of projects in the cybersecurity and privacy field by SWForum.eu.

2.2 Technology Readiness Levels (TRL)

Technology Readiness Levels (TRL) are a type of measurement system used to assess the maturity level of a particular technology, as previously mentioned, initially defined by NASA. There are nine technology readiness levels, from TRL 1 the lowest to TRL 9 that is the highest, as represented in Figure 1.
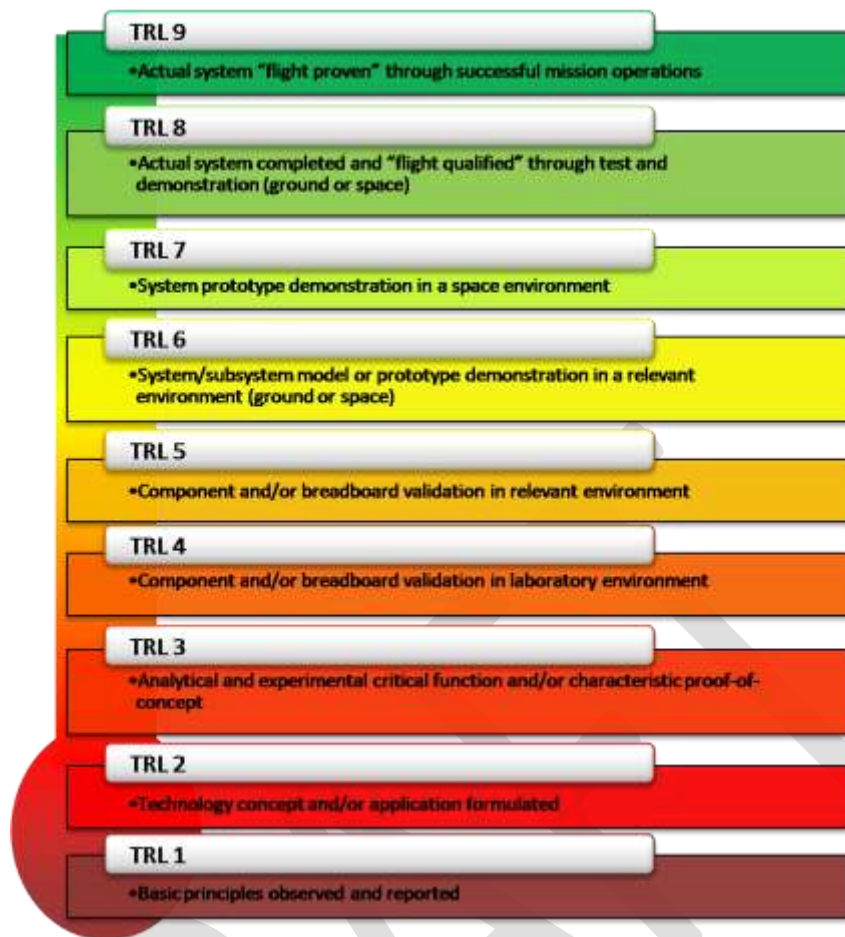
Figure 1. NASA Technology Readiness Levels

Using the NASA definition as a starting point, the European Commission (in the H2020 general annexes G [4]) provides the description of the TRL that is applied to EC projects.

- 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).

As showed in **Error! Reference source not found.**, CloudWATCH2 added a new category "Phase" with several objectives: to simplify the TRL scale in order to keep a limited number of categories; to put more emphasis on and differentiate more between Research (TRL 0 – 3) and Innovation (TRL 4- 5); to recognise industry's need of mature technology which is easier and quicker to develop for market entry.

Table 1. CloudWATCH2 Technology Readiness Levels

TRL	Description	Phase
0	**Idea**. Unproven concept, no testing has been performed.	Idea
1	**Basic Research.** Principles postulated and observed but no experimental proof available.	
2	**Technology formulation.** Concept and application have been formulated.	
3	**Applied research.** First laboratory test completed; proof of concept.	
4	**Small scale prototype.** Built in a laboratory environment (early prototype).	Prototype
5	**Large scale prototype.** Tested in intended environment.	
6	**Prototype system**. Tested in intended environment close to expected performance.	Validation
7	**Demonstration system.** Operating in operation environment at pre-commercial scale.	
8	**First of a king commercial system.** Manufacturing issues solved.	Production
9	**Full commercial application.** Technology generally available for all consumers.	

In SWForum.eu we will use this TRL classification, though we also identify the higher level phases as a useful mechanism to offer broad understanding to a product/project's current technical readiness level that may be more easily understood by the project being assessed and by others who wish to compare where they are on the runway towards product ''launchability''.

2.3 Market Readiness Levels (MRL)

As we already mentioned, although the TRL is a widely used and validated methodology to obtain the state of maturity of a technology, it has certain limitations, especially when determining the readiness for commercialization of that technology.

To bring the results of a project to the market, it is not enough to complete the technological developments, but rather a set of support activities is necessary. This support includes business strategy, business modelling, marketing, sales, after-sales support, etc. And this set of activities must be also measured to accurately determine the readiness level of a project outcome.

It is in this scenario where methodologies, such as Market Readiness Level (MRL), from CloudWATCH2, are applied to better assess the non-technical readiness level of a project output. MRL represents the work performed in the development of business process and administration, as TRL does for technical activities.

Starting from the concept of "business model" as the key mechanics of the product or service brought to market and applying their own "Four Fits Model" [5], CloudWATCH2 defined, as showed in **Error! Reference source not found.**, the MRLs for cloud-centric projects.

Table 2. CloudWATCH2 Market Readiness Levels

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 stakeholder campaign.** Run a campaign with stakeholders ("closed" beta – 50 friendly stakeholders).	Testing
5	**Large scale early adopter campaign.** Run a campaign with early adopters ("open" beta – 100 intended customers).	
6	**Proof of traction**. Sales match 100 paying customers.	Traction
7	**Proof of satisfaction.** A happy team and happy customers give evidence to progress.	
8	**Proof of scalability.** A stable sales pipeline and strong understanding of the market allow revenue projections.	Scaling
9	**Proof of stability.** KPIs surpassed and predictable growth.	

MRLs inherit their scale from TRLs, matching the level of granularity. Similar to technical product development, MRLs feature four business process-oriented phases, from Ideation to Scaling business to a sustainable – and resilient – commercial operation.

3   Project Assessment Procedure

As defined in Section 2, the evaluation of a project according to the MTRL methodology is done through the evaluation against the pair of measures, TRL and MRL. It is here where we find the main differences between the CloudWatch2 and SWForum.eu methodologies.

The CloudWATCH2 project required a significant contribution of project manpower at a level where it is not realistic to try to emulate with the smaller scale of the SWForum.eu project. As such we must instead look to projects themselves to perform the collection of necessary information and utilise a methodology to generate the assessment without high levels of SWForum.eu staffing contributions of effort and hence time.

As such, **SWForum.eu proposes the use of a tool that allows to obtain the MTRL, TRL & MRL scores automatically**. This will be the same methodology that was used within the cyberwatching.eu project for their MTRL assessments.

The use of an automatic evaluation method provides certain advantages, such as:

1. *It is easier to reach and evaluate a larger number of projects.*
2. *It provides a standardized, repeatable process for evaluating the project under analysis.*
3. *It quickly provides a snapshot of the status of a project at a given time allowing creation of timeseries of evaluations.*

The MTRL SWForum.eu tool will be sent to a representative of each project from relevant calls and whose details are now available in the SWForum.eu hub. This will be done with tailored messaging including some recommendations regarding the need for honesty in answering. It can be seen as an auto-evaluation tool to assess the current state of the project, and once completed and returned to the SWForum.eu team, the outcome of the assessment will be added to the SWForum.eu Radar and hub.

The output of the assessment aims to help the project to identify its own weaknesses and next steps as part of an overall self-evaluation process that we would expect all projects to undertake. Therefore, as per the earlier comment on honesty, If the project representative distorts their answers to give an enhanced MTRL scoring, the project itself will be the main one harmed, as it will generate wrong expectations and the potential buyers or testers will be disappointed, not willing to have more interactions with those partners. Overall, when using this kind of tool, the given score is based only on objective criteria, not being contrasted with the subjective opinion of a team of expert reviewers and, therefore, this provided result should be taken only informatively, so the project representative will be advised not to take any action without having previously consulted with a professional advisor.

The MTRL SWForum.eu Tool is an adaptation of a previously successful automated assessment tool from Cyberwatching.eu which itself is an adaptation of the NYSERDA TRL Calculator. In the following sections, we describe the questionnaire that has been used for implementing the MTRL tool and how the scores will be calculated from the answers to get the pair (TRL, MRL). This is a customisation of the previous Cyberwatching.eu tool since it is clear that there are different highlights that we would desire to make with software products/outputs when compared to purely cybersecurity and privacy ones.

3.1   SWForum.eu MTRL Tool – The Questionnaire

The NYSERDA TRL Calculator [6] is defined to help emerging and growing companies determine the level of technical and commercial maturity of their products/innovations through the calculation of the Technology Readiness Level (TRL) and the Commercialisation Readiness Level

(CRL). It consists of 7 questions regarding Technology, Product Development, Product Definition / Design, Competitive Landscape, Team, Go-To-Market and Manufacturing / Supply Chain. The Cyberwatching.eu MTRL tool modified these questions and then added two more specifically related to crucial issues when dealing with R&D projects: Documentation and Intellectual Property Management, making 9 questions in total. The first two questions are focused on obtaining a value for the TRL and the rest for the MRL. For each question, 5 possible answers are shown, ordered from less developed (answer number 1) to more developed (answer number 5). The project representative should select the answer that best fits their project. Within SWForum.eu we have not altered the questions or selectable responses from that which was used for Cyberwatching.eu.

Error! Reference source not found. shows the content of the questionnaire (it will also include an introduction and the instructions to fill it). The first sub table gathers general information/metadata about the project to be evaluated. Following this are the 9 significant questions for the project assessment.

Table 3. MTRL Questionnaire

GENERAL INFORMATION	
Project name	Acronym and full name of the project
Website	The project's website
Full name	The name of the contact person for the project
Email	The contact email address
Project outcomes	A brief description of the expected results of the project, i.e. products, services, components, etc.
Authorization	(A checklist for the user to give permission about certain issues, for example: to publish the results, etc.)

1. PROJECT MATURITY
1.   Project work is beyond basic research and technology concept has been defined
2.   Applied research has begun and practical applications have been identified
3.   Preliminary testing of technology components has begun in a laboratory environment
4.   Initial testing of integrated product has been completed in an operational environment
5.   Integrated product demonstrates performance in the intended applications

2. PRODUCT DEVELOPMENT
1.   Initial product/market fit has been defined
2.   Pilot scale product has been tested in the intended application
3.   Demonstration of a full-scale product prototype has been completed in the intended application
4.   Actual product has been proven to work in its near-final form under a representative set of expected conditions and environments
5.   Product is in final format and has been operated under the full range of operating conditions and environments

3. PRODUCT DEFINITION/DESIGN
1.   One or more initial product hypotheses have been defined
2.   Mapping product attributes against customer needs has highlighted a clear value proposition
3.   The product has been scaled from laboratory to pilot scale and issues that may affect achieving full scale have been identified
4.   Comprehensive customer value proposition model has been developed, including a detailed understanding of product design specifications, required certifications, and trade-offs
5.   Product final design optimization has been completed, required certifications have been obtained and product has incorporated detailed customer and product requirements

4. COMPETITIVE LANDSCAPE
1. Market research has been performed and basic knowledge of potential applications and competitive landscape have been identified
2. Primary market research to prove the product commercial feasibility has been completed and basic understanding of competitive products has been demonstrated
3. Comprehensive market research to prove the product commercial feasibility has been completed and intermediate understanding of competitive products has been demonstrated
4. Competitive analysis to illustrate unique features and advantages of the product compared to competitive products has been completed
5. Full and complete understanding of the competitive landscape, target applications, competitive products and market has been achieved

5. TEAM
1. No team or organization (single individual, no legal entity)
2. Solely technical or non-technical founders running the organization with no outside assistance
3. Solely technical or non-technical founders running the organization with assistance from outside (advisors, mentors, incubator, accelerator, etc.)
4. Balanced team with technical and business experience running the organization
5. Balanced team with all capabilities on-board (sales, marketing, customer service, operations, etc.) running the organization

6. DOCUMENTATION
1. Solely technical descriptions have been elaborated, i.e., software documentation, architecture diagrams, etc.
2. User-oriented documentation has been created, such as user manual, installation guides, reference manual, etc.
3. Live demonstration resources have been developed (recorded videos, website with link to demo, etc.)
4. Position papers, press releases, posters, etc. have been elaborated for the dissemination of the project
5. Marketing documentation has been created, such as a Business Model Canvas, etc.

7. INTELLECTUAL PROPERTY MANAGEMENT
1. No IPR have been defined
2. Initial means of protection have been considered
3. A proper and clear definition of shares has been elaborated
4. An assignation of exploitation rights has been developed
5. A contractual obligation regarding IPR has been established

8. GO-TO-MARKET
1. Initial business model and value proposition have been defined
2. Customers have been interviewed to understand their needs and business model and value proposition have been redefined based on customer feedback
3. Market and customer needs and how those translate to product requirements have been defined, and initial relationships have been developed with key stakeholders across the value chain
4. Partnerships have been formed with key stakeholders across the value chain (suppliers, partners, service providers, customers)
5. Supply agreements with suppliers and partners are in place and initial purchase orders from customers have been received

9. MANUFACTURING/SUPPLY CHAIN
1. Potential suppliers, partners and customers have been identified and mapped in an initial value chain analysis
2. Relationships have been established with potential suppliers, partners, service providers and customers and the have provided input on product and manufacturability requirements
3. Manufacturing process qualifications have been defined and are in progress
4. Products have been pilot manufactured and sold to initial customers
5. Full scale manufacturing and widespread deployment of product to customers has been achieved

This questionnaire is implemented through an Excel spreadsheet which also contains the algorithms used to score the answers given. The following section details how the TRL and MRL values will be calculated from the users' replies.

3.2 SWForum.eu MTRL Tool – The Scoring

As previously described, there are two sets of questions, one focused on obtaining the TRL (the first two questions) and the other on obtaining the MRL (the rest of the questions).

To obtain the TRL score, SWForum.eu MTRL tool uses the same criteria as the NYSERDA tool: the value selected for PROJECT MATURITY determines the TRL between levels 1 – 5 and the value selected for PRODUCT DEVELOPMENT determines the TRL between levels 6 – 9. To be more specific:

- When the value of PRODUCT DEVELOPMENT is between 2 and 5, the TRL value is obtained proportionally to this value, regardless of the value of PROJECT MATURITY.
- When PRODUCT DEVELOPMENT is 1, the value of PROJECT MATURITY coincides with the TRL value.

Error! Reference source not found. shows how the scores are obtained from these two questions.

Table 4. TRL Score dependent on answers to questions 1 & 2.

1. PROJECT MATURITY	2. PRODUCT DEVELOPMENT	TRL
-	5	9
-	4	8
-	3	7
-	2	6
5	1	5
4	1	4
3	1	3
2	1	2
1	1	1

To explain with a mathematical expression, let q_1 be the value selected for the PROJECT MATURITY question and q_2 the value selected for the PRODUCT DEVELOPMENT question, then the final TRL score would be calculated using the expression:

$$TRLscore = \begin{cases} q_2 + 4, & (q_2 \geq 2) \\ q_1, & otherwise \end{cases}$$

To get the MRL score, the SWForum.eu MTRL tool follows a different approach. We assign each question a weight depending on which of the particular areas being question we believe is the most important right through to the one which is the least important for the particular assessment being completed. We have used the following considerations to establish the weight for each question:

- **Team**: Human assets are key for any organization. So a well-organized group of people are most likely to lead a project to success.

- **Manufacturing/Supply chain**: Having an experienced sales mechanism will pave the entry of any product/service into the market. Starting to commercialise a product without previous experience is a difficult task.
- **Go to Market**: Business models enable an organization to create value out of new ideas. Simply having a good product or service is not enough without the answers to key questions about how to take it forward.
- **Product Definition / Design**: A good business model needs to be complemented by a well-defined product/service from the beginning, responding to the end user needs. If not, the brand name can be affected by the bad opinions about the product/service after what seemed like a successful product launch.
- **Competitive landscape**: With all the previous issues covered, success seems quite probable. But there is still a weak point that can affect the sales: a lack of knowledge of the market in understanding and demonstrating that the product/service satisfies a need or requirement better than competitors.
- **Documentation**: Specifically for highly innovative R&D projects, including new technologies or new ways to apply technologies, there is a need to capture each step in the product/service development, from design to commercialization, because innovation means new ways of doing things, and everything must be highly detailed.
- **Intellectual Property Management**: Intellectual Property is one of the most important assets of a leading-edge technology organization. Therefore its management and the appropriateness of steps taken must be clear.

Error! Reference source not found. shows the weights assigned to each question in the scope of the cyberwatching.eu project.

Table 5. Weight of the questions

QUESTION	WEIGHT
3. PRODUCT DEFINITION/DESIGN	4
4. COMPETITIVE LANDSCAPE	3
5. TEAM	7
6. DOCUMENTATION	2
7. INTELLECTUAL PROPERTY MANAGEMENT	1
8. GO-TO-MARKET	5
9. MANUFACTURING/SUPPLY CHAIN	6

To explain this by a mathematical expression, let q_i be the value of the answer to question *i* and w_i the weight of that question (for *i* from 3 to 9), then the score obtained according to the questionnaire would be $\Sigma(q_i \cdot w_i)$. Given that 5 is the highest possible value for each answer, the maximum value that could be obtained according to this questionnaire would be $5 \cdot \Sigma w_i$. Since what is intended is to obtain a value within the scale defined for MRLs, which has 9 values, the final MRL score would be calculated using the expression:

$$MRLscore = \frac{9 \times \Sigma(q_i \times w_i)}{5 \times \Sigma w_i}$$

To better understand the formula above, let's calculate the pair (TRL, MRL) for a real project included in the SWForum.eu project hub, the SODALITE [7]project.

We sent the questionnaire to a project representative of SODALITE, who provided the answers shown in **Error! Reference source not found.**.

Table 6. Response to the questionnaire (SODALITE project)

1. PROJECT MATURITY
4. Initial testing of integrated product has been completed in a laboratory environment. Early prototype.
2. PRODUCT DEVELOPMENT
2. Pilot scale product has been tested in the intended environment close to the expected performance. Prototype System.
3. PRODUCT DEFINITION/DESIGN
3. The product has been scaled from laboratory to pilot scale and issues that may affect achieving full scale have been identified
4. COMPETITIVE LANDSCAPE
4. Competitive analysis to illustrate unique features and advantages of the product compared to competitive products has been completed
5. TEAM
2. Solely technical or non-technical founders running the organization with no outside assistance
6. DOCUMENTATION
5. Marketing documentation has been created, such as a Business Model Canvas, etc.
7. INTELLECTUAL PROPERTY MANAGEMENT
4. An assignation of exploitation rights has been developed
8. GO-TO-MARKET
3. Market and customer needs and how those translate to product requirements have been defined, and initial relationships have been developed with key stakeholders across the value chain
9. MANUFACTURING/SUPPLY CHAIN
2. Relationships have been established with potential suppliers, partners, service providers and customers and the have provided input on product and manufacturability requirements

After applying the formulas for TRL and MRL using the weights of **Error! Reference source not found.**, its score would be:

- $TRL = 6$
- $MRL = \dfrac{9 \times [(3 \times 4) + (4 \times 3) + (2 \times 7) + (5 \times 2) + (4 \times 1) + (3 \times 5) + (2 \times 6)]}{5 \times (4 + 3 + 7 + 2 + 1 + 5 + 6)} = \dfrac{9 \times 79}{140} = 5.08$

Rounding down values, the score (TRL, MRL) is (6, 5).

From these two values we are then able to provide a single MTRL score. It has been decided within the SWForum.eu project that the MTRL value itself will be calculated using a simple product of the two values. Therefore in this case SODALITE has a MTRL value of 30.

The next step is understanding how we are then able to give some simple recommendations to the project about what steps etc. are needed to improve their TRL & MRL scores.

3.3 SWForum.eu MTRL Tool – The Recommendations

Alongside the scoring that the project receives for TRL, MRL and MTRL, they also receive tailored high level feedback as a one line piece of guidance or recommendation which is dependent on the scoring for their different questions.

3.3.1 TRL Recommendations

For each value of TRL that is given as a result of the assessment there is a simple recommendation for next steps as described below:

Table 7. Recommendations/comments dependent on TRL levels measured.

TRL	RECOMMENDATION/COMMENT
1	"It seems you are still doing basic research. Next step is advancing to technology formulation."
2	"It seems that you already formulated the technology. It's time to advance to an applied research."
3	"You are doing applied research. Next step is validating your results in a controlled environment."
4	"You reached the prototype phase. If it is still an early prototype, next step is taking it on a large scale. If your MRL is over 4 you should use participation in the SWForum.eu Forum to publicise your activities."
5	"Your product/service has been proved in its prototype version in an intended environment. It is time to validate your results, so if your MRL is over 4 you could use contacts in the SWForum.eu Forum to find possible partners/users."
6	"Your project is in a validation phase close to the expected performance."
7	"Your project is being validating in an operational environment. You are in a pre-commercial phase. If your MRL is over 6 you think of using the SWForum.eu Forum to find customers to further exploit outputs."
8	"Your project is already a commercial system. You should join ensure the SWForum.eu Forum members are aware of this and that your entry on the Hub has links to your outputs."
9	" Your project is already a commercial system. You should join ensure the SWForum.eu Forum members are aware of this and that your entry on the Hub has links to your outputs."

3.3.2 MRL Recommendations

The recommendations here are not only dependent on score but also on how the score given has been achieved. As such there is a combination of what the actual MRL score is and what the

answers to some of the questions were giving multiple different possible options for some aspects of the recommendations/comments:

Table 8. Recommendations/comments dependent on MRL levels measured.

CONDITION	RECOMMENDATION/COMMENT
MRL <= 4	"Your project results are not marketable yet. You still have a long way to go. You could start by improving…
& Q5 <= 2	"…your team."
& Q5 !<= 2 & Q9 <= 2	"…your manufacturing/supply chain."
& Q5 !<= 2 & Q8 !<= 2 & Q8 <= 2	"…your Go to Market Strategy."
& Q5 !< 2 & Q8 !< 2 & Q8 !<= 2 & Q3 <= 2	"…the definition/design of your product/service."
MRL <= 6	Your project needs to improve some aspects of the preparation to market, but if your TRL is over 4 you could be ready to join the SWForum.eu End User Club for validating results.
MRL <= 7	Your project results are ready to be commercialized, but there is still room for enhancement and some aspects should be improved. If your TRL is over 6, think about the SWForum.eu Forum should be used for publicity of the near production nature of your outputs.
MRL <= 8	Your sales are going well and your product/service seems stable.

3.4 Representing MTRL Assessment Outputs

The main objective of the task to which this deliverable is associated is to facilitate better exploitation of the outputs of EC funded actions and in particular to ensure that possible exploiters from outside the project/product are able to better assess the state of something that they may wish to base future activities on. As such we will also be utilising the MTRL value calculated for each project within the other method of project assessment/visualisation that SWForum.eu has available, the project radar as described in SWForum.eu Deliverable 2 [8]. where we have described the different visual degrees of freedom that we will be using. As part of this a key visual clue is the colour of the blip for which we have finalised a scoring is as follows;

Based on the numerical MTRL score, the blip will be coloured as follows within the SWForum.eu Radar allowing clear representation of status:

1. **Red** for scores below 25;
2. **Yellow** for scores between 25 and 45 (inclusive); and

3. **Green** otherwise (46 and above).

4   MTRL Assessments and Webinars

Since the launch of the MTRL process within the SWForum.eu and following the two MTRL webinars performed so far we have started to collect MTRL assessments that have been completed by projects. This collection process was instigated through an email broadcast to webinar attendees. As such the early results from projects which have responded to that email are shown here in Table 9. As can be seen the response rate has not been good and as such we will be circulating through a direct message to the co-ordinators of projects within relevant calls to hopefully increase the response rate.

Table 9: MTRL Assessments for supported projects as per 1/4/2022

NAME	CALL	1. PROJECT MATURITY	2. PRODUCT DEVELOPMENT	3. PRODUCT DEFINITION / DESIGN	4. COMPETITIVE LANDSCAPE	5. TEAM	6. DOCUMENTATION	7. IP MANAGEMENT	8. GO-TO-MARKET	9. MANUFACTURING/SUPPLY CHAIN	TRL	MRL	MTRL
SODALITE	ICT-16-2018	4	2	3	4	2	5	4	3	2	6	5	30
FISHY	ICT-2018-2020	4	2	3	4	2	5	4	3	2	6	5	30
MEDINA	ICT-2018-2020	3	1	1	2	3	5	2	2	2	3	4	12
PIACERE	ICT-50-2020	3	1	1	2	2	5	2	1	1	3	3	9

Links to the webinars are below:

- The MTRL Methodology : https://www.youtube.com/watch?v=LnRkbemsxmU&t

- Understanding criteria for optimal self-assessment of project outcomes using MTRL: https://www.youtube.com/watch?v=2Er44RGXxz8

5 Conclusions

Having outlined the methodology that we use to obtain the TRL, MRL and MTRL values for outputs from projects that we are supporting, we have seen that there is a structural framework behind the assessments to ensure that we are able to not only get projects to self-assess but also that they should be repeatable and we will be able to track progress of these projects through multiple assessments, spaced appropriately through their lifetime.

We have seen that as yet we have not been able to engage significant numbers of projects though we have defined a direct contact methodology which we hope will be able to be used to bring stronger engagement over the next three months.

Finally once we have a more significant number of projects that are self-assessing, we will also utilise that generated dataset, as well as the data from previous projects, to produce an academic paper on an evaluation of MTRL as a methodology to understand its effectiveness. This may conclude any number of outcomes though we hope following previous feedback that it is positive and that projects themselves can see the benefits of producing assessments.

6   References

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